



BSI Standards Publication

Information technology — Radio frequency identification device conformance test methods

Part 6: Test methods for air interface communications at 860 MHz to 930 MHz

National foreword

This British Standard is the UK implementation of ISO/IEC 18047-6:2025. It supersedes BS ISO/IEC 18047-6:2017, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee IST/6, Data communications.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2025
Published by BSI Standards Limited 2025

ISBN 978 0 539 31235 5

ICS 35.040.50

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2025.

Amendments/corrigenda issued since publication

Date	Text affected



**International
Standard**

ISO/IEC 18047-6

**Information technology — Radio
frequency identification device
conformance test methods —**

**Part 6:
Test methods for air interface
communications at 860 MHz to 930
MHz**

*Technologies de l'information — Méthodes d'essai de conformité
du dispositif d'identification de radiofréquence —*

*Partie 6: Méthodes d'essai pour des communications d'une
interface d'air à 860 MHz et jusqu'à 930 MHz*

**Third edition
2025-11**

Reference number
ISO/IEC 18047-6:2025(en)

Full document details: BS ISO/IEC 18047-6:2025


© ISO/IEC 2025

Documents
Document Sharing Hub



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms, definitions, symbols and abbreviated terms	2
3.1 Terms and definitions	2
3.2 Symbols	2
3.3 Abbreviated terms	3
4 Default conditions applicable to the test methods	3
4.1 Test environment	3
4.2 Pre-conditioning	3
4.2.1 General	3
4.2.2 Default tolerance	3
4.2.3 Noise floor at test location	3
4.2.4 Total measurement uncertainty	4
5 Setup of test equipment	4
5.1 Setup of test equipment for interrogator tests	4
5.1.1 General	4
5.1.2 Sense antenna	4
5.1.3 Test apparatus and test circuits for ISO/IEC 18000-61, ISO/IEC 18000-62 and ISO/IEC 18000-64 interrogator	4
5.2 Setup of test equipment for tag tests	5
5.2.1 General	5
5.2.2 Test apparatus and test circuits for ISO/IEC 18000-61, ISO/IEC 18000-62 and ISO/IEC 18000-64 tags	6
6 Conformance tests for ISO/IEC 18000-61	7
6.1 Functional tests of interrogator	7
6.1.1 Interrogator modulation test	7
6.1.2 Interrogator demodulation and turn-around time	8
6.2 Functional tests of tag	9
6.2.1 Tag demodulation and turn-around time	9
6.2.2 Tag backscatter	10
6.2.3 Tag response time	11
6.2.4 Tag bit rate	12
6.2.5 Tag state storage time	13
7 Conformance tests for ISO/IEC 18000-62	13
7.1 Functional tests of interrogator	13
7.1.1 Interrogator modulation test	13
7.1.2 Interrogator demodulation and turn-around time	14
7.2 Functional tests of tag	15
7.2.1 Tag demodulation and turn-around time	15
7.2.2 Tag backscatter	16
7.2.3 Tag response time	17
7.2.4 Tag bit rate	18
7.2.5 Tag state storage time	19
8 Conformance tests for ISO/IEC 18000-64	20
8.1 Functional tests of interrogator	20
8.1.1 Interrogator modulation test	20
8.1.2 Interrogator demodulation and data decoding	20
8.2 Functional tests of tag	22
8.2.1 General	22
8.2.2 Data encoding	23

ISO/IEC 18047-6:2025(en)

8.2.3	Link bits.....	24
8.2.4	Tag timing parameters.....	25
8.2.5	Tag bit rate.....	27
8.2.6	Tag multi-page timing.....	27
8.2.7	Tag LBT.....	28
Annex A (normative) Test measurement site		29
Annex B (normative) Command coding for conformance tests for the different types of ISO/ IEC 18000-6		40
Annex C (normative) Technical performance of the generic electronic test instruments		41
Annex D (normative) Tag emulator		42
Annex E (informative) Measurement examples		44
Bibliography		46

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.

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 document 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 or www.iec.ch/members_experts/refdocs).

ISO and IEC draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO and IEC take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO and IEC had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents and <https://patents.iec.ch>. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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. In the IEC, see www.iec.ch/understanding-standards.

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

This third edition cancels and replaces the second edition (ISO/IEC 18047-6:2017), which has been technically revised.

The main changes are as follows:

- tests related to ISO/IEC 18000-63 have been removed from this document since these tests are described in ISO/IEC 18047-63;
- the frequency range has been changed from 860 MHz to 960 MHz to 860 MHz to 930 MHz, as all applicable global radio regulations are within this frequency range.

A list of all parts in the ISO/IEC 18047 series can be found on the ISO and IEC websites.

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 and www.iec.ch/national-committees.

Introduction

The ISO/IEC 18000 series defines the air interfaces for radio frequency identification (RFID) devices used in item management applications. ISO/IEC 18000-61, ISO/IEC 18000-62, ISO/IEC 18000-63 and ISO/IEC 18000-64 define the air interface for RFID devices operating at frequencies from 860 MHz to 930 MHz.

The ISO/IEC 18047 series provides test methods for conformance to the various parts of the ISO/IEC 18000 series.

Each part of the ISO/IEC 18047 series contains all measurements required to be made on a product in order to establish whether it conforms to the corresponding part of the ISO/IEC 18000 series.

NOTE Test methods for interrogator and tag performance are covered by the ISO/IEC 18046 series.

[Clause 6](#) describes all necessary conformance tests for ISO/IEC 18000-61.

[Clause 7](#) describes all necessary conformance tests for ISO/IEC 18000-62.

[Clause 8](#) describes all necessary conformance tests for ISO/IEC 18000-64.

Information technology — Radio frequency identification device conformance test methods —

Part 6:

Test methods for air interface communications at 860 MHz to 930 MHz

1 Scope

This document specifies test methods for determining the conformance of radio frequency identification (RFID) devices (tags and interrogators) for item management with the specifications given in ISO/IEC 18000-61, ISO/IEC 18000-62 and ISO/IEC 18000-64. However, this document does not apply to the testing of conformance with regulatory or similar requirements.

The test methods require only that the mandatory functions, and any optional functions which are implemented, are verified. This can, in appropriate circumstances, be supplemented by further, application-specific functionality criteria that are not available in the general case.

The interrogator and tag conformance parameters in this document are the following:

- type-specific conformance parameters including nominal values and tolerances;
- parameters that apply directly affecting system functionality and inter-operability.

Parameters that are already included in regulatory test requirements are not included in this document.

Unless otherwise specified, the tests in this document are intended to be applied exclusively to RFID tags and interrogators defined in ISO/IEC 18000-61, ISO/IEC 18000-62 and ISO/IEC 18000-64.

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/IEC 18000-61:2012, *Information technology — Radio frequency identification for item management — Part 61: Parameters for air interface communications at 860 MHz to 960 MHz Type A*

ISO/IEC 18000-62:2012, *Information technology — Radio frequency identification for item management — Part 62: Parameters for air interface communications at 860 MHz to 960 MHz Type B*

ISO/IEC 18000-64, *Information technology — Radio frequency identification for item management — Part 64: Parameters for air interface communications at 860 MHz to 960 MHz Type D*

ISO/IEC 19762, *Information technology — Automatic identification and data capture (AIDC) techniques — Vocabulary*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

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

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.2 Symbols

For the purposes of this document, the symbols given in ISO/IEC 19762 and the following apply.

Δ_{RCS}	change in radar cross-section
λ	test frequency wavelength
D	modulation depth of data coding pulse
d_1	largest dimension of the DUT/dipole after substitution
d_2	largest dimension of the test antenna
d_s	distance between the interrogator antenna and sense antenna
$d_{\text{T,IA}}$	interrogator antenna to tag distance
$d_{\text{T,MA}}$	measurement antenna to tag distance
d_{TE}	distance between the interrogator antenna and tag emulator
G_{IA}	gain of interrogator antenna
G_{MA}	gain of measurement antenna
I_{CIR}	isolation of a circulator
M_i	modulation index for ISO/IEC 18000-62
n_{spacing}	spacing factor
P_e	average power measured at the entrance of the transmit antenna
P_I	delivered power at the carrier frequency
P_M	measured power at the carrier frequency
R_{rlb}	tag return link bit rate
T_{apf}	pulse fall time for ISO/IEC 18000-61
T_{apr}	pulse rise time for ISO/IEC 18000-61
T_f	fall time for ISO/IEC 18000-62
T_r	rise time for ISO/IEC 18000-62
T_{rlb}	tag return link bit time

T_{rs} tag response time for ISO/IEC 18000-61

3.3 Abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO/IEC 19762 and the following apply.

BER	bit error rate
CRC	cyclic redundancy check
CW	continuous wave
DUT	device under test
RF	radio frequency
RCS	radar cross section
TTO	tag talks only

4 Default conditions applicable to the test methods

4.1 Test environment

Unless otherwise specified, testing shall take place in an environment of temperature $(23 \pm 3) ^\circ\text{C}$ and of relative (non-condensing) humidity from 40 % to 60 %.

4.2 Pre-conditioning

4.2.1 General

The interrogators and tags to be tested shall be conditioned to the test environment for a period of 24 h before testing.

For this document, each interrogator and each tag shall support at least one of the types A or B or D.

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 (e.g. linear dimensions) and the test method procedures (e.g. test equipment adjustments).

4.2.3 Noise floor at test location

Noise floor at test location shall be measured for at least 1 min with the spectrum analyser using the same conditions as for the measurement of the DUT.

The maximum of the measured noise amplitude measured in a 10 kHz bandwidth shall be -60 dB from 0,5 GHz to 2 GHz and -90 dBm around the frequency of the main signal of the tag backscatter signal.

Special attention has to be given to spurious emissions, e.g., insufficiently shielded computer monitors. The electromagnetic test conditions of the measurements shall be checked by performing the measurements with and without a tag in the field.

4.2.4 Total measurement uncertainty

The total measurement uncertainty for each quantity determined by these test methods shall be stated in the test report.

NOTE Basic information is given in ISO/IEC Guide 98-3.

5 Setup of test equipment

5.1 Setup of test equipment for interrogator tests

5.1.1 General

The DUT shall be an interrogator including an antenna.

All conformance measurements and setups shall be done in an anechoic chamber as defined in [Annex A](#).

All measurements shall be done at one of the test frequencies in [Table 1](#).

Table 1 — Test frequencies

Test carrier frequency	Comment
866 MHz	Recommended for tests under European regulations
915 MHz	Recommended for tests under Japan, Korean, Australian or US regulations
922 MHz	Recommended for test under China regulations

NOTE With the test frequencies specified in [Table 1](#), all frequencies of the entire band from 860 MHz to 930 MHz are within $\pm 2,9$ % of one of the test frequencies. All practically used frequencies in the frequency bands 860 MHz to 870 MHz, 900 MHz to 930 MHz are within $\pm 1,7$ % of the test frequencies.

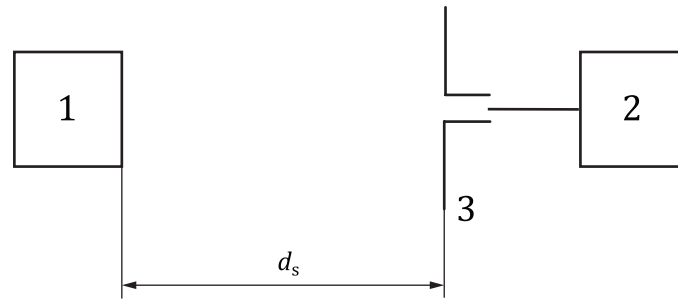
5.1.2 Sense antenna

Where applicable, tests shall be carried out using a sense antenna, which shall be a substantially non-reactive, non-radiating load of $50\ \Omega$ equipped with an antenna connector. The voltage standing wave ratio (VSWR) at the $50\ \Omega$ connector shall not be greater than 2:1 over the frequency range of the measurement.

5.1.3 Test apparatus and test circuits for ISO/IEC 18000-61, ISO/IEC 18000-62 and ISO/IEC 18000-64 interrogator

5.1.3.1 Interrogator modulation test setup

For this test, the sense antenna shall always be placed and orientated for optimum field strength reception in the direction of the major power radiation of the DUT interrogator antenna in accordance with [Figure 1](#) at a distance, d_s , of 0,8 m to 1,1 m (see ISO/IEC 18000-61 and ISO/IEC 18000-62) or $3\ \lambda$ and $10\ \lambda$ (see ISO/IEC 18000-64).

**Key**

- 1 DUT interrogator antenna
- 2 scope
- 3 sense antenna

Figure 1 — Interrogator modulation test setup**5.1.3.2 Interrogator demodulation and turn-around time test setup**

For this test, the tag emulator as defined in [Annex D](#) shall be placed and orientated for optimum field strength reception in the direction of the major power radiation of the DUT interrogator antenna in accordance with [Figure 2](#) at a distance, d_{TE} , of 0,8 m to 1,1 m (see ISO/IEC 18000-61 and ISO/IEC 18000-62) or 10λ (see ISO/IEC 18000-64).

**Key**

- 1 DUT interrogator antenna
- 2 tag emulator

Figure 2 — Interrogator demodulation and turn-around test setup**5.2 Setup of test equipment for tag tests****5.2.1 General**

The DUT shall be a tag including all means in order to be capable to communicate with an interrogator.

When tests require the use of an interrogator, this shall be a measurement equipment that fulfils the requirements in order to act as interrogator and in particular, it shall support the minimum tag response to interrogator command turn-around time.

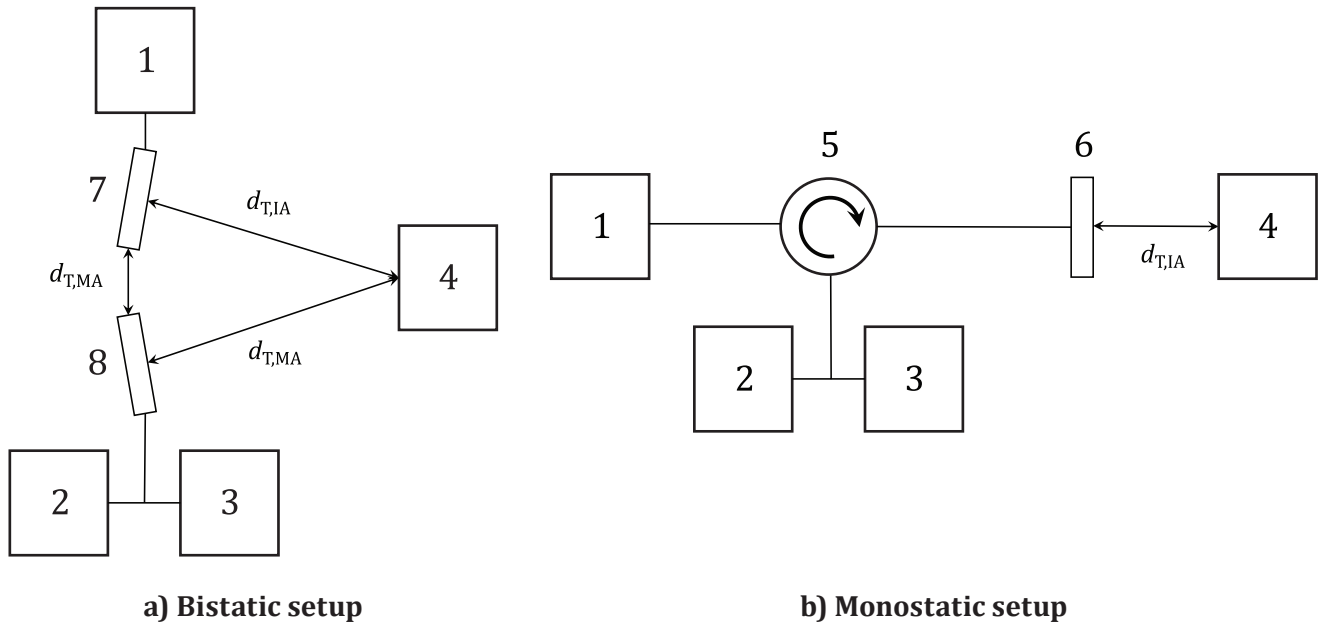
All conformance measurements and setups shall be done in an anechoic chamber as defined in [Annex A](#).

All measurements shall be done at one of the test frequencies in [Table 1](#).

5.2.2 Test apparatus and test circuits for ISO/IEC 18000-61, ISO/IEC 18000-62 and ISO/IEC 18000-64 tags

5.2.2.1 Tag demodulation and turn-around time test setup

For this test, the tag shall be placed and oriented for optimum field strength reception in the direction of the major power radiation of the interrogator.



Key

- | | |
|---|---|
| 1 | test interrogator |
| 2 | spectrum analyser |
| 3 | scope |
| 4 | tag |
| 5 | circulator |
| 6 | test interrogator and measurement antenna |
| 7 | test interrogator antenna |
| 8 | measurement antenna |

Figure 3 — Tag demodulation test setup

5.2.2.2 Tag backscatter test setup

For this test, two different setups may be used.

In one setup (see [Figure 3](#)), the test interrogator antenna setup (the interrogator may alternately also be realized with a signal generator according to [Annex C](#)) shall consist of a set of two mechanically assembled antennas specifically designed to reduce the signal coupling between each other. One shall be used as the interrogator antenna while the second shall be used as the measurement antenna and shall be connected either to a spectrum analyser or to an oscilloscope as specified in [Annex C](#). The tag under test shall be placed at this focal point and oriented for optimum field strength reception. The distances between the tag and the antennas are $d_{T,IA}$ and $d_{T,MA}$, respectively (see [Figure 3](#)).

The tag backscatter test setup parameters are defined in [Table 2](#).

Table 2 — Tag backscatter setup parameters

Symbol	Name	Description
$d_{T,IA}$	Interrogator antenna to tag distance	0,8 m to 1,1 m (see ISO/IEC 18000-61 and ISO/IEC 18000-62) or 3λ (see ISO/IEC 18000-64)
$d_{T,MA}$	Measurement antenna to tag distance	0,8 m to 1,1 m (see ISO/IEC 18000-61 and ISO/IEC 18000-62) or 3λ (see ISO/IEC 18000-64)
G_{IA}	Gain of interrogator antenna	The maximum 3 dB beam width shall be $\pm 35^\circ$.
G_{MA}	Gain of measurement antenna	The maximum 3 dB beam width shall be $\pm 35^\circ$.
I_{CIR}	Isolation of the circulator	The minimum isolation of the circulator shall be 20 dB.

In another setup (see [Figure 3](#)), the test interrogator antenna setup (the interrogator may alternatively also be realized with a signal generator according to [Annex C](#)) shall consist of a single antenna specifically designed to transmit the signal from the interrogator and to receive the signal backscattered from the tag under test. This antenna shall be connected to the interrogator and to either a spectrum analyser or an oscilloscope as specified in [Annex C](#) via a circulator. The tag under test shall be oriented for optimum field strength reception. The distance between the tag and the antenna is $d_{T,IA}$ (see [Figure 3](#)).

The tag backscatter test setup parameters are defined in [Table 2](#).

5.2.2.3 Tag response time

The setup for this test shall be as described in [5.2.2.1](#).

5.2.2.4 Tag bit rate accuracy test setup

The setup for this test shall be as described in [5.2.2.1](#).

5.2.2.5 Tag state storage time test setup

The setup for this test shall be as described in [5.2.2.1](#).

6 Conformance tests for ISO/IEC 18000-61

6.1 Functional tests of interrogator

6.1.1 Interrogator modulation test

6.1.1.1 Test objective

The objective of this test is to verify that the interrogator provides the appropriate modulation waveform required for operation of tags.

6.1.1.2 Test procedure

The interrogator shall transmit an Init_round_all command (see [B.1.1](#)) at the maximum power of the selected carrier frequency for testing.

In case the interrogator is intended for operation of non-overlapping RF bands, then this test shall be done for each RF band.

A digital oscilloscope as specified in [Annex C](#) and the sense antenna shall be used to record the waveform provided by the interrogator.

6.1.1.3 Test report

The test report shall give the measured values of the parameters in accordance with [Table 3](#). The pass/fail condition is determined whether the measured values are within the requirements as specified in ISO/IEC 18000-61. Furthermore, the DUT and the sense antenna orientation and position, as well as the used interrogator output power, and the used operation frequency shall be recorded. In addition, the test report shall provide information on at least the following aspects of the test:

- the sample;
- the International Standard used (including its year of publication);
- the method used;
- the result(s), including a reference to the clause which explains how the results were calculated;
- any deviations from the procedure;
- any unusual features observed;
- the date of the test.

Table 3 — Measurements to be made

Parameter	Condition
D	Default modulation operation mode
T_{apr}	Default modulation operation mode
T_{apf}	Default modulation operation mode

6.1.2 Interrogator demodulation and turn-around time

6.1.2.1 Test objective

The objectives of this test are to verify whether the interrogator is capable of:

- demodulating signals from the tags, and
- receiving the data transmitted by the tag emulator after the minimum specified turn-around time.

6.1.2.2 Test procedure

The interrogator shall transmit an Init_round_all command (see [B.1.1](#)) at the maximum power of the selected carrier frequency for testing.

After the command provided by the interrogator has been sent and after the minimum turn-around time, a tag emulator as specified in [Annex D](#) shall transmit a typical response to the Init_round_all command at a minimum Δ_{RCS} specified in ISO/IEC 18000-61. It is not necessary for the tag emulator to demodulate the command but shall only detect its end to respond after the minimum turn-around time.

When the interrogator is intended for operation of non-overlapping RF bands, this test shall be done for each RF band.

Measurements shall be done for both the minimum and maximum tag response data rate, i.e. the turn-around time from interrogator command to tag response.

In case the interrogator is designed for shorter communication distances, then the distance d_{TE} may be decreased and the actual used value shall be mentioned in the test report.

The interrogator (digital) demodulator shall accept the tag response including verification of the CRC.

6.1.2.3 Test report

The test report shall contain the tag emulator distance to the interrogator and the Δ_{RCS} value setup in the tag emulator. Furthermore, the set-up turn-around time from the tag emulator, the DUT and the tag emulator orientation and position as well as the used interrogator output power and the used operation frequency shall also be recorded. In addition, the test report shall provide information on at least the following aspects of the test:

- the sample;
- the International Standard used (including its year of publication);
- the method used;
- the result(s), including a reference to the clause which explains how the results were calculated;
- any deviations from the procedure;
- any unusual features observed;
- the date of the test.

6.2 Functional tests of tag

6.2.1 Tag demodulation and turn-around time

6.2.1.1 Test objective

The objectives of this test are to verify whether the tag is capable of:

- demodulating signals from the interrogator, and
- receiving the data transmitted by the interrogator after the minimum specified response to command turn-around time.

6.2.1.2 Test procedure

The test interrogator shall transmit an Init_round_all (see [B.1.1](#)) command.

The tag (DUT) shall receive the command provided by the interrogator and shall provide an appropriate response. After complete reception of the tag response, the interrogator shall generate a Next_slot command within the minimum specified turn-around time between tag response and interrogator command.

Measurements shall be done by verifying that the tag detects the command appropriately by means of evaluation of its response. Measurements shall be done at $P_I = 1,2 P_{I,\text{min}}$.

In case the interrogator is designed for shorter communication distances, then the distance d_{TE} may be decreased and the actual used value shall be mentioned in the test report.

The test shall be seen as successful when it can be shown that the tag sent the correct response for both commands including verification of the CRC.

The interrogator waveform shall contain the setup of the waveform for the respective types in accordance with [Table 4](#).