

Information technology — Radio frequency identification device conformance test methods

Part 63: Test methods for air interface communications at 860 MHz to 960 MHz

National foreword

This British Standard is the UK implementation of ISO/IEC 18047-63:2023.

The UK participation in its preparation was entrusted to Technical Committee IST/34, Automatic identification and data capture techniques.

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 2023
Published by BSI Standards Limited 2023

ISBN 978 0 539 13877 1

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 28 February 2023.

Amendments/corrigenda issued since publication

Date	Text affected

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

**Part 63:
Test methods for air interface
communications at 860 MHz to 960
MHz**

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

*Partie 63: Méthodes d'essai pour des communications d'une interface
d'air entre 860 MHz et 960 MHz*



Reference number
ISO/IEC 18047-63:2023(E)

Documents
© ISO/IEC 2023
DocuSign Hub



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2023

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, abbreviated terms and notations	1
3.1 Terms and definitions	1
3.2 Symbols	2
3.3 Abbreviated terms	2
3.4 Notation	2
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	3
5 Conformance	3
6 Conformance tests for ISO/IEC 18000-63:2021, Clause 6	3
7 Conformance tests for ISO/IEC 18000-63:2021, 7.1 to 7.4	95
7.1 Tag functional tests	95
7.1.1 General	95
7.1.2 Battery-assisted passive tag persistence time test	95
8 Conformance tests for ISO/IEC 18000-63:2021, 7.5	97
8.1 General	97
8.2 Functional tests of interrogator	97
8.2.1 Interrogator RF envelope parameters	97
8.2.2 Interrogator activation minimum dwell time, T_A	98
8.2.3 Interrogator link timing T_2	99
8.2.4 Interrogator link timing T_3	100
8.2.5 Interrogator link timing T_4	101
8.3 Functional tests of tag	102
8.3.1 Tag demodulation capability	102
8.3.2 Tag link frequency tolerance and variation	103
8.3.3 Tag link timing, T_1	104
8.3.4 Tag link timing T_2	105
8.3.5 Tag activation time maximum, T_A	107
8.3.6 Tag stateful hibernate timer	108
9 Conformance tests for ISO/IEC 18000-63:2021, Clause 8	109
9.1 General	109
9.2 Simple sensor test	109
9.2.1 Purpose	109
9.2.2 Procedure	109
9.2.3 Test report	110
9.3 Full-function sensor test	110
9.3.1 Purpose	110
9.3.2 Procedure	110
9.3.3 Test report	111
9.4 Snapshot sensor test	111
9.4.1 Purpose	111
9.4.2 Procedure	111
9.4.3 Test report	112

Annex A (normative) Setup of test equipment..... 113

Bibliography.....117

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).

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. 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) or the IEC list of patent declarations received (see <https://patents.iec.ch>).

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*.

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 interface 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 that operate at frequencies from 860 MHz to 960 MHz.

The ISO/IEC 18047 series provides air interface communication test methods to ensure conformance with the different 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 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.

This document specifies the conformance requirements for a passive-backscatter, interrogator-talks-first (ITF), radio-frequency identification (RFID) system operating in the 860 MHz to 960 MHz frequency range. The system comprises interrogators, also known as readers, and tags, also known as labels.

An Interrogator transmits information to a Tag by modulating a radiofrequency (RF) signal in the 860 MHz to 960 MHz frequency range. The Tag receives both information and operating energy from this RF signal. Tags are passive, meaning that they receive all of their operating energy from the Interrogator's RF waveform.

An Interrogator receives information from a Tag by transmitting a continuous-wave (CW) RF signal to the Tag; the Tag responds by modulating the reflection coefficient of its antenna, thereby backscattering an information signal to the Interrogator. The system is ITF, meaning that a Tag modulates its antenna reflection coefficient with an information signal only after being directed to do so by an Interrogator.

Interrogators and Tags are not required to talk simultaneously; rather, communications are half-duplex, meaning that Interrogators talk and Tags listen – or vice versa.

[Clause 6](#) describes and specifies all necessary conformance tests for ISO/IEC 18000-63:2021, Clause 6.

[Clause 7](#) describes all necessary conformance tests that are described in ISO/IEC 18000-63:2021, 7.1 to 7.4.

[Clause 8](#) describes all necessary conformance tests for ISO/IEC 18000-63:2021, 7.5.

[Clause 9](#) describes all necessary conformance tests for ISO/IEC 18000-63:2021, Clause 8.

The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of a patent.

ISO and IEC take no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured ISO and IEC that he/she is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO and IEC. Information may be obtained from the patent database available at www.iso.org/patents or <https://patents.iec.ch>.

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

Information technology — Radio frequency identification device conformance test methods —

Part 63:

Test methods for air interface communications at 860 MHz to 960 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 18000-63.

This document does not apply to the testing of conformity with regulatory or similar requirements.

The test methods specify only the verification of the mandatory functions and any optional functions which are implemented. 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 directly affect 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 18000-63.

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 18000-63:2021, *Information technology — Radio frequency identification for item management — Part 63: Parameters for air interface communications at 860 MHz to 960 MHz Type C*

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

3 Terms, definitions, symbols, abbreviated terms and notations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 18000-63 and 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.

D	distance between the interrogator and test antenna
T_{REPLY}	time between the Interrogator's command and the Tag's backscattered reply

3.3 Abbreviated terms

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

BLF	backscatter-link frequency ($\text{BLF} = 1/T_{\text{pri}} = \text{DR}/T_{\text{Rcal}}$)
CW	continuous-wave
DUT	device under test
ITF	interrogator-talks-first
ppm	parts per million
RBW	resolution bandwidth
RF	radiofrequency
RFID	radiofrequency identification
RNG	random or pseudo-random number generator
VSWR	voltage standing wave ratio

3.4 Notation

This document uses the following notational conventions as used in ISO/IEC 18000-63:

— States and flags are denoted in bold.

EXAMPLE 1 **ready**.

— Commands and variables are denoted in italics. Where there can be confusion between commands and variables, this document provides an explicit statement.

— Command parameters are underlined.

EXAMPLE 2 Pointer.

— For logical negation, labels are preceded by “~”.

EXAMPLE 3 If **flag** is true, then ~**flag** is false.

— The symbol, R=>T, refers to commands or signalling from an Interrogator to a Tag (Reader-to-Tag).

— The symbol, T=>R, refers to commands or signalling from a Tag to an Interrogator (Tag-to-Reader).

4 Default conditions applicable to the test methods

4.1 Test environment

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

4.2 Pre-conditioning

4.2.1 General

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

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 center frequency of the tag backscatter signal.

Special attention shall be given to spurious emissions, for example, 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 Conformance

To claim conformance to ISO/IEC 18000-63, a device shall pass the conformance tests in this document.

6 Conformance tests for ISO/IEC 18000-63:2021, Clause 6

This clause specifies conformance tests for product built according to ISO/IEC 18000-63:2021, Clause 6:

- conformance requirements for physical interactions (the signalling layer of the communications) between Interrogators and Tags;
- conformance requirements for Interrogator and Tag operating procedures and commands.

Testing for this clause shall be done with the test setups as defined in [Annex A](#).

All tests are defined in [Table 1](#); the column M/O indicates either mandatory (M) or optional (O).

NOTE 1 In case an error condition has multiple choices for the error codes, either of the error codes is valid and the test has to be evaluated as pass for any of these codes.

For conformance evaluation, as in [Table 1](#), the following conformance test methods shall apply:

- By design: for Protocol requirements that are verified by design, the method of technical analysis is at the discretion of the product vendor and, except in special cases, is not specified by this document. In general, the technical analysis shall have sufficient rigor and technical depth to be accepted by a test engineer knowledgeable of the Protocol that the requirement has been met.
- By demonstration: for Protocol requirements that are verified by demonstration, the test conditions are specified by this document.

NOTE 2 A competent demonstrator typically complies with ISO/IEC 17025.

- As implemented: if a Tag or Interrogator implements a subset of the Protocol, conformance shall be verified over the subset that is implemented. For example, although Interrogators may implement DSB-ASK, SSB-ASK or PR-ASK modulation, a manufacturer may choose to only implement DSB-ASK modulation. In this case, conformance testing shall only use DSB-ASK modulation. For parameters that are continuously variable, conformance shall be verified at the minimum and maximum values of the implemented range, unless the test conditions specifically state otherwise.

Table 1 — ISO/IEC 18000-63 protocol subclauses and requirements

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
1	6.1.1	Tags shall not be required to demodulate Interrogator commands while backscattering.	M	T	By design
2	6.1.1	A Tag shall not respond to a mandatory or optional command using full-duplex communications.	M	T	By design
3	6.3.1.1	Tags shall receive power from and communicate with Interrogators within the frequency range from 860 MHz to 960 MHz, inclusive.	M	T	By demonstration Test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz, 910 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 25 µs RTcal: 62,5 µs PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: ≤ 0,33 × Tari TRcal: 100 µs DR: 8 M: 1 TRext: 0
4	6.3.1.1	Interrogators certified for operation in dense-Interrogator environments shall support, but are not required to always use, the dense-Interrogator mode described in ISO/IEC 18000-63:2021, Annex G.	M	I	By design
5	6.3.1.2	Interrogators shall use a fixed modulation format and data rate for the duration of an inventory round, where “inventory round” is defined in ISO/IEC 18000-63:2021, 4.1.	M	I	By design
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
6	6.3.1.2.1	Interrogators certified for operation in single- or multiple-Interrogator environments shall have appropriate frequency accuracy. Local regulations can apply to the frequency accuracy	M	I	By design
7	6.3.1.2.1	Interrogators certified for operation in dense-Interrogator environments shall have a frequency accuracy of ± 10 ppm (parts per million) over the nominal temperature range (-25°C to $+40^{\circ}\text{C}$) and ± 20 ppm over the extended temperature range (-40°C to $+65^{\circ}\text{C}$) while transmitting. Local regulations can apply to the frequency accuracy. Local regulations can specify a tighter frequency accuracy.	M	I	By demonstration. Test conditions: Temperature: maximum (-40°C , minimum supported temperature) and minimum (65°C , maximum supported temperature). If supported temperature range exceeds -25°C or 40°C then testing shall also be performed at -25°C or 40°C respectively. All temperatures are in $^{\circ}\text{C}$ (all $\pm 3^{\circ}\text{C}$). Frequency: 5 test points situated at the band edges and linearly spanning the supported band at valid channel frequencies. Test can be skipped if regulatory approval shows that these requirements have been fulfilled already. Measurement equipment setting: Resolution bandwidth: 1 kHz Video bandwidth: equal to the RBW. Sweep time: AUTO Span: 1 MHz Trace mode: max. hold sufficient to capture all emissions. Detection mode: averaging. Modulation method: continuous wave to allow exact measurement based on the clear peak.
8	6.3.1.2.2	Interrogators shall communicate using DSB-ASK, SSB-ASK, or PR-ASK modulation, detailed in ISO/IEC 18000-63:2021, Annex H.	M	I	By design
9	6.3.1.2.2	Tags shall demodulate all three modulation types.	M	T	By demonstration Test conditions: Temperature: $(23 \pm 3)^{\circ}\text{C}$ Frequency: 860 MHz and 960 MHz. Power: 0 dBm at Tag antenna. Modulation: DSB-ASK, SSB-ASK and PR-ASK. Tari: 6,25 μs , 12,5 μs and 25 μs . RTcal: $2,5 \times \text{Tari}$. PW: minimum and maximum. Modulation depth: 90 % ASK, 200 % PR-ASK.
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
					DSB-ASK rise/fall time: $\leq 0,33 \times \text{Tari}$ SSB-ASK rise/fall time: $\leq 0,33 \times \text{Tari}$ PR-ASK rise/fall time: $\leq 0,62 \times \text{PW}$ TRcal: $2 \times \text{RTcal}$ DR: 8 M: 1 TRext: 0
10	6.3.1.2.3	The R=>T link shall use PIE, shown in ISO/IEC 18000-63:2021, Figure 6.1.	M	I	By design
11	6.3.1.2.3	Pulse modulation depth, rise time, fall time and PW shall be as specified in ISO/IEC 18000-63:2021, Table 6.5, and shall be the same for a data-0 and a data-1.	M	I	By demonstration Test conditions: Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: at channel frequency closest to center of supported band. Power: maximum Interrogator transmit power, as implemented. Other transmit parameters: as implemented.
12	6.3.1.2.3	Interrogators shall use a fixed modulation depth, rise time, fall time, PW, Tari, data-0 length and data-1 length for the duration of an inventory round.	M	I	By design
13	6.3.1.2.3	The RF envelope shall be as specified in ISO/IEC 18000-63:2021, Figure 6.2.	M	I	By demonstration Test conditions: Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: at channel frequency closest to center of supported band. Power: maximum Interrogator transmit power, as implemented. Other transmit parameters: as implemented.
14	6.3.1.2.4	Interrogators shall communicate using Tari values in the range of $6,25 \mu\text{s}$ to $25 \mu\text{s}$.	M	I	By design
15	6.3.1.2.4	Interrogator conformance shall be evaluated using at least one Tari value between $6,25 \mu\text{s}$ and $25 \mu\text{s}$ with at least one value of the parameter x.	M	I	This document uses vendor preferred Tari and x values as consistent with the Protocol.
16	6.3.1.2.4	The tolerance on all parameters specified in units of Tari shall be $\pm 1 \%$.	M	I	By demonstration Test conditions: Temperature: either a) or b) shown below
Key M: mandatory O: optional T: tag I: interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
					a) Single and Multi-Interrogators: (23 ± 3) °C b) Dense-Interrogators tested at modulation, data rate and encoding parameters specified in ISO/IEC 18000-63:2021, Annex G of the Protocol specification: maximum (–40 °C, minimum supported temperature) and minimum (65 °C, maximum supported temperature). If supported temperature range exceeds –25 °C or 40 °C then testing shall also be performed at –25 °C or 40 °C respectively. All temperatures are in °C (all ±3 °C). Frequency: at channel frequency closest to center of supported band. Power: maximum Interrogator transmit power, as implemented. Other transmit parameters: as implemented.
17	6.3.1.2.4	The choice of Tari value and x shall be in accordance with local radio regulations.	M	I	By design
18	6.3.1.2.5	The R=>T RF envelope shall comply with ISO/IEC 18000-63:2021, Figure 6.2 and Table 6.1.	M	I	Tested in compliance with 6.3.1.2.3.
19	6.3.1.2.5	An Interrogator shall not change the R=>T modulation type (i.e. shall not switch between DSB-ASK, SSB-ASK or PR-ASK) without first powering down its RF waveform (see ISO/IEC 18000-63:2021, 6.3.1.2.7).	M	I	By design
20	6.3.1.2.6	The Interrogator power-up RF envelope shall comply with ISO/IEC 18000-63:2021, Figure 6.3 and Table 6.6.	M	I	By demonstration Test conditions: Temperature: (23 ± 3) °C Frequency: at channel frequency closest to center of supported band. Power: maximum Interrogator transmit power, as implemented.
21	6.3.1.2.6	Once the carrier level has risen above the 10 % level, the power-up envelope shall rise monotonically until at least the ripple limit M ₁ . The RF envelope shall not fall below the 90 % point in ISO/IEC 18000-63:2021, Figure 6.3 during interval T _s .	M	I	By demonstration Test conditions: Temperature: (23 ± 3) °C Frequency: at channel frequency closest to center of supported band. Power: maximum Interrogator transmit power, as implemented.
22	6.3.1.2.6	Interrogators shall not issue commands before the end of the maximum settling-time interval in ISO/IEC 18000-63:2021, Table 6.6 (i.e. before T _d).	M	I	By design
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
23	6.3.1.2.7	The Interrogator power-down RF envelope shall comply with ISO/IEC 18000-63:2021, Figure 6.3 and Table 6.7.	M	I	By demonstration Test conditions: Temperature: (23 ± 3) °C Frequency: at channel frequency closest to center of supported band. Power: maximum Interrogator transmit power, as implemented.
24	6.3.1.2.7	Once the carrier level has fallen below the 90 % level, the power-down envelope shall fall monotonically until the power-off limit M_s .	M	I	By demonstration Test conditions: Temperature: (23 ± 3) °C Frequency: at channel frequency closest to center of supported band. Power: maximum Interrogator transmit power, as implemented.
25	6.3.1.2.7	Once powered off, an Interrogator shall remain powered off for a least 1ms before powering up again.	M	I	By design
26	6.3.1.2.8	An Interrogator shall begin all R=>T signalling with either a preamble or a frame-sync, both of which are shown in ISO/IEC 18000-63:2021, Figure 6.4.	M	I	By design
27	6.3.1.2.8	A preamble shall precede a <i>Query</i> command (see ISO/IEC 18000-63:2021, 6.3.2.12.2.1) and denotes the start of an inventory round.	M	I	By design – inherently tested with other tests
28	6.3.1.2.8	All other signalling shall begin with a frame-sync.	M	I	By design – inherently tested with other tests
29	6.3.1.2.8	The tolerance on all parameters specified in units of Tari shall be ±1 %.	M	I	Tested in compliance with 6.3.1.2.3.
30	6.3.1.2.8	PW shall be as specified in ISO/IEC 18000-63:2021, Table 6.5.	M	I	Tested in compliance with 6.3.1.2.3.
31	6.3.1.2.8	The RF envelope shall be as specified in ISO/IEC 18000-63:2021, Figure 6.2.	M	I	By design
32	6.3.1.2.8	A preamble shall comprise a fixed-length start delimiter, a data-0 symbol, an R=>T calibration (RTcal) symbol and a T=>R calibration (TRcal) symbol.	M	I	By demonstration Test conditions: Temperature: (23 ± 3) °C Frequency: at channel frequency closest to center of supported band. Power: maximum Interrogator transmit power, as implemented. Other transmit parameters: as implemented.
33	6.3.1.2.8	An Interrogator shall set RTcal equal to the length of a data-0 symbol plus the length of a data-1 symbol ($RTcal = 0_{length} + 1_{length}$).	M	I	By design
34	6.3.1.2.8	A Tag shall measure the length of RTcal and compute $pivot = RTcal / 2$.	M	T	By design
35	6.3.1.2.8	A Tag shall interpret subsequent Interrogator symbols shorter than <i>pivot</i> to be data-0s and subsequent Interrogator symbols longer than <i>pivot</i> to be data-1s.	M	T	By design
Key M: mandatory O: optional T: tag I: interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
36	6.3.1.2.8	A Tag shall interpret symbols longer than $4 \times \text{RTcal}$ to be invalid.	M	T	By design
37	6.3.1.2.8	Prior to changing RTcal , an Interrogator shall transmit CW for a minimum of $8 \times \text{RTcal}$.	M	I	By design
38	6.3.1.2.8	An Interrogator shall specify a Tag's backscatter link frequency (its FM0 datarate or the frequency of its Miller subcarrier) using the TRcal and divide ratio (DR) in the preamble and payload, respectively, of a <i>Query</i> command that initiates an inventory round.	M	I	By design
39	6.3.1.2.8	A Tag shall measure the length of TRcal , compute BLF and adjust its $T \Rightarrow R$ link rate to be equal to BLF (ISO/IEC 18000-63:2021, Table 6.9 shows BLF values and tolerances).	M	T	Tested in compliance with 6.3.1.3.3.
40	6.3.1.2.8	The TRcal and RTcal that an Interrogator uses in any inventory round shall meet the constraints in ISO/IEC 18000-63:2021, Formula (2): $1,1 \times \text{RTcal} \leq \text{TRcal} \leq 3 \times \text{RTcal}$.	M	I	By design – inherently tested with other tests
41	6.3.1.2.8	An Interrogator, for the duration of an inventory round, shall use the same length RTcal in a frame-sync as it used in the preamble that initiated the round.	M	I	By design
42	6.3.1.2.9	When an Interrogator uses frequency-hopping spread spectrum (FHSS) signalling, the Interrogator's RF envelope shall comply with ISO/IEC 18000-63:2021, Figure 6.5 and ISO/IEC 18000-63:2021, Table 6.8. The RF envelope shall not fall below the 90 % point in ISO/IEC 18000-63:2021, Figure 6.5 during interval T_{hs} .	M	I	By demonstration, for Interrogators that use FHSS: Test conditions: Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: at channel frequency closest to center of supported band. Power: maximum Interrogator transmit power, as implemented.
43	6.3.1.2.9	Interrogators shall not issue commands before the end of the maximum settling-time interval in ISO/IEC 18000-63:2021, Table 6.8 (i.e. before T_{hs}).	M	I	By design
44	6.3.1.2.9	Local regulatory requirements apply to the maximum time between frequency hops and the minimum RF-off time during a hop.	M	I	By design
45	6.3.1.2.10	Local regulations apply for spread-spectrum channelization.	M	I	By design
Key M: mandatory O: optional T: tag I: interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
46	6.3.1.2.10	Local regulations apply for interrogators certified for operation in multiple- or dense-Interrogator environments for spread-spectrum channelization. If channelization is unregulated, the channel plan in Reference [22] (see also ISO/IEC 18000-63:2021, Annex G, which describes multiple- and dense-Interrogator channelized signalling) applies.	M	I	By demonstration, for multiple- or dense-Interrogator certification. Test conditions: Temperature: (23 ± 3) °C Frequency: either a) or b) shown below a) Interrogators that are capable of commanding Tags to backscatter using subcarrier signalling: 50 discrete center frequencies as specified in ISO/IEC 18000-63:2021, Figure G.1, and b) Interrogators that are not capable of commanding Tags to backscatter using subcarrier signalling: All center frequencies supported by the Interrogator. NOTE The certification laboratory reserves the right to test a random subset of the Interrogator's supported center frequencies. Power: maximum Interrogator transmit power, as implemented. Measurement equipment setting: Resolution bandwidth: 1 kHz Video bandwidth: equal to the RBW. Sweep time: AUTO Span: 1 MHz Trace mode: max. hold sufficient to capture all emissions. Detection mode: averaging. Modulation method: continuous modulation. Test can be skipped if regulatory approval shows that these requirements have been fulfilled already.
47	6.3.1.2.11	Local regulations apply for out-of-channel and out-of-band spurious radio-frequency emissions.	M	I	By design
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
48	6.3.1.2.11	Interrogators certified for operation in multiple-Interrogator environments, shall meet the Multiple-Interrogator Transmit Mask shown in ISO/IEC 18000-63:2021, Figure 6.6. Local regulations can apply.	M	I	By demonstration, for multiple-Interrogator certification. Test conditions: Temperature: (23 ± 3) °C Frequency: at channel frequency closest to center of supported band. Power: maximum Interrogator transmit power, as implemented. Channel width: 200 kHz for Interrogators certified for operation in Europe; A maximum of 500 kHz for Interrogators certified for operation in North America. Modulation: as implemented. Transmit data: either a) or b), below. a) a continuous repeating 9-bit maximum length sequence with polynomial $x^9 + x^4 + 1$, initially seeded with all ones, resulting in a repeating 511-bit sequence of FF83DF1732094ED1E7C-D8A91C6D5C4C44021184E5586F4D-C8A15A7EC92DF93533018CA34B-FA2C759678FBA0D6DD82D7D540A-57977039D27AEA243385ED9A-1DE0h, or b) a repeating Select command with a 252 bit Mask value set to ACBCD2114DAE1577C6DBF-4C91A3CDA2F169B340989C1D-32C290465E5C1423CCh. Bit sequences are listed MSB first. Other transmit parameters: as implemented. Measurement equipment setting: Resolution bandwidth: 1 kHz Video bandwidth: equal to the RBW. Sweep time: AUTO Span: 1 MHz Trace mode: max. hold sufficient to capture all emissions. Detection mode: averaging. Modulation method: continuous modulation.
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
49	6.3.1.2.11	Multiple-Interrogator Transmit Mask: for an Interrogator transmitting random data in channel R and any other channel $S \neq R$, the ratio of the integrated power $P()$ in channel S to that in channel R shall not exceed the specified values: a) $ R - S = 1$: $10\log_{10}(P(S) / P(R)) < -20$ dB b) $ R - S = 2$: $10\log_{10}(P(S) / P(R)) < -50$ dB c) $ R - S = 3$: $10\log_{10}(P(S) / P(R)) < -60$ dB d) $ R - S > 3$: $10\log_{10}(P(S) / P(R)) < -65$ dB	M	I	Tested in compliance with ISO/IEC 18000-63:2021, 6.3.1.2.11 and Figure 6.6.
50	6.3.1.2.11	Each channel that exceeds the mask shall be counted as an exception.	M		Tested in compliance with ISO/IEC 18000-63:2021, 6.3.1.2.11 and Figure 6.6.
51	6.3.1.2.11	Interrogators certified for operation in dense-Interrogator environments shall meet the Dense-Interrogator Transmit Mask described below and shown in ISO/IEC 18000-63:2021, Figure 6.7. Local regulations can apply.	M	I	By demonstration, for dense-Interrogator certification. Test conditions: Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: at channel frequency closest to center of supported band. Power: maximum Interrogator transmit power, as implemented. Reference bandwidth: $2,5/\text{Tari}$ Modulation: as implemented. Transmit data: continuous modulation. Tari: according to vendor-selected value for normal operation. Backscatter data rate: one or more of the dense-interrogator data rates specified in ISO/IEC 18000-63:2021, Annex G, as implemented. Other transmit parameters: as implemented. Measurement equipment setting: Resolution bandwidth: 1 kHz Video bandwidth: equal to the RBW. Sweep time: AUTO Span: according to Tari ranges below. Tari $\geq 20 \mu\text{s}$: 1 MHz $20 \mu\text{s} > \text{Tari} \geq 10 \mu\text{s}$: 2 MHz Tari $< 10 \mu\text{s}$: 3 MHz Trace mode: max. hold sufficient to capture all emissions. Detection mode: averaging. Modulation method: continuous modulation.
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
52	6.3.1.2.11	Regardless of the mask used, Interrogators certified for operation in dense-Interrogator environments shall not be permitted the two exceptions to the transmit mask that are allowed for Interrogators certified for operation in multiple-Interrogator environments.	M	I	Tested in compliance with ISO/IEC 18000-63:2021, 6.3.1.2.11 and Figure 6.7. Measurement equipment setting: Resolution bandwidth: 1 kHz Video bandwidth: equal to the RBW. Sweep time: AUTO Span: 1 MHz Trace mode: max. hold sufficient to capture all emissions. Detection mode: averaging Modulation method: continuous repeated inventory sequence (no tags present)
53	6.3.1.2.11	For Interrogator transmissions centered at a frequency f_c , a 2,5/Tari bandwidth R_{BW} also centered at f_c , an offset frequency $f_o = 2,5/Tari$ and a 2,5/Tari bandwidth S_{BW} centered at $(n \times f_o) + f_c$ (integer n), the ratio of the integrated power $P()$ in S_{BW} to that in R_{BW} with the Interrogator transmitting random data shall not exceed the specified values: a) $ n = 1$: $10\log_{10}(P(S_{BW}) / P(R_{BW})) < -30$ dB b) $ n = 2$: $10\log_{10}(P(S_{BW}) / P(R_{BW})) < -60$ dB c) $ n > 2$: $10\log_{10}(P(S_{BW}) / P(R_{BW})) < -65$ dB	M	I	Tested in compliance with ISO/IEC 18000-63:2021, 6.3.1.2.11 and Figure 6.7. Measurement equipment setting: Resolution bandwidth: 1 kHz Video bandwidth: equal to the RBW. Sweep time: AUTO Span: 1 MHz Trace mode: max. hold sufficient to capture all emissions. Detection mode: averaging. Modulation method: continuous repeated inventory sequence (no tags present).
54	6.3.1.3	A Tag shall backscatter using a fixed modulation format, data encoding and data rate for the duration of an inventory round, where "inventory round" is defined in ISO/IEC 18000-63:2021, 4.1.	M	T	By design
55	6.3.1.3.1	Tag backscatter shall use ASK and/or PSK modulation.	M	T	By design
56	6.3.1.3.1	Interrogators shall demodulate both modulation types.	M	I	By design
57	6.3.1.3.2	Tags shall encode the backscattered data as either FM0 baseband or Miller modulation of a subcarrier at the data rate.	M	T	Tested in compliance with ISO/IEC 18000-63:2021, 6.3.1.3.2.1 and 6.3.1.3.2.3.
Key M: mandatory O: optional T: tag I: interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
58	6.3.1.3.2.1	The duty cycle of a 00 or 11 sequence, measured at the modulator output, shall be a minimum of 45 % and a maximum of 55 %, with a nominal value of 50 %.	M	T	By demonstration Test conditions: Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: 860 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: $0,5 \times \text{Tari}$ Modulation depth: 90 % Rise/fall time: $\leq 0,33 \times \text{Tari}$ TRext: 0 Test # 1 Tari: 6,25 μs RTcal: 18,75 μs TRcal: 33,3 μs and 50 μs DR: 64/3 M: 1 Test # 2 Tari: 12,5 μs RTcal: 31,25 μs TRcal: 66,7 μs, 83,3 μs DR: 64/3 M: 1
59	6.3.1.3.2.1	FM0 signalling shall always end with a "dummy" data-1 bit at the end of a transmission, as shown in ISO/IEC 18000-63:2021, Figure 6.10.	M	T	By design
60	6.3.1.3.2.2	T=>R FM0 signalling shall begin with one of the two preambles shown in ISO/IEC 18000-63:2021, Figure 6.11.	M	T	By demonstration Test conditions: Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: 860 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: $0,5 \times \text{Tari}$ Modulation depth: 90 % Rise/fall time: $\leq 0,33 \times \text{Tari}$ Tari: 25 μs RTcal: 75 μs TRcal: 100 μs DR: 8 M: 1 TRext: 0 and 1
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
61	6.3.1.3.2.2	The choice depends on the T_{Rext} value specified in the <i>Query</i> that initiated the inventory round, unless a Tag is replying to a command that uses a delayed or in-process reply (see ISO/IEC 18000-63:2021, 6.3.1.6), in which case a Tag shall use the extended preamble regardless of T_{Rext} (i.e. the Tag replies as if T_{Rext} = 1 regardless of the T_{Rext} value specified in the <i>Query</i> — see ISO/IEC 18000-63:2021, 6.3.2.12.3).	M	T	By demonstration Tested in compliance with ISO/IEC 18000-63:2021, 6.3.2.6 and Figure 6.21.
62	6.3.1.3.2.3	ISO/IEC 18000-63:2021, Figure 6.13 shows Miller-modulated subcarrier sequences; the Miller sequence shall contain exactly two, four, or eight subcarrier cycles per bit, depending on the M value specified in the <i>Query</i> command that initiated the inventory round (see ISO/IEC 18000-63:2021, Table 6.10).	M	T	By design
63	6.3.1.3.2.3	The duty cycle of a 0 or 1 symbol, measured at the modulator output, shall be a minimum of 45 % and a maximum of 55 %, with a nominal value of 50 %.	M	T	By demonstration Test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: ≤ 0,33 × Tari T _{Rext} : 0 Test # 1 Tari: 6,25 µs RTcal: 18,75 µs TRcal: 33,3 µs and 50 µs DR: 64/3 M: 2, 4, 8 Test # 2 Tari: 12,5 µs RTcal: 31,25 µs TRcal: 66,7 µs, 83,3 µs DR: 64/3 M: 2, 4, 8
64	6.3.1.3.2.3	Miller signaling shall always end with a “dummy” data-1 bit at the end of a transmission, as shown in ISO/IEC 18000-63:2021, Figure 6.14.	M	T	By design
Key M: mandatory O: optional T: tag I: interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
65	6.3.1.3.2.4	T=>R subcarrier signalling shall begin with one of the two preambles shown in ISO/IEC 18000-63:2021, Figure 6.15.	M	T	By demonstration Test conditions: Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: 860 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: $0,5 \times \text{Tari}$ Modulation depth: 90 % Rise/fall time: $< 0,33 \times \text{Tari}$ Tari: 25 μs RTcal: 75 μs TRcal: 100 μs DR: 8 M: 2, 4, 8 TRe xt: 0 and 1
66	6.3.1.3.2.4	The choice depends on the TRe xt value specified in the Query that initiated the inventory round, unless a Tag is replying to a command that uses a delayed or in-process reply (see ISO/IEC 18000-63:2021, 6.3.1.6), in which case a Tag shall use the extended preamble regardless of TRe xt (i.e. the Tag replies as if TRe xt=1 regardless of the TRe xt value specified in the Query—see ISO/IEC 18000-63:2021, 6.3.2.10.3).	M	T	By demonstration Tested in compliance with ISO/IEC 18000-63:2021, 6.3.2.6 and Figure 6.21.
67	6.3.1.3.3	Tags shall support all R=>T Tari values in the range of 6,25 μs to 25 μs , over all parameters allowed by ISO/IEC 18000-63:2021, 6.3.1.2.3. Tags shall support the T=>R link frequencies and tolerances specified in ISO/IEC 18000-63:2021 Table 6.9 and the T=>R data rates specified in ISO/IEC 18000-63:2021, Table 6.10.	M	T	The FT requirements in ISO/IEC 18000-63:2021, Table 6.9 shall be verified by design. Tag manufacturers shall provide plots of worst-case FT error versus TRcal. Tag manufacturers shall also provide measured data used to generate the FT plots, including: a) Tag oscillator frequency tolerance; b) Tag oscillator frequency drift; c) TRcal measurement error budget; d) Other contributors to FT error. The frequency-variation during backscatter requirements in ISO/IEC 18000-63:2021, Table 6.9 shall be verified by demonstration. The testing laboratory shall measure the minimum, median and maximum symbol length ($M = 1$) or subcarrier period ($M = 2, 4, 8$) during backscatter of a 128-bit sequence (16-bit PC, 96-bit UII and a CRC-16). The minimum and maximum values shall not deviate by more than 2,5 % from the median. The test conditions are:
Key M: mandatory O: optional T: tag I: interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
					Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: 860 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: $0,5 \times \text{Tari}$ Modulation depth: 90 % Rise/fall time: $\leq 0,33 \times \text{Tari}$ TRext: 0 Test # 1 Tari: 6,25 μs RTcal: 18,75 μs TRcal: $33,3 \times 0,99 \mu\text{s}$, 33,3 μs and $33,3 \times 1,01 \mu\text{s}$ DR: 64/3 M: 1, 2, 4, 8 For all TRcal values above, FT shall be verified with the value for TRcal = 33,3 μs. Test # 2 Tari: 6,25 μs RTcal: 18,75 μs TRcal: $50 \times 0,99 \mu\text{s}$, 50 μs and $50 \times 1,01 \mu\text{s}$ DR: 64/3 M: 1, 2, 4, 8 For all TRcal values above, FT shall be verified with the value for TRcal = 50 μs. Test # 3 Tari: 25 μs RTcal: 75 μs TRcal: $200 \times 0,99 \mu\text{s}$, 200 μs and $200 \times 1,01 \mu\text{s}$ DR: 8 M: 1, 2, 4, 8 For all TRcal values above, FT shall be verified with the value for TRcal = 200 μs.
68	6.3.1.3.4	Tags energized by an Interrogator shall be capable of receiving and acting on Interrogator commands within a period not exceeding the maximum settling-time interval specified in ISO/IEC 18000-63:2021, Table 6.6 or ISO/IEC 18000-63:2021, Table 6.8, as appropriate (i.e. within T_s or T_{hs} , respectively).	M	T	By design
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
69	6.3.1.3.5	For a Tag certified to this protocol, the Tag manufacturer shall specify: a) free-space, sensitivity, b) minimum backscattered modulated power (ASK modulation) or change in radar cross-section or equivalent (phase modulation), and c) the manufacturer's normal operating conditions for the Tag mounted on one or more manufacturer-selected materials.	M	T	By design The Tag manufacturer shall provide this specification in the supplied documents.
70	6.3.1.4	The transmission order for all R=>T and T=>R communications shall be most-significant bit (MSB) first.	M	T and I	By design
71	6.3.1.4	Within each message, the most-significant word shall be transmitted first.	M	T and I	By design
72	6.3.1.4	Within each word, the MSB shall be transmitted first.	M	T and I	By design
73	6.3.1.5	To generate a CRC-16 a Tag or Interrogator shall first generate the CRC-16 precursor shown in ISO/IEC 18000-63:2021, Table 6.11 and then take the ones-complement of the generated precursor to form the CRC-16.	M	T and I	By design
74	6.3.1.5	A Tag or Interrogator shall verify the integrity of a received message that uses a CRC-16.	M	T and I	By design
75	6.3.1.5	Tags shall append a CRC-16 to those replies that use a CRC-16 — see ISO/IEC 18000-63:2021, 6.3.2.12 for command-specific replies.	M	T	By design
76	6.3.1.5	To generate a CRC-5 an Interrogator shall use the definition in ISO/IEC 18000-63:2021, Table 6.12.	M	I	By design
77	6.3.1.5	A Tag shall verify the integrity of a received message that uses a CRC-5.	M	T	By design
78	6.3.1.5	Interrogators shall append the appropriate CRC to R=>T transmissions as specified in ISO/IEC 18000-63:2021, Table 6.28.	M	I	By design
79	6.3.1.6	Tags and Interrogators that support Immediate Reply Type (see ISO/IEC 18000-63:2021, Table 6.28) shall meet all timing requirements shown in ISO/IEC 18000-63:2021, Table 6.16.	M	T and I	By demonstration Interrogator test conditions: Verify Interrogator meets T_2 , T_3 and T_4 . Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: At channel frequency closest to center of supported band. Power: Maximum Interrogator transmit power, as implemented. Other transmit parameters: As implemented. Tag test conditions:
Key M: mandatory O: optional T: tag I: interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
					Verify Tag meets T_1 over T_2 extremes. Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: 860 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: $0,5 \times T_{\text{ari}}$ Modulation depth: 90 % Rise/fall time: $\leq 0,33 \times T_{\text{ari}}$ TRext: 0 Minimum T_2 condition: Tari: 6,25 μs RTcal: 18,75 μs TRcal: 33,3 μs and 50 μs DR: 64/3 M: 1 Maximum T_2 condition: Tari: 25 μs RTcal: 75 μs TRcal: 200 μs DR: 8 M: 2, 4, 8
80	6.3.1.6	Tags and Interrogators that support Delayed Reply Type (see ISO/IEC 18000-63:2021, Table 6.28) shall meet all timing requirements shown in ISO/IEC 18000-63:2021, Table 6.16.	M	T and I	By demonstration Interrogator test conditions: Verify Interrogator meets T_2 , and T_4 . Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: At channel frequency closest to center of supported band. Power: Maximum Interrogator transmit power, as implemented. Other transmit parameters: as implemented Tag test conditions: Verify Tag meets T_5 over T_2 extremes. Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: 860 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: $0,5 \times T_{\text{ari}}$
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
					Modulation depth: 90 % Rise/fall time: $\leq 0,33 \times T_{\text{ari}}$ TRext: 1 Minimum T_2 condition: Tari: 6,25 μs RTcal: 18,75 μs TRcal: 33,3 μs and 50 μs DR: 64/3 M: 1 Maximum T_2 condition: Tari: 25 μs RTcal: 75 μs TRcal: 200 μs DR: 8 M: 2,4, 8
81	6.3.1.6	Tags and Interrogators that support In-process Reply Type (see ISO/IEC 18000-63:2021, Table 6.28) shall meet all timing requirements shown in ISO/IEC 18000-63:2021, Table 6.16.	M	T and I	By demonstration Interrogator test conditions: Verify Interrogator meets T_2 and T_4 . Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: At channel frequency closest to center of supported band. Power: Maximum Interrogator transmit power, as implemented. Other transmit parameters: as implemented. Tag test conditions: Verify Tag meets T_6 and T_7 over T_2 extremes. Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: 860 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: $0,5 \times T_{\text{ari}}$
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
					Modulation depth: 90 % Rise/fall time: $\leq 0,33 \times T_{\text{ari}}$ T _{Rext} : 1 Minimum T ₂ condition: T _{ari} : 6,25 µs RT _{cal} : 18,75 µs TR _{cal} : 33,3 µs and 50 µs DR: 64/3 M: 1 Maximum T ₂ condition: T _{ari} : 25 µs RT _{cal} : 75 µs TR _{cal} : 200 µs DR: 8 M: 2, 4, 8
82	6.3.1.6	As described in ISO/IEC 18000-63:2021, 6.3.1.2.8, an Interrogator shall use a fixed R=>T link rate for the duration of an inventory round.	M	I	By design
83	6.3.1.6	Prior to changing the R=>T link rate, an Interrogator shall transmit CW for a minimum of 8×RT _{cal} .	M	I	By design
84	6.3.1.6 Table 6.16	The maximum value for T ₂ shall apply only to Tags in the reply or acknowledged states (see ISO/IEC 18000-63:2021, 6.3.2.6.3 and ISO/IEC 18000-63:2021, 6.3.2.6.4).	M	T	By demonstration Issue a Read command in Secured State. T ₂ before the Read command shall be at least 10 ms. Test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz, 910 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK T _{ari} : 12,5 µs RT _{cal} : 31,25 µs PW: 0,5 × T _{ari} Modulation depth: 90 % Rise/fall time: $< 0,33 \times T_{\text{ari}}$ TR _{cal} : 66,7 µs DR: 64/3 M: 3 T _{Rext} : 1
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
85	6.3.1.6 Table 6.16	For a Tag in the reply or acknowledged states, if T_2 expires (i.e. reaches its maximum value) without the Tag receiving a valid command, the Tag shall transition to the arbitrate state (see ISO/IEC 18000-63:2021, 6.3.2.6.2).	M	T	By design
86	6.3.1.6 Table 6.16	For a Tag in the reply or acknowledged states, if T_2 expires (i.e. reaches its maximum value) during the reception of a valid command, the Tag shall execute the command.	M	T	By design
87	6.3.1.6 Table 6.16	For a Tag in the reply or acknowledged states, if T_2 expires (i.e. reaches its maximum value) during the reception of an invalid command, the Tag shall transition to arbitrate upon determining that the command is invalid.	M	T	By design
88	6.3.1.6 Table 6.16	In all other states the maximum value for T_2 shall be unrestricted.	M	T	By design
89	6.3.1.6	$T_1 + T_3$ shall not be less than T_4	M	T	By design
90	6.3.1.6.2	After issuing a command that uses delayed reply timing an Interrogator shall transmit CW for at least the lesser of T_{REPLY} or $T_{5(\text{max})}$, where T_{REPLY} is the time between the Interrogator's command and the Tag's backscattered reply.	M	I	By demonstration
91	6.3.1.6.2	When an Interrogator issues a command that uses delayed reply timing and the Tag successfully executes the command, after executing the command the Tag shall backscatter the reply shown in ISO/IEC 18000-63:2021, Table 6.13 and Figure 6.16, comprising a header (a 0-bit), the Tag's handle, and a CRC-16 calculated over the 0-bit and handle.	M	T	By demonstration Write the PC with value 0x3000. Verify that the Tag response is according to Table 6.13 and Figure 6.16. T_5 should meet the limit in Table 6.16. Test conditions: Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: 860 MHz, 910 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 μs RTcal: 31,25 μs PW: $0,5 \times \text{Tari}$ Modulation depth: 90 % Rise/fall time: $< 0,33 \times \text{Tari}$ TRcal: 66,7 μs DR: 64/3 M: 3 TRext: 1
92	6.3.1.6.2	The reply shall meet the T_5 limits in ISO/IEC 18000-63:2021, Table 6.16.	M	T	By demonstration Tested in compliance with Item 91.
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
93	6.3.1.6.2	When an Interrogator issues a command that uses delayed reply timing and the Tag encounters an error, the Tag shall backscatter an error code (see ISO/IEC 18000-63:2021, Annex I) during the CW period rather than the reply shown in ISO/IEC 18000-63:2021, Table 6.13.	M	T	By demonstration Write the Stored-CRC with value 0x0000. Verify that the Tag respond with an error message. Test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz, 910 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 µs RTcal: 31,25 µs PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: < 0,33 × Tari TRcal: 66,7 µs DR: 64/3 M: 3 TRExt: 1
94	6.3.1.6.2	A Tag shall ignore Interrogator commands while processing a prior command that specified a delayed reply.	M	T	By demonstration Write the PC with value 0x3000. Issue a <i>Req_RN</i> command before the Tag has time to respond. Verify that the Tag ignores the <i>Req_RN</i> command and only processes the Write operation (either with/without write error). Test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz, 910 MHz and 960 MHz Power: ≥ 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 µs RTcal: 31,25 µs PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: < 0,33 × Tari TRcal: 66,7 µs DR: 64/3 M: 3 TRExt: 1 For this test, it shall be verified that the tag always has sufficient power available.
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
95	6.3.1.6.2	A delayed Tag reply shall use the extended preamble shown in ISO/IEC 18000-63:2021, Figure 6.11 or ISO/IEC 18000-63:2021, Figure 6.15, as appropriate (i.e. the Tag shall reply as if $T_{Rext}=1$ regardless of the T_{Rext} value in the <i>Query</i> that initiated the inventory round).	M	T	By design
96	6.3.1.6.3	An <i>in-process</i> reply may include multiple backscatter transmissions from Tag to Interrogator.	O	I	By demonstration Issue a valid command that employs an in-process reply. Verify that the Interrogator is able to decode all backscatter transmissions. The maximum number of backscatter transmissions shall be specified by the interrogator manufacturer. Test conditions: Temperature: $(23 \pm 3) ^\circ\text{C}$ Frequency: 860 MHz, 910 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 μs RTcal: 31,25 μs PW: $0,5 \times \text{Tari}$ Modulation depth: 90 % Rise/fall time: $< 0,33 \times \text{Tari}$ TRcal: 66,7 μs DR: 64/3 M: 3 T_{Rext}: 1
97	6.3.1.6.3	The first transmission shall meet the T_6 limits specified in ISO/IEC 18000-63:2021, Table 6.16; subsequent transmissions (if any) shall meet T_7 .	M	T	By design
98	6.3.1.6.3	A Tag shall backscatter a transmission at least once every $T_{7(max)}$ while processing the command.	M	T	By demonstration Issue a valid command that employs an in-process reply. Verify that the Tag replies as shown in Table 6.14. T_6 and T_7 shall meet limits specified in Table 6.16. The number of backscatter transmissions shall be limited to MIN (maximum number of backscatter transmissions, 4). Test conditions: Temperature: $(23 \pm 3) ^\circ\text{C}$
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
					Frequency: 860 MHz, 910 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 µs RTcal: 31,25 µs PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: < 0,33 × Tari TRcal: 66,7 µs DR: 64/3 M: 3 TRext: 1
99	6.3.1.6.3	A Tag's <i>in-process</i> reply or replies shall be as shown in ISO/IEC 18000-63:2021, Table 6.14.	M	T	By demonstration Tested in compliance with Item 98.
100	6.3.1.6.3	The Tag replies shall be consistent for first and subsequent Tag transmissions – i.e. if the final reply includes length , then all intermediate replies shall include length and vice versa.	M	T	By design
101	6.3.1.6.3	While processing the command the Tag backscatters a transmission as shown in ISO/IEC 18000-63:2021, Table 6.14 at least once every $T_{7(max)}$. Done and header for these intermediate replies shall be zero, response shall be null, and if the replies include length , then length =0000 _h .	M	T	By demonstration Tested in compliance with Item 98.
102	6.3.1.6.3	All replies shall meet the T_6 and T_7 limits specified in ISO/IEC 18000-63:2021, Table 6.16. If the Interrogator observes a final reply with header =0, then the command completed successfully.	M	T	By demonstration Tested in compliance with Item 98.
103	6.3.1.6.3	All replies shall meet the T_6 and T_7 limits specified in ISO/IEC 18000-63:2021, Table 6.16. If the Interrogator observes a final reply with header =1, then the Tag encountered an error (see ISO/IEC 18000-63:2021, Annex I).	M	T	By demonstration Issue a command with an unsupported parameter that employs an in-process reply. Verify that the Tag replies an error (see ISO/IEC 18000-63:2021, Table 6.14 and ISO/IEC 18000-63:2021, Annex I). T_6 and T_7 shall meet limits specified in Table 6.16. Test conditions: Temperature: (23 ± 3) °C
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
					Frequency: 860 MHz, 910 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 µs RTcal: 31,25 µs PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: < 0,33 × Tari TRcal: 66,7 µs DR: 64/3 M: 3 TRExt: 1
104	6.3.1.6.3	<u>Length</u> shall comprise a 15-bit value field followed by an even parity bit (the number of 1's in the 16-bit <u>length</u> field shall be an even number, with <u>length</u> =0000 _h an allowed value).	M	T	By design
105	6.3.1.6.3	A Tag shall ignore Interrogator commands while processing a prior command that specified an <i>in-process</i> reply.	M	T	By demonstration Issue a valid command that employs an in-process reply. Issue a <i>Req_RN</i> command before the Tag has time to respond. Verify that the Tag ignores the <i>Req_RN</i> command and only processes the in-process reply. Test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz, 910 MHz and 960 MHz Power: ≥ 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 µs RTcal: 31,25 µs PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: < 0,33 × Tari TRcal: 66,7 µs DR: 64/3 M: 3 TRExt: 1 For this test, it shall be verified that the tag always has sufficient power available.
Key M: mandatory O: optional T: tag I: interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
106	6.3.1.6.3	After issuing a command that uses an <i>in-process</i> reply an Interrogator shall transmit CW until the Interrogator either a) observes a reply with <u>done</u> =1 indicating the Tag has finished executing the command, or b) fails to observe a reply for at least $T_{6(max)}$ or $T_{7(max)}$ (as appropriate) indicating that the Tag failed to execute the command.	M	I	By design
107	6.3.1.6.3	An <i>in-process</i> Tag reply shall use the extended preamble shown in ISO/IEC 18000-63:2021, Figure 6.11 or ISO/IEC 18000-63:2021, Figure 6.15, as appropriate (i.e. the Tag shall reply as if <u>TRExt</u> =1 regardless of the <u>TRExt</u> value in the <i>Query</i> that initiated the inventory round).	M	T	By design
108	6.3.1.6.4	A Tag that implements a <i>Challenge</i> command, or any access command (other than <i>AuthComm</i>) that employs an <i>in-process</i> reply, shall implement a C flag and a Response-Buffer with the following properties:	M	T	By demonstration Tested in compliance with Item 109.
109	6.3.1.6.4	A Tag shall set C=0 upon either a) receiving an access command containing <u>SenRep</u> (c.f. ISO/IEC 18000-63:2021, 6.3.2.12.3.10), b) receiving a <i>Challenge</i> command, or c) when specified by a cryptographic suite, and shall set C=1 after storing a <u>response</u> (result or error code) in its ResponseBuffer.	M	T	By demonstration Read XPC_W1 value to verify that the initial value of C flag is '0'. Issue a <i>Challenge</i> or an <i>Authenticate</i> command with <u>SenRep</u> =0. Read XPC_W1 value to verify that the value of C flag has changed to '1'. Test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz, 910 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 µs RTcal: 31,25 µs PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: < 0,33 × Tari TRcal: 66,7 µs DR: 64/3 M: 3 TRExt: 1
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
110	6.3.1.6.4	The C flag shall be selectable using a <i>Select</i> command.	M	T	By demonstration Test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz, 910 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 µs RTcal: 31,25 µs PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: < 0,33 × Tari TRcal: 66,7 µs DR: 64/3 M: 3 TRext: 1
111	6.3.1.6.4	If an access command with <i>SenRep</i> =0 or a <i>Challenge</i> command specifies <i>IncReplLen</i> =0 then a Tag shall not include a <i>length</i> field with its stored <i>response</i> , so the first word of the stored <i>response</i> shall be at Response-Buffer location 00 _h .	M	T	By demonstration Issue a <i>Challenge</i> or an <i>Authenticate</i> command with <i>SenRep</i>=0 and <i>IncReplLen</i>=0. Verify that no length field is contained in the ResponseBuffer, by using the <i>ReadBuffer</i> command. Test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz, 910 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 µs RTcal: 31,25 µs PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: < 0,33 × Tari TRcal: 66,7 µs DR: 64/3 M: 3 TRext: 1
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
112	6.3.1.6.4	If the command specifies <u>IncReplen</u> =1 then ResponseBuffer bits 00 _h – 0E _h shall contain the length of the stored <u>response</u> in bits, ResponseBuffer bit 0F _h shall contain an even parity bit that the Tag computes over bits 00 _h – 0E _h and the first word of the stored <u>response</u> shall be at ResponseBuffer location 10 _h . See ISO/IEC 18000-63:2021, Figure 6.17.	M	T	By demonstration Issue a <i>Challenge</i> or an <i>Authenticate</i> command with <u>SenRep</u> =0 and <u>IncReplen</u> =1. Verify that the <u>length</u> field is contained in the ResponseBuffer, by using the <i>ReadBuffer</i> command. Test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz, 910 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 µs RTcal: 31,25 µs PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: < 0,33 × Tari TRcal: 66,7 µs DR: 64/3 M: 3 TRext: 1
113	6.3.1.6.4	The maximum size of a stored <u>response</u> shall be 32 kbits.	M	T	By design
114	6.3.1.6.4	The maximum ResponseBuffer size shall be 32,784 bits (15 length bits, 1 parity bit, 32k <u>response</u> bits). A Tag manufacturer may limit the ResponseBuffer to a size less than this maximum.	M	T	By design
115	6.3.1.6.4	A Tag shall dynamically adjust its ResponseBuffer, on a command-by-command basis, to the required size.	M	T	By design
116	6.3.1.6.4	The ResponseBuffer shall be read-only to an Interrogator.	M	T	By Design
117	6.3.1.6.4	A Tag shall abort command processing and instead store an error code in its ResponseBuffer if and when it determines that <u>response</u> will overflow the ResponseBuffer (see ISO/IEC 18000-63:2021, Annex I).	M	T	By Design
118	6.3.1.6.4	A Tag shall retain data in its ResponseBuffer with the persistence of its C flag (see ISO/IEC 18000-63:2021, Table 6.20).	M	T	By demonstration Issue a <i>Challenge</i> or an <i>Authenticate</i> command with <u>SenRep</u> =0. Switch of the carrier after successful tag response. Read XPC_W1 after the persistence of the C flag. Verify that C=1. Issue a <i>ReadBuffer</i> command to verify that the Tag deallocated its ResponseBuffer. Test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz, 910 MHz and 960 MHz
Key M: mandatory O : optional T : tag I : interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63: 2021 subclause	Requirement	M/O	Applies to	Conformance test method
					Power: 0 dBm at Tag antenna Modulation: DSB-ASK Tari: 12,5 µs RTcal: 31,25 µs PW: 0,5 Tari Modulation depth: 90 % Rise/fall time: < 0,33Tari TRcal: 66,7 µs DR: 64/3 M: 3 TRezt: 1
119	6.3.1.6.4	When C is 1, then a Tag shall maintain the data in its ResponseBuffer.	M	T	By demonstration Tested in compliance with Item 112.
120	6.3.1.6.4	When C is or becomes 0, then a Tag shall deallocate its ResponseBuffer.	M	T	By demonstration Tested in compliance with Item 119.
121	6.3.1.6.4	The maximum value for T_2 shall apply only to Tags in the reply or acknowledged states (see ISO/IEC 18000-63:2021, 6.3.2.6.3 and ISO/IEC 18000-63:2021, 6.3.2.6.4). For a Tag in the reply or acknowledged states, if T_2 expires (i.e. reaches its maximum value): — without the Tag receiving a valid command, the Tag shall transition to the arbitrate state (see ISO/IEC 18000-63:2021, 6.3.2.6.2), — during the reception of a valid command, the Tag shall execute the command, and — during the reception of an invalid command, the Tag shall transition to arbitrate upon determining that the command is invalid. In all other states the maximum value for T_2 shall be unrestricted. A Tag shall be allowed a tolerance of $20,0 \times T_{pri} \leq T_{2(max)} \leq 32 \times T_{pri}$ in determining whether T_2 has expired. "Invalid command" is defined in ISO/IEC 18000-63:2021, 6.3.2.12.	M	T	By design
122	6.3.1.6.4	$T_1 + T_3$ shall not be less than T_4 .	M	T	By design
123	6.3.2.1	Tag memory shall be logically separated into four distinct banks, each of which may comprise zero or more memory words.	M	T	By demonstration Tested in compliance with Item 132.
124	6.3.2.1	Reserved memory shall contain the kill and/or access passwords, if passwords are implemented on the Tag.	M	T	By demonstration Tested in compliance with Item 132.
125	6.3.2.1	The kill password shall be stored at memory addresses 00_h to $1F_h$.	M	T	By design
126	6.3.2.1	The access password shall be stored at memory addresses 20_h to $3F_h$.	M	T	By design
Key M: mandatory O: optional T: tag I: interrogator					

Table 1 (continued)

Item	ISO/IEC 18000-63:2021 subclause	Requirement	M/O	Applies to	Conformance test method
127	6.3.2.1	UII memory shall contain a CRC-16 at memory addresses 00 _h to 0F _h , Protocol-Control (PC) bits at memory addresses 10 _h to 1F _h and a code (such as a Unique Item Identifier, hereafter referred to as an UII) that identifies the object to which the Tag is or will be attached beginning at address 20 _h .	M	T	By design
128	6.3.2.1	TID memory shall contain an 8-bit ISO/IEC 15963-1 allocation class identifier at memory locations 00 _h to 07 _h . TID memory shall contain sufficient identifying information above 07 _h for an Interrogator to uniquely identify the custom commands and/or optional features that a Tag supports.	M	T	By demonstration Singulate the Tag, read its TID memory and verify the contents. Tag test conditions: Temperature: (23 ± 3) °C Frequency: 860 MHz and 960 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0,5 × Tari Modulation depth: 90 % Rise/fall time: ≤ 0,33 × Tari Tari: 25 µs RTcal: 75 µs TRcal: 100 µs DR: 8 M: 1 TRext: 0
129	6.3.2.1	The logical addressing of all memory banks and User-memory files shall begin at zero (00 _h).	M	T	By design
130	6.3.2.1	The backscatter shall fall on word boundaries (except in the case of a truncated reply – see ISO/IEC 18000-63:2021, 6.3.2.10.1.1).	M	T	By design
131	6.3.2.1	MemBank shall be defined as follows: 00 ₂ Reserved 01 ₂ UII 10 ₂ TID 11 ₂ User	M	T	By design
Key M: mandatory O : optional T : tag I : interrogator					