ecma INTERNATIONAL

Standard ECMA-362

3rd Edition / June 2024

NFCIP-1 - Protocol test methods

Standard

Rue du Rhône 114 CH-1204 Geneva T: +41 22 849 6000 F: +41 22 849 6001

Contents

Page

Introduction

In 2002, Ecma International formed Task Group 19 of Technical Committee 32 to specify Near Field Communication (NFC) signal interfaces and protocols. The NFC devices are wireless closely coupled devices communicating at 13,56 MHz. In 2008, Task Group 19 became Technical Committee 47.

The General Assembly of December 2002 adopted Near Field Communication Interface and Protocol 1 (NFCIP-1) as Standard ECMA-340.

This Ecma Standard specifies protocol tests for ECMA-340 and complements ECMA-356, which specifies the RF interface tests for ECMA-340.

The 2nd edition was completely aligned with ISO/IEC 23917:2005.

This 3rd edition is fully aligned with the 2nd edition of ISO/IEC 23917:2023. The main changes include alignments with the latest edition of ISO/IEC 18092, improvements on descriptions of test procedures and corrections of test scenarios.

This Ecma Standard was developed by Technical Committee 51 and was adopted by the General Assembly of June 2024.

NFCIP-1 - Protocol test methods

1 Scope

This document specifies protocol test methods for Near Field Communication Interface and Protocol 1 (NFCIP-1), as defined in ISO/IEC 18092 (the base standard).

The radio frequency (RF) test methods for NFCIP-1 (also defined in ISO/IEC 18092) are specified in ISO/IEC 22536.

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 10373-6, *Cards and security devices for personal identification — Test methods — Part 6: Contactless proximity objects*

ISO/IEC 18092:2023, *Telecommunications and information exchange between systems — Near Field Communication Interface and Protocol 1 (NFCIP-1)*

ISO/IEC 22536, *Information technology — Telecommunications and information exchange between systems — Near Field Communication Interface and Protocol 1 (NFCIP-1) — RF interface test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 18092 and the following 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/

3.1
activation in active communication mode
flow to activate the device under test (DUT) in *active communication mode* (3.3), which includes initialisation and protocol activation

3.2
activation in passive communication mode
flow to activate the device under test (DUT) in *passive communication mode* (3.5), which includes initialisation and protocol activation

3.3
active communication mode
mode in which both the Initiator and the Target use their own radio frequency (RF) field to enable the communication

[SOURCE: ISO/IEC 18092:2023, 3.1.]

3.4
operating volume
volume with a field strength of at least H_{min} and not exceeding H_{max} generated by a near field communication (NFC) device at manufacturer specified positions

3.5
passive communication mode
mode in which the Initiator is generating the radio frequency (RF) field and the Target responds to an Initiator command in a load modulation scheme

[SOURCE: ISO/IEC 18092:2023, 3.17.]

3.6
Single Device Detection
SDD
algorithm used by the Initiator to detect one out of several Targets in its radio frequency (RF) field

[SOURCE: ISO/IEC 18092:2023, 3.20.]

3.7
scenario
protocol and application-specific sequence of test commands

NOTE 1 to entry: Scenario description tables list all individual *test commands* (3.8).

3.8
test commands
commands defined for dedicated functional behaviour on a device under test (DUT)

NOTE 1 to entry: Table 1 lists test commands.

3.9
transport protocol
protocol for data exchange between Initiator and Target, consisting of activation, data exchange and deactivation

NOTE 1 to entry: The transport protocol is defined in ISO/IEC 18092.

4 Symbols and abbreviated terms

The abbreviated terms in ISO/IEC 18092 and the following apply.

ATR_REQ	ATtribute Request command
ATR_RES	Response to the ATR_REQ
CRC	Cyclic Redundancy Check
~CRC	CRC as defined above with all bits inverted
DEP_REQ	Data Exchange Protocol Request
DEP_RES	Response to the Data Exchange Protocol Request
DID	Device ID
DSL_REQ	DeSeLect Request command
DSL_RES	Response to the DSL_REQ
DUT	Device Under Test
f_c	Frequency of operating field (carrier frequency)

H_{max}	Maximum field strength of the Initiator antenna field
H_{min}	Minimum field strength of the Initiator antenna field
$H_{Threshold}$	Threshold value to detect an external RF field
ID	Identification number
I/O	Input and Output
LT	Lower Tester, the Target-emulation part of the Initiator-Test-apparatus
Mute	No response within a specified timeout
NFCIP-1	Near field communication interface and protocol
PDU	Protocol Data Unit
PNI	Packet Number Information
POL_REQ	POLling Request command
POL_RES	Response to the POL_REQ
PSL_REQ	Parameter SeLect Request command
PSL_RES	Response to the PSL_REQ
RF	Radio Frequency
RFU	Reserved for Future Use
RLS_REQ	ReLease Request command
RLS_RES	Response to the RLS_REQ
RTO PDU	Response TimeOut extension
SAK	Select Acknowledge
SDD	Single Device Detection
t_d	The delay between the end of the Request frame and the start of the first time slot for SDD at $f_c/64$ and $f_c/32$ (equals $512 \times 64/f_c$)
t_s	The period of one time slot (equals $256 \times 64/f_c$)
t_{ADT}	Active delay time
t_{RFW}	RW waiting time
$t_{RF,OFF}$	the time between the start of the rising edge of the last modulation and the start of falling edge when the device turns off the RF field
TSN	Time Slot Number
UT	Upper Tester, the master part of the Initiator-Test-apparatus
WUPA	Wake-UP command, Type A

5 Notational conventions

5.1 Representation of numbers

The following conventions and notations apply in this document unless otherwise stated.

— Letters and digits in parentheses represent numbers in hexadecimal notation.

— The setting of bits is denoted by ZERO or ONE.

— Numbers in binary notation and bit patterns are represented by strings of digits 0 and 1 shown with the most significant bit to the left. Within such strings, x is used to indicate that the setting of a bit is not specified within the string.

5.2 Names

The names of basic elements, e.g. specific fields, are written with a capital initial letter.

5.3 Test report

The test reports (Annex A and Annex B) include the number of passed tests versus the total number of tests, the number of different samples and the date of the tests (see Annex A and Annex B).

6 Conformance

A DUT conforms to the protocols specified in ISO/IEC 18092 when it meets the test requirements in this document.

7 Apparatus for testing

7.1 General

This clause is valid for Initiator and Target tests.

The test-apparatus may require information about the implemented protocol and functionality. These parameters shall be recorded in the test report.

Although this document does not define a dedicated test circuit for timing measurements and to check the correctness of the framing, the influence of such a circuit shall be avoided.

7.2 Generating the I/O character timing in reception mode

The target-test-apparatus and the lower tester (LT) shall be able to generate the I/O bit stream according to ISO/IEC 18092. All timing parameters (e.g. start bit length, guard time, bit width, request guard time, start of frame width, end of frame width) shall be set to any value within the defined ranges of ISO/IEC 18092. The limits shall be tested according to ISO/IEC 22536.

7.3 Measuring and monitoring the RF I/O protocol

The target-test-apparatus and the LT shall be able to measure the timing of the logical low and high states of the incoming demodulated data.

7.4 Test scenario and report

Testing of the DUT as defined in this document requires a test scenario to be executed. A test scenario is defined as a protocol and application specific sequence of test commands.

The test commands are listed in Table 1. The test commands are specified based on PDUs specified in ISO/IEC 18092.

Table 1 — Test commands

Test command	Description
A(ACK)$_{xx}$	DEP_REQ or DEP_RES PDU coded as ACK/NACK PDU with ACK/NACK bit set to ZERO and PNI set to xx.
A(NACK)$_{xx}$	DEP_REQ or DEP_RES PDU coded as ACK/NACK PDU with ACK/NACK bit set to ONE and PNI set to xx.
S(A)	DEP_REQ or DEP_RES PDU coded as Supervisory PDU (as defined in ISO/IEC 18092) with the Timeout bit set to ZERO. No PNI is used for this command.
S(TO)	DEP_REQ or DEP_RES PDU coded as Supervisory PDU (as defined in ISO/IEC 18092) with the Timeout bit set to ONE. No PNI is used for this command.
TEST_COMMAND1$_{xx}$	Default Test command, it is a DEP_REQ frame coded as information PDU with "More Information" bit set to ZERO (no chaining) and the PNI set to xx. The Initiator or the target-test-apparatus sends this PDU.
TEST_RESPONSE1$_{xx}$	Response to TEST_COMMAND1 (DEP_RES) with the PNI set to xx.
TEST_COMMAND2$_{xx}$	Test command used for tests of the chaining procedure. This command forces the counterpart (either Initiator or Target) to use chaining in the next DEP_REQ. This command is a DEP_REQ or DEP_RES frame, for an Initiator or Target respectively, with its "More Information" bit set to ZERO and it uses the same PDU as TEST_COMMAND1, but this PDU has different data.
TEST_COMMAND3B$_{xx}$	The first part of a chaining command. This command marks the beginning of a DEP_REQ or DEP_RES frame, for an Initiator or Target respectively, with its "More Information" bit set to ONE and the PNI set to xx.
TEST_COMMAND3*n*$_{xx}$	The middle part of a chaining command. This command is sent after TEST_COMMAND3B and before TEST_COMMAND3E. The lowercase *n* represents a number ranging from 0 to 9. This command has the "More Information" bit set to ONE and the PNI set to xx.
TEST_COMMAND3E$_{xx}$	The last part of a chaining command. This command marks the end of the chaining procedure and is a DEP_REQ or DEP_RES frame, for an Initiator or Target respectively, with the "More Information" bit set to ZERO and the PNI set to xx.
TEST_RESPONSE3$_{xx}$	Response to a chaining command, which can be a DEP_REQ or DEP_RES frame, for an Initiator or Target respectively, with the "More Information" bit set to ZERO and the PNI set to xx.
TEST_COMMAND4$_{xx}$	Test command used for tests dealing with frame waiting time. The Initiator sends this command and forces the Target to use a Supervisory PDU with the timeout bit set to ONE and the PNI set to xx.
TEST_RESPONSE4$_{xx}$	Response to TEST_COMMAND4. It is a DEP_RES with the "More Information" bit set to ZERO and the PNI set to xx. It may be the same as TEST_RESPONSE1.
TEST_COMMAND5$_{xx}$	Test command used for tests of the deactivation. This command forces the Initiator to send a DSL_REQ. It is a DEP_RES with the "More Information" bit set to ZERO and the PNI set to xx.
TEST_COMMAND6$_{xx}$	Test command used for tests of the deactivation. This command forces the Initiator to send an RLS_REQ. It is a DEP_RES with the "More Information" bit set to ZERO and the PNI set to xx.

The PDUs that are actually used in these commands shall be recorded in the test report templates in Annex A and Annex B.

The result of the test scenario shall be documented in a test report as defined in Annex A and Annex B.

7.5 RFU bits

A test shall fail and the DUT shall be declared non-compliant in case an RFU field is not set to its defined value.

7.6 General rules

The following rules apply:

— An Initiator (Target-test-apparatus) always sends a request, whereas a Target (LT) sends a response.

— A response shall follow a request.

— If the PNIs for the TEST_RESPONSE*n* and TEST_COMMAND*n* are the same, then TEST_COMMAND*n* is correct.

8 Target test methods

8.1 General

The DUT shall answer as specified in the scenarios, optionally inserting one or more RTO PDUs before responding with the PDU as specified in the scenarios.

8.2 Apparatus for testing the Target (Target-test-apparatus)

The Target-test-apparatus tests the DUT by emulating an Initiator.

The Target-test-apparatus shall execute the initialisation and protocol activation and perform data exchange commands.

8.3 List of protocol test methods related to ISO/IEC 18092

To test Targets performing initialisation and SDD in Passive communication mode at $f_c/128$, the PICC test methods of ISO/IEC 10373-6 and the test methods listed in Table 1 shall be executed.

Table 2 — Activation in Passive communication mode at fc/128

Test method		Corresponding requirement	
Clause in this document	**Name**	**Base standard**	**Clause(s)**
8.4.1	SDD for transport protocol activation	ISO/IEC 18092:2023	11.3.1

To test Targets performing initialisation and SDD in Passive communication mode at $f_c/64$ and $f_c/32$ the test methods listed in Table 2 shall be executed.

Table 3 — Activation in Passive communication mode at fc/64 and fc/32

Test method		Corresponding requirement	
Clause in this document	**Name**	**Base standard**	**Clause(s)**
8.5.1	Activation time	ISO/IEC 18092:2023	11.3.2.3
8.5.2	Frame format	ISO/IEC 18092: 2023	11.3.2.2
8.5.3	SDD timing	ISO/IEC 18092: 2023	11.3.2.3
8.5.4	SDD for transport protocol activation	ISO/IEC 18092: 2023	11.3.2.3 11.3.2.4

To test Targets performing initialisation in Active communication mode, the test method in Table 3 shall be executed.

Table 4 — Activation in Active communication mode

Test method		Corresponding requirement	
Clause in this document	**Name**	**Base standard**	**Clause(s)**
8.6.1	RFCA	ISO/IEC 18092: 2023	11.2.3

To test Targets using the transport protocol, the test methods listed in Table 4 shall be executed.

Table 5 — Logical operation of the Transport Protocol

Test method		Corresponding requirement	
Clause in this document	**Name**	**Base standard**	**Clause(s)**
8.7.1	Handling of ATR_REQ	ISO/IEC 18092: 2023	12.6.1.3
8.7.2	Handling of PSL_REQ	ISO/IEC 18092: 2023	12.6.3.3
8.7.3	Handling of DEP_REQ Information PDUs	ISO/IEC 18092: 2023	12.7.1.2
8.7.4	Handling of DEP_REQ Information PDUs with the more information bit set to ONE	ISO/IEC 18092: 2023	12.7.1.3
8.7.5	Handling of DEP_REQ supervisory PDUs with timeout bit set to ONE	ISO/IEC 18092: 2023	12.7.1.3
8.7.6	Handling of DEP_REQ supervisory PDUs with timeout bit set to ZERO	ISO/IEC 18092: 2023	12.7.1.3
8.7.7	Handling of DSL_REQ	ISO/IEC 18092: 2023	12.8.2.3
8.7.8	Handling of RLS_REQ	ISO/IEC 18092: 2023	12.8.3.3
8.7.9	Handling of WUP_REQ (Active communication mode only)	ISO/IEC 18092: 2023	12.6.2.4

8.4 Activation in Passive communication mode at $f_c/128$

8.4.1 SDD for transport protocol activation

8.4.1.1 Purpose

The purpose of this test is to determine the activation of transport protocol when the Target supports the transport protocol (see ISO/IEC 18092: 2023, 11.3.1).

8.4.1.2 Procedure

Repeat steps a) to e) for the data rates of $f_c/128$.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Perform SDD and receive a valid SAK with support of transport protocol.

d) Send an ATR_REQ command frame.

e) Verify that a valid ATR_RES frame is sent by the DUT.

8.4.1.3 Test report

The test report shall indicate whether the DUT behaves correctly.

8.5 Activation in Passive communication mode at $f_c/64$ and $f_c/32$

8.5.1 Activation time

8.5.1.1 Purpose

The purpose of this test is to verify that the Target responds to a POL_REQ with a POL_RES within two seconds after power up (see ISO/IEC 18092: 2023, 11.3.2.3).

8.5.1.2 Procedure

Repeat steps a) to e) for the data rates of $f_c/64$ and $f_c/32$.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Send a POL_REQ command frame with TSN is set to 0 at the selected data rate.

d) If there is no POL_RES received after t_d and t_s are passed, send the POL_REQ again. Repeat this step until a response from the DUT is received.

e) Measure the timing between RF-on and the beginning of the first response of the DUT. If the DUT responds in less than 2 sec, the test is PASS, otherwise it is FAIL.

8.5.1.3 Test report

The test report shall indicate whether the DUT behaves correctly for both data rates.

8.5.2 Frame format

8.5.2.1 Purpose

The purpose of this test is to determine that the frame formats at $f_c/64$ and $f_c/32$ are correct (see ISO/IEC 18092: 2023, 11.3.2.2).

8.5.2.2 Procedure

Repeat steps a) to d) for the data rates of $f_c/64$ and $f_c/32$.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Send the POL_REQ command frame at the selected data rate.

d) Verify the correct framing of the response from the DUT.

8.5.2.3 Test report

The test report shall indicate whether the DUT behaves correctly for both data rates and shall include results for the characteristics as shown in Table 6.

Table 6 — Expected results for characteristics of frame formats

Characteristic	Expected result
Preamble	minimum 48 bits all logical ZEROs
SYNC	1st byte is ´B2´ 2nd byte is ´4D´
value of the length byte	´12´
CRC bytes	according to ISO/IEC 18092: 2023, Annex A

8.5.3 SDD timing

8.5.3.1 Purpose

The purpose of this test is to determine the correct response to the POL_REQ (see ISO/IEC 18092: 2023, 11.3.2.3) in a timely manner.

8.5.3.2 Procedure

Repeat steps a) to f) for the data rates of $f_c/64$ and $f_c/32$. Initially TSN is set to 0.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Send a POL_REQ command frame with TSN at the selected data rate.

d) Record the time between POL_REQ and POL_RES. If the DUT does not respond in the last time slot available repeat step c).

e) Analyse the content of the response.

f) Increase the TSN to the next allowed value and repeat steps a) to e) until the maximum TSN value is reached.

8.5.3.3 Test report

The test report shall indicate whether the DUT behaves correctly for both data rates and shall include results for the characteristics as shown in Table 7.

Table 7 — Expected result of characteristics of SDD timing

Characteristic	Expected result
1st byte of the payload	´01´
time between end of POL_REQ and end of POL_RES	t_d + (TSN + 1) * t_s

8.5.4 SDD for transport protocol activation

8.5.4.1 Purpose

The purpose of this test is to determine the activation of transport protocol when the Target supports the transport protocol (see ISO/IEC 18092: 2023, 11.3.2.3 and 11.3.2.4).

8.5.4.2 Procedure

Repeat steps a) to g) for the data rates of $f_c/64$ and $f_c/32$. Initially TSN is set to 0.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Send a POL_REQ command frame with TSN at the selected data rate.

d) Record the 6-byte number of POL_RES and the time between POL_REQ and POL_RES. If the DUT does not respond in the last time slot available repeat step c).

e) Analyse the content of the response.

f) If the 6-byte number of POL_RES is identical to the 6-byte number of POL_RES previously received, turn the RF field off and then repeat step a) to e).

g) Send an ATR_REQ command frame.

h) Verify that a valid ATR_RES frame is sent by the DUT.

8.5.4.3 Test report

The test report shall indicate whether the DUT behaves correctly for both data rates and shall include results for the characteristics as shown in Table 8.

Table 8 — Expected result of characteristics of SDD for transport protocol

Characteristic	Expected result
1st byte of the payload	´01´
2nd byte of the payload	´01´
3rd byte of the payload	´FE´

8.6 Activation in Active communication mode

8.6.1 RFCA

8.6.1.1 Purpose

The purpose of this test is to determine the behaviour of the DUT in Active communication mode during RFCA (see ISO/IEC 18092: 2023, 11.2.3).

8.6.1.2 Procedure

Repeat steps a) to g) for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Send a valid ATR_REQ command frame at the selected data rate and switch off the RF afterwards.

d) Receive a valid ATR_RES frame at the selected data rate.

e) Measure the time between RF-off of the Target test-apparatus and RF-on of the DUT.

f) Measure the time between the start of the rising edge of the last modulation and RF-off of the DUT.

g) Repeat steps a) to f) until all randomly generated number of time periods are met and count the number of retries necessary.

8.6.1.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates as shown in Table 9.

Table 9 — Expected results for characteristics of RFCA

Characteristic	Expected result
t_{ADT}	minimum $768/f_c$ maximum $2559/f_c$
t_{RFW}	n times $512/f_c$
$t_{RF,OFF}$	minimum $350/f_c$ and maximum $2559/f_c$ for a bit rate of $f_c/128$ minimum $215/f_c$ and maximum $2559/f_c$ for a bit rate of $f_c/64$ or $f_c/32$

8.7 Logical operation of the Target Transport Protocol

8.7.1 Handling of ATR_REQ

8.7.1.1 Purpose

The purpose of this test is to determine the correct handling of the ATR_REQ of the DUT (see ISO/IEC 18092: 2023, 12.6.1.3).

8.7.1.2 Procedure

Repeat steps a) to e) for each of test scenario T 1, T 2 and T 3, for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$ and for both Active and Passive communication modes. Test scenarios T 1, T 2 and T 3 are defined in Table 10, Table 11 and Table 12, respectively.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Perform activation at the selected data rate and follow the rules for RFCA in Active communication mode.

d) Apply the test scenario T 1, T 2 and T 3. T 3 is optional.

e) Check if the response and the PNIs from the DUT are according to the applied scenario.

Table 10 — Scenario T 1 — ATR_REQ with PPi:b8 set to ZERO, correct transaction

Target-test-apparatus		DUT
ATR_REQ	→	
	←	ATR_RES
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$

Table 11 — Scenario T 2 — ATR_REQ with PPi:b8 set to ZERO, erroneous transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	Mute
ATR_REQ (~CRC)	→	
	←	Mute
ATR_REQ	→	
	←	ATR_RES
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
ATR_REQ	→	
	←	Mute
TEST_COMMAND1$_{01}$	→	
	←	TEST_RESPONSE1$_{01}$

Table 12 — Scenario T 3 — ATR_REQ with PPi:b8 set to ONE

Target-test-apparatus		DUT
ATR_REQ	→	
	←	ATR_RES
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$

8.7.1.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

8.7.2 Handling of PSL_REQ

8.7.2.1 Purpose

The purpose of this test is to determine the correct PSL handling of the DUT (see ISO/IEC 18092: 2023, 12.6.3.3).

8.7.2.2 Procedure

Repeat steps a) to f) for each test scenario T 4, T 5 and T 6, for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$ and for both Active and Passive communication modes. Test scenarios T 4, T 5 and T 6 are defined in Table 13, Table 14 and Table 15, respectively.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Perform initialisation and protocol activation in the selected communication mode and data rate.

d) Send an ATR_REQ and receive ATR_RES.

e) Apply the test scenario T 4, T 5 or T 6.

f) Check if the response and the PNIs from the DUT are according to the applied scenario.

Table 13 — Scenario T 4 — PSL_REQ

Target-test-apparatus		DUT
PSL_REQ	→	
	←	PSL_RES
PSL_REQ	→	
	←	Mute
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$

Table 14 — Scenario T 5 — PSL_REQ

Target-test-apparatus		DUT
PSL_REQ (~CRC)	→	
	←	Mute
PSL_REQ	→	
	←	Mute
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$

Table 15 — Scenario T 6 — PSL_REQ

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
PSL_REQ	→	
	←	Mute
TEST_COMMAND1$_{01}$	→	
	←	TEST_RESPONSE1$_{01}$

8.7.2.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

8.7.3 Handling of DEP_REQ Information PDUs

8.7.3.1 Purpose

The purpose of this test is to determine the correct handling of the DEP_REQ information PDU of the DUT (see ISO/IEC 18092: 2023, 12.7.1.3).

8.7.3.2 Procedure

Repeat steps a) to f) for each test scenario T 7, T 8, and T 9, for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$ and for both Active and Passive communication modes. Test scenarios T 7, T 8 and T 9 are defined in Table 16, Table 17 and Table 18, respectively.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Perform activation in the selected communication mode and data rate.

d) Send an ATR_REQ and receive the ATR_RES from the DUT.

e) Apply the test scenario T 7, T 8 or T 9.

f) Check if the response and the PNIs from the DUT are according to the scenarios.

Table 16 — Scenario T 7 — DEP_REQ information PDU, correct transaction

Target-test-apparatus		DUT
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$
$TEST\_COMMAND1_{01}$	→	
	←	$TEST\_RESPONSE1_{01}$
$TEST\_COMMAND1_{10}$	→	
	←	$TEST\_RESPONSE1_{10}$
$TEST\_COMMAND1_{11}$	→	
	←	$TEST\_RESPONSE1_{11}$
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$

Table 17 — Scenario T 8 — DEP_REQ information PDU, erroneous transaction

Target-test-apparatus		DUT
$TEST\_COMMAND1_{00}$ (~CRC)	→	
	←	Mute
S(A)	→	
	←	S(A)
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$
$TEST\_COMMAND1_{01}$	→	
	←	$TEST\_RESPONSE1_{01}$

Table 18 — Scenario T 9 — DEP_REQ information PDU, erroneous transaction

Target-test-apparatus		DUT
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$
$TEST\_COMMAND1_{01}$ (~CRC)	→	
	←	Mute
S(A)	→	
	←	S(A)
$TEST\_COMMAND1_{01}$	→	
	←	$TEST\_RESPONSE1_{01}$

8.7.3.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes for both scenarios.

8.7.4 Handling of DEP_REQ Information PDUs with chaining Initiator to Target and Target to Initiator

8.7.4.1 Purpose

The purpose of this test is to determine the correct handling of the DEP_REQ information PDU with chaining feature. The chaining feature is enabled by the more information bit set to ONE (see ISO/IEC 18092: 2023, 12.7.1.3).

8.7.4.2 Procedure

Repeat steps a) to f) for each test scenario T 10, T 11, T 12, T 13, T 14 and T 15, for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$ and for both Active and Passive communication modes. Test scenarios T 10, T 11, T 12, T 13, T 14 and T 15 are defined in Table 19, Table 20, Table 21, Table 22, Table 23 and Table 24, respectively.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Perform activation in the selected communication mode and data rate.

d) Send an ATR_REQ and receive the ATR_RES from the DUT.

e) Apply the test scenario T 10, T 11, T 12, T 13, T 14 or T 15. T 13 is optional.

f) Check if the response and the PNIs from the DUT are according to the test scenarios.

Table 19 — Scenario T 10 — DEP_REQ information PDU with more information bit set to ONE, correct transaction

Target-test-apparatus		DUT
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$
$TEST\_COMMAND3B_{01}$	→	
	←	$A(ACK)_{01}$
$TEST\_COMMAND3E_{10}$	→	
	←	$TEST\_RESPONSE3_{10}$
$TEST\_COMMAND1_{11}$	→	
	←	$TEST\_RESPONSE1_{11}$

Table 20 — Scenario T 11 — DEP_REQ information PDU with more information bit set to ONE, correct transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND3B$_{01}$	→	
	←	A(ACK)$_{01}$
TEST_COMMAND30$_{10}$	→	
	←	A(ACK)$_{10}$
TEST_COMMAND31$_{11}$	→	
	←	A(ACK)$_{11}$
TEST_COMMAND32$_{00}$	→	
	←	A(ACK)$_{00}$
TEST_COMMAND33$_{01}$	→	
	←	A(ACK)$_{01}$
TEST_COMMAND3E$_{10}$	→	
	←	TEST_RESPONSE3$_{10}$
TEST_COMMAND1$_{11}$	→	
	←	TEST_RESPONSE1$_{11}$

Table 21 — Scenario T 12 — DEP_REQ information PDU with more information bit set to ONE, correct transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND2$_{01}$	→	
	←	TEST_COMMAND3B$_{01}$
A(ACK)$_{10}$	→	
	←	TEST_ COMMAND3E$_{10}$
TEST_COMMAND1$_{11}$	→	
	←	TEST_RESPONSE1$_{11}$

The following test scenario is optional as it is possible that the DUT will not be capable of storing data that needs more than one information PDU when sending.

Table 22 — Scenario T 13 — DEP_REQ information PDU with more information bit set to ONE, correct transaction (optional)

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND2$_{01}$	→	
	←	TEST_COMMAND3B$_{01}$
A(ACK)$_{10}$	→	
	←	TEST_ COMMAND30$_{10}$
A(ACK)$_{11}$	→	
	←	TEST_ COMMAND31$_{11}$
A(ACK)$_{00}$	→	
	←	TEST_ COMMAND32$_{00}$
A(ACK)$_{01}$	→	
	←	TEST_ COMMAND33$_{01}$
A(ACK)$_{10}$	→	
	←	TEST_ COMMAND3E$_{10}$
TEST_COMMAND1$_{11}$	→	
	←	TEST_RESPONSE1$_{11}$

Table 23 — Scenario T 14 — DEP_REQ information PDU with more information bit set to ONE, erroneous transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND3B$_{01}$	→	
	←	A(ACK)$_{01}$
TEST_COMMAND30$_{10}$ (~CRC)	→	
	←	Mute
S(A)	→	
	←	S(A)
TEST_COMMAND30$_{10}$	→	
	←	A(ACK)$_{10}$
TEST_COMMAND3E$_{11}$	→	
	←	TEST_RESPONSE3$_{11}$
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$

Table 24 — Scenario T 15 — DEP_REQ information PDU with more information bit set to ONE, erroneous transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND2$_{01}$	→	
	←	TEST_COMMAND3B$_{01}$
A(ACK)$_{10}$ (~CRC)	→	
	←	Mute
S(A)	→	
	←	S(A)
A(ACK)$_{10}$	→	
	←	TEST_RESPONSE3E$_{10}$
TEST_COMMAND1$_{11}$	→	
	←	TEST_RESPONSE1$_{11}$

8.7.4.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

8.7.5 Handling of DEP_REQ supervisory PDUs with timeout bit set to ONE

8.7.5.1 Purpose

The purpose of this test is to determine the correct handling of the DEP_REQ with supervisory PDU with timeout bit set to ONE (see ISO/IEC 18092: 2023, 12.7.1.3).

8.7.5.2 Procedure

Repeat steps a) to f) for each test scenario T 16 and T 17, for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$ and for both Active and Passive communication modes. Test scenarios T 16 and T 17 are defined in Table 25 and Table 26, respectively.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Perform activation in the selected communication mode and data rate.

d) Send an ATR_REQ and receive the ATR_RES from the DUT.

e) Apply the test scenario T 16 or T 17.

f) Check if the response and the PNIs from the DUT are according to scenarios.

Table 25 — Scenario T 16 — DEP_REQ supervisory PDU with timeout bit set to ONE, correct transaction

Target-test-apparatus		DUT
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$
$TEST\_COMMAND4_{01}$	→	
	←	S(TO)
S(TO)	→	
	←	$TEST\_RESPONSE4_{01}$
$TEST\_COMMAND1_{10}$	→	
	←	$TEST\_RESPONSE1_{10}$

Table 26 — Scenario T 17 — DEP_REQ supervisory PDU with timeout bit set to ONE, erroneous transaction

Target-test-apparatus		DUT
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$
$TEST\_COMMAND4_{01}$	→	
	←	S(TO)
S(TO) (~CRC)	→	
	←	Mute
S(A)	→	
	←	S(A)
S(TO)	→	
	←	$TEST\_RESPONSE4_{01}$
$TEST\_COMMAND1_{10}$	→	
	←	$TEST\_RESPONSE1_{10}$

8.7.5.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and both communication modes

8.7.6 Handling of DEP_REQ supervisory PDUs with timeout bit set to ZERO

8.7.6.1 Purpose

The purpose of this test is to determine the correct handling of the DEP_REQ supervisory PDU with the timeout bit set to ZERO (see ISO/IEC 18092:2023, 12.7.1.3).

8.7.6.2 Procedure

Repeat steps a) to f) for each test scenario T 18 and T 19, for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$ and for both Active and Passive communication modes. Test scenarios T 18 and T 19 are defined in Table 27 and Table 28, respectively.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Perform activation in the selected communication mode and data rate.

d) Send an ATR_REQ and receive the ATR_RES from the DUT.

e) Apply the test scenario T 18 or T 19.

f) Check if the response and the PNIs from the DUT are according to the scenarios.

Table 27 — Scenario T 18 — DEP_REQ supervisory PDU with timeout bit set to ZERO, correct transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
S(A)	→	
	←	S(A)
TEST_COMMAND1$_{01}$	→	
	←	TEST_RESPONSE1$_{01}$

Table 28 — Scenario T 19 — DEP_REQ supervisory PDU with timeout bit set to ZERO, erroneous transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
S(A) (~CRC)	→	
	←	Mute
S(A)	→	
	←	S(A)
TEST_COMMAND1$_{01}$	→	
	←	TEST_RESPONSE1$_{01}$

8.7.6.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

8.7.7 Handling of DSL_REQ

8.7.7.1 Purpose

The purpose of this test is to determine the correct handling of the DSL_REQ (see ISO/IEC 18092: 2023, 12.8.2.3).

8.7.7.2 Procedure

Repeat steps a) to g) for each test scenario T 20 and T 21, for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$ and for both Active and Passive communication modes. Test scenarios T 20 and T 21 are defined in Table 29 and Table 30, respectively.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Perform activation in the selected communication mode and data rate.

d) Send an ATR_REQ and receive the ATR_RES from the DUT.

e) Apply the test scenario T 20 or T 21.

f) Check if the response and the PNIs from the DUT are according to the scenarios.

g) In Passive communication mode, send a WUPA for $f_c/128$ or POL_REQ for $f_c/64$ and $f_c/32$, and then check a valid response from the DUT.

Table 29 — Scenario T 20 — DSL_REQ, correct transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
DSL_REQ	→	
	←	DSL_RES
DSL_REQ	→	
	←	Mute

Table 30 — Scenario T 21 — DSL_REQ, erroneous transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
DSL_REQ (~CRC)	→	
	←	Mute
DSL_REQ	→	
	←	DSL_RES

8.7.7.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

8.7.8 Handling of RLS_REQ

8.7.8.1 Purpose

The purpose of this test is to determine the correct handling of the RLS_REQ of the DUT (see ISO/IEC 18092: 2023, 12.8.3.3).

8.7.8.2 Procedure

Repeat steps a) to h) for each test scenario T 22 and T 23, for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$ and for both Active and Passive communication modes. Test scenarios T 22 and T 23 are defined in Table 31 and Table 32, respectively.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits Hmin and Hmax and verify that the field strength does not influence the test results.

c) Perform activation in the selected communication mode and data rate.

d) Send an ATR_REQ and receive the ATR_RES from the DUT.

e) Apply the test scenario T 22 or T 23.

f) Check if the response and the PNIs from the DUT are according to the scenarios.

g) Perform activation for the selected communication mode and data rate.

h) Send ATR_REQ and check a valid ATR_RES from the DUT.

Table 31 — Scenario T 22 — RLS_REQ, correct transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
RLS_REQ	→	
	←	RLS_RES
RLS_REQ	→	
	←	Mute

Table 32 — Scenario T 23 — RLS_REQ, erroneous transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
RLS_REQ (~CRC)	→	
	←	Mute
RLS_REQ	→	
	←	RLS_RES

8.7.8.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

8.7.9 Handling of WUP_REQ (Active communication mode only)

8.7.9.1 Purpose

The purpose of this test is to determine the correct handling of the WUP_REQ of the DUT (see ISO/IEC 18092: 2023, 12.6.2.4).

8.7.9.2 Procedure

Repeat steps a) to g) for each test scenario T 24, T 25 and T 26, for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$. Test scenarios T 24, T 25 and T 26 are defined in Table 33, Table 34 and Table 35, respectively.

a) Place the DUT into the operating volume.

b) Generate an RF field between the limits H_{min} and H_{max} and verify that the field strength does not influence the test results.

c) Perform activation in Active communication mode at the selected data rate.

d) Send an ATR_REQ and receive the ATR_RES from the DUT.

e) Apply the test scenario T 24, T 25 or T 26.

f) Check if the response and the PNIs from the DUT are according to the scenarios.

g) Send an ATR_REQ and check a valid ATR_RES from the DUT.

Table 33 — Scenario T 24 — WUP_REQ, correct transaction

Target-test-apparatus		DUT
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$
$TEST\_COMMAND1_{01}$	→	
	←	$TEST\_RESPONSE1_{01}$
DSL_REQ	→	
	←	DSL_RES
WUP_REQ	→	
	←	WUP_RES
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$

Table 34 — Scenario T 25 — WUP_REQ, erroneous transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND1$_{01}$	→	
	←	TEST_RESPONSE1$_{01}$
DSL_REQ	→	
	←	DSL_RES
TEST_COMMAND1$_{10}$	→	
	←	Mute
TEST_COMMAND1$_{00}$	→	
	←	Mute
WUP_REQ	→	
	←	WUP_RES
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$

Table 35 — Scenario T 26 — WUP_REQ, erroneous transaction

Target-test-apparatus		DUT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND1$_{01}$	→	
	←	TEST_RESPONSE1$_{01}$
DSL_REQ	→	
	←	DSL_RES
WUP_REQ(~CRC)	→	
	←	Mute
WUP_REQ	→	
	←	WUP_RES
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$

8.7.9.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates.

9 Initiator test methods

9.1 Apparatus for testing the Initiator (Initiator-test-apparatus)

9.1.1 Initiator-test-apparatus concept

The Initiator-test-apparatus consists of two parts. See Figure 1.

- The Upper Tester (UT) configures the Initiator and instructs the Initiator to send commands. This document does not specify how the UT controls the DUT.
- The Lower Tester (LT) emulates the Target protocol and includes a digital sampling oscilloscope for timing measurements.

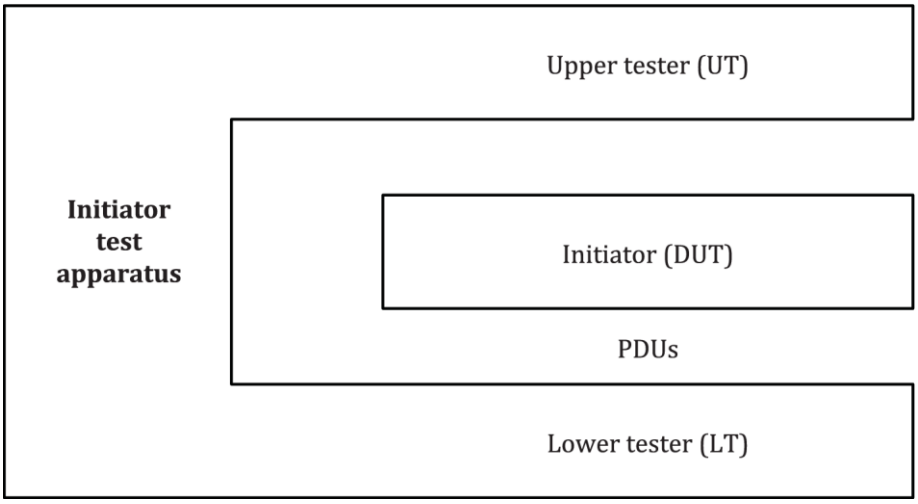

Figure 1 — Initiator test apparatus concept

9.1.2 Protocol activation procedure for Passive communication mode at $f_c/128$

Activate the LT by executing the following sequence:

a) Set the LT in Passive communication mode at $f_c/128$.

b) Set the DUT in Passive communication mode at $f_c/128$.

c) Instruct the DUT to perform activation and SDD at $f_c/128$.

9.1.3 Protocol activation procedures for Passive communication mode at $f_c/64$ and $f_c/32$

Repeat the following sequence for the data rates of $f_c/64$ and $f_c/32$:

a) Set the LT in Passive communication mode at the selected data rate.

b) Set the DUT in Passive communication mode at the selected data rate.

c) Instruct the DUT to perform SDD at the selected data rate.

9.1.4 Protocol activation procedures for Active communication mode

Repeat the following sequence for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$:

a) Set the LT in Active communication mode at the selected data rate.

b) Set the DUT in Active communication mode at the selected data rate.

c) Instruct the DUT to perform Active communication mode activation flow at selected data rate (see ISO/IEC 18092: 2023, 12.4).

9.2 List of protocol test methods for Initiators

This subclause lists all required protocol test methods for Initiators.

To test Initiators performing initialisation and SDD in Passive communication mode at f_c/128 the PCD test methods as defined in ISO/IEC 10373-6 and the test methods in Table 5 shall be executed.

Table 36 — Activation in Passive communication mode at fc/128

Test method		Corresponding requirement	
Clause in this document	**Name**	**Base standard**	**Clause(s)**
9.3.1	Initial RFCA	ISO/IEC 18092: 2023	11.2.2
9.3.2	SDD for transport protocol activation	ISO/IEC 18092: 2023	11.3.1

To test initiators performing initialisation and SDD in Passive communication Mode at f_c/64 and f_c/32 the test methods in Table 6 shall be executed.

Table 37 — Activation in Passive communication mode at fc/64 and fc/32

Test method		Corresponding requirement	
Clause in this document	**Name**	**Base standard**	**Clause(s)**
9.4.1	Initial RFCA	ISO/IEC 18092: 2023	11.2.2
9.4.2	Frame format	ISO/IEC 18092: 2023	11.3.2.2
9.4.3	SDD for transport protocol activation	ISO/IEC 18092: 2023	11.3.2.3 11.3.2.4

To test Initiators performing initialisation in Active communication Mode the test methods in Table 7 shall be executed.

Table 38 — Activation in Active communication mode

Test method		Corresponding requirement	
Clause in this document	**Name**	**Base standard**	**Clause(s)**
9.5.1	Initial RFCA	ISO/IEC 18092: 2023	11.2.2
9.5.2	Response RFCA with time jitter n=0	ISO/IEC 18092: 2023	11.4.2

To test initiators using the transport protocol the test methods in Table 8 shall be executed.

Table 39 — Logical operation of the Initiator Transport Protocol

Test method		Corresponding requirement	
Clause in this document	**Name**	**Base standard**	**Clause(s)**
9.6.1	Handling of ATR_RES	ISO/IEC 18092: 2023	12.6.1.3
9.6.2	Handling of PSL_RES	ISO/IEC 18092: 2023	12.6.3.3
9.6.3	Handling of DEP_RES information PDUs	ISO/IEC 18092: 2023	12.7.1.2
9.6.4	Handling of DEP_RES Information PDUs with more information bit set to ONE	ISO/IEC 18092: 2023	12.7.1.3
9.6.5	Handling of DEP_RES supervisory PDUs with timeout bit set to ONE	ISO/IEC 18092: 2023	12.7.1.3
9.6.6	Handling of DEP_RES supervisory PDUs with timeout bit set to ZERO	ISO/IEC 18092: 2023	12.7.1.3
9.6.7	Handling of DSL_RES	ISO/IEC 18092: 2023	12.8.2.3
9.6.8	Handling of RLS_RES	ISO/IEC 18092: 2023	12.8.3.3
9.6.9	Handling of WUP_RES (Active communication mode only)	ISO/IEC 18092: 2023	12.6.2.4

9.3 Activation in Passive communication mode at f_c/128

9.3.1 Initial RFCA

9.3.1.1 Purpose

The purpose of this test is to verify the behaviour of the DUT during initial RFCA (see ISO/IEC 18092: 2023, 11.2.2).

9.3.1.2 Procedure

Perform steps a) to h) for the data rates of f_c/128.

a) Place the LT into the operating volume of the DUT.

b) The LT (field generating antenna) shall generate an RF field (the arrangement of test assembly can be found in ISO/IEC 22536).

c) Ensure that the field strength at the DUT is at least $H_{Threshold}$.

d) Execute 9.1.2.

e) The LT shall switch off its RF field.

f) The LT waits until the DUT sends a valid REQA.

g) Analyse the timing between the RF-off of the LT and the RF-on of the DUT (see ISO/IEC 18092: 2023, 11.2.2).

h) Repeat steps a) to g) until all possible values for n of t_{RFW} are detected.

9.3.1.3 Test report

The test report shall indicate whether the DUT behaves correctly.

9.3.2 SDD for transport protocol activation

9.3.2.1 Purpose

The purpose of this test is to determine the correct handling of the SAK of the DUT (see ISO/IEC 18092: 2023, 11.3.1).

9.3.2.2 Procedure

Perform steps a) to f) for the data rates of $f_c/128$.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.2.

c) The DUT performs SDD until a valid SELECT command is received.

d) The LT answers with a SAK with support of transport protocol, i.e. bit 7 set to (1)b, bit 6 set to (0)b and bit 3 set to (0)b.

e) Instruct the DUT to send ATR_REQ.

f) The LT receives the ATR_REQ.

9.3.2.3 Test report

The test report shall indicate whether the DUT behaves correctly.

9.4 Activation in Passive communication mode at $f_c/64$ and $f_c/32$

9.4.1 Initial RFCA

9.4.1.1 Purpose

The purpose of this test is to verify the behaviour of the DUT during initial RFCA (see ISO/IEC 18092: 2023, 11.2.2).

9.4.1.2 Procedure

Repeat steps a) to h) for the data rates of $f_c/64$ and $f_c/32$.

a) Place the LT into the operating volume of the DUT.

b) The LT (field generating antenna) shall generate an RF field (the arrangement of test assembly can be found in ISO/IEC 22536).

c) Ensure that the field strength at the DUT is at least $H_{Threshold}$.

d) Execute 9.1.2.

e) The LT shall switch off its RF field.

f) The LT waits until the DUT sends a valid POL_REQ.

g) Analyse the timing between the RF-off of the LT and the RF-on of the DUT (see ISO/IEC 18092: 2023, 11.2.2).

h) Repeat steps a) to g) until all possible values for *n* of t_{RFW} are detected.

9.4.1.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates.

9.4.2 Frame format

9.4.2.1 Purpose

The purpose of this test is to determine the correct frame format of the DUT at $f_c/64$ and $f_c/32$ (see ISO/IEC 18092: 2023, 11.3.2.2).

9.4.2.2 Procedure

Repeat steps a) to d) for the data rates of $f_c/64$ and $f_c/32$.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.3 with selected data rate.

c) The LT waits until the DUT sends a valid POL_REQ.

d) Verify that the frame attributes are according to ISO/IEC 18092: 2023, 11.3.2.2.

9.4.2.3 Test report

The test report shall indicate whether the DUT behaves correctly for both data rates.

9.4.3 SDD for transport protocol activation

9.4.3.1 Purpose

The purpose of this test is to determine the correct handling of the POL_REQ of the DUT (see ISO/IEC 18092: 2023, 11.3.2.3 and 11.3.2.4).

9.4.3.2 Procedure

Repeat steps a) to f) for all TSN values and for the data rates of $f_c/64$ and $f_c/32$.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.3 with selected TSN and selected data rate.

c) The LT waits until the DUT sends a valid POL_REQ.

d) The LT answers with a POL_RES with an NFCID2 prefix code set to '01' 'FE' in the last allowed timeslot.

e) Instruct the DUT to send ATR_REQ.

f) The LT receives the ATR_REQ.

9.4.3.3 Test report

The test report shall indicate whether the DUT behaves correctly for both data rates and all TSN values.

9.5 Activation in Active communication mode

9.5.1 Initial RFCA

9.5.1.1 Purpose

The purpose of this test is to verify the behaviour of the DUT during initial RFCA (see ISO/IEC 18092: 2023, 11.2.2).

9.5.1.2 Procedure

Repeat steps a) to h) for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$.

a) Place the LT into the operating volume of the DUT.

b) The LT (field generating antenna) shall generate an RF field (the arrangement of test assembly can be found in ISO/IEC 22536).

c) Ensure that the field strength at the DUT is at least $H_{Threshold}$.

d) Execute 9.1.4 with selected data rate.

e) The LT shall switch off its RF field.

f) The LT waits until the DUT sends a valid ATR_REQ.

g) Analyse the timing between the RF-off of the LT and the RF-on of the DUT (see ISO/IEC 18092: 2023, 11.2.2).

h) Repeat steps a) to g) until all possible values for n of t_{RFW} are detected.

9.5.1.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates.

9.5.2 Response RFCA with time jitter n=0

9.5.2.1 Purpose

The purpose of this test is to verify the behaviour of the DUT during response RFCA with n=0 (see ISO/IEC 18092: 2023, 11.4.2).

9.5.2.2 Procedure

Repeat steps a) to g) for the data rates of $f_c/128$, $f_c/64$ and $f_c/32$.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.4 with selected data rate.

c) The LT waits until the DUT sends a valid ATR_REQ.

d) The LT answers with a valid ATR_RES.

e) Instruct the DUT to send TEST_COMMAND1$_{00}$.

f) The LT receives the TEST_COMMAND1$_{00}$.

g) Verify that the following times are in accordance with ISO/IEC 18092: 2023, 11.2.2:

— the time between the RF-off of the LT and the RF on of the DUT, and

— the time between the start of the rising edge of the last modulation of the ATR_REQ and RF-off of the DUT.

9.5.2.3 Test report

The test report shall indicate whether the timing is correct for all data rates.

9.6 Logical operation of the Transport Protocol

9.6.1 Handling of ATR_RES

9.6.1.1 Purpose

The purpose of this test is to determine the correct handling of the ATR_RES of the DUT (see ISO/IEC 18092: 2023, 12.6.1.3).

9.6.1.2 Procedure

Repeat steps a) to c) for each test scenario I 1 and I 2, for all specified data rates, communication modes and protocol activation procedure combinations. Test scenarios I 1 and I 2 are defined in Table 40 and Table 41, respectively.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.2 for Passive communication mode at f_c/128, 9.1.3 for Passive communication mode at f_c/64 and f_c/32 and 9.1.4 for Active communication mode at all data rates.

c) Execute scenario I 1 or I 2.

Table 40 — Scenario I 1 — ATR_RES, correct transaction

DUT		LT
ATR_REQ	→	
	←	ATR_RES
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND1$_{01}$	→	

Table 41 — Scenario I 2 — ATR_RES, erroneous transaction

DUT		LT
ATR_REQ	→	
	←	ATR_RES(~CRC)
ATR_REQ	→	
	←	ATR_RES
$TEST\_COMMAND1_{00}$	→	

9.6.1.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

9.6.2 Handling of PSL_RES

9.6.2.1 Purpose

The purpose of this test is to determine the correct handling of the PSL_RES (see ISO/IEC 18092: 2023, 12.6.3.3).

9.6.2.2 Procedure

Repeat steps a) to c) for each test scenario I 3 and I 4, for all specified data rate, communication mode and protocol activation procedure combinations. Test scenarios I 3 and I 4 are defined in Table 42 and Table 43, respectively.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.2 for Passive communication mode at $f_c/128$, 9.1.3 for Passive communication mode at $f_c/64$ and $f_c/32$ and 9.1.4 for Active communication mode at all data rates.

c) Execute scenario I3 or I 4.

Table 42 — Scenario I 3 — PSL_RES

DUT		LT
ATR_REQ	→	
	←	ATR_RES (changeable params)
PSL_REQ	→	
	←	PSL_RES
$TEST\_COMMAND1_{00}$	→	

Table 43 — Scenario I 4 — PSL_RES

DUT		LT
ATR_REQ	→	
	←	ATR_RES (changeable params)
PSL_REQ	→	
	←	PSL_RES (~CRC)
PSL_REQ (NOTE)	→	
	←	Mute
DSL_REQ or RLS_REQ (NOTE)	→	

NOTE This behaviour is valid but optional.

9.6.2.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

9.6.3 Handling of DEP_RES Information PDUs

9.6.3.1 Purpose

The purpose of this test is to determine the correct handling of the DEP_RES (see ISO/IEC 18092: 2023, 12.7.1.2).

9.6.3.2 Procedure

Repeat steps a) to d) for each test scenario I 5, I 6 and I 7, for all specified data rate, communication mode and protocol activation procedure combinations. Test scenarios I 5, I 6 and I 7 are defined in Table 44, Table 45 and Table 46, respectively.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.2 for Passive communication mode at f_c/128, 9.1.3 for Passive communication mode at f_c/64 and f_c/32 and 9.1.4 for Active communication mode at all data rates.

c) Instruct the DUT to send an ATR_REQ and then the LT sends an ATR_RES.

d) Execute scenario I 5, I 6 or I 7.

Table 44 — Scenario I 5 — DEP_RES information PDU, correct transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND1$_{01}$	→	
	←	TEST_RESPONSE1$_{01}$
TEST_COMMAND1$_{10}$	→	
	←	TEST_RESPONSE1$_{10}$
TEST_COMMAND1$_{11}$	→	
	←	TEST_RESPONSE1$_{11}$
TEST_COMMAND1$_{00}$	→	

Table 45 — Scenario I 6 — DEP_RES information PDU, erroneous transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$ (~CRC)
A(NACK)$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND1$_{01}$	→	

Table 46 — Scenario I 7 — DEP_RES information PDU, erroneous transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$ (~CRC)
A(NACK)$_{00}$	→	
	←	Mute
A(NACK)$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND1$_{01}$	→	

9.6.3.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

9.6.4 Handling of DEP_RES Information PDUs with chaining Initiator to Target and Target to Initiator

9.6.4.1 Purpose

The purpose of this test is to determine the correct handling of the DEP_RES with chaining feature. The chaining feature is enabled by the more information bit set to ONE (see ISO/IEC 18092: 2023, 12.7.1.3).

9.6.4.2 Procedure

Repeat steps a) to d) for each test scenario I 8, I 9, I 10, I 11, I 12, I 13 and I 14, for all specified data rate, communication mode and protocol activation procedure combinations. Test scenarios I 8, I 9, I 10, I 11, I 12, I13 and I 14 are defined in Table 47, Table 48, Table 49, Table 50, Table 51, Table 52 and Table 53, respectively.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.2 for Passive communication mode at f_c/128, 9.1.3 for Passive communication mode at f_c/64 and f_c/32 and 9.1.4 for Active communication mode at all data rates.

c) Instruct the DUT to send an ATR_REQ and then the LT sends an ATR_RES.

d) Execute scenario I 8, I 9, I 10, I 11, I 12, I 13, or I 14. I 11 is optional.

Table 47 — Scenario I 8 — DEP_RES with more information bit set to ONE, correct transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	TEST_COMMAND2$_{00}$
TEST_COMMAND3B$_{01}$	→	
	←	A(ACK)$_{01}$
TEST_COMMAND3E$_{10}$	→	
	←	TEST_RESPONSE3$_{10}$
TEST_COMMAND1$_{11}$	→	

Table 48 — Scenario I 9 — DEP_RES with more information bit set to ONE, correct transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	TEST_COMMAND3B$_{00}$
A(ACK)$_{01}$	→	
	←	TEST_COMMAND3E$_{01}$
TEST_RESPONSE3$_{10}$	→	

Table 49 — Scenario I 10 — DEP_RES with more information bit set to ONE, correct transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	TEST_COMMAND3B$_{00}$
A(ACK)$_{01}$	→	
	←	TEST_COMMAND30$_{01}$
A(ACK)$_{10}$	→	
	←	TEST_COMMAND31$_{10}$
A(ACK)$_{11}$	→	
	←	TEST_COMMAND32$_{11}$
A(ACK)$_{00}$	→	
	←	TEST_COMMAND33$_{00}$
A(ACK)$_{01}$	→	
	←	TEST_COMMAND3E$_{01}$
TEST_RESPONSE3$_{10}$	→	

Scenario I 11 is optional as it is possible that the DUT will not be capable of storing data that needs more than one information PDU when sending.

Table 50 — Scenario I 11 — DEP_RES with more information bit set to ONE, correct transaction (optional)

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	TEST_COMMAND2$_{00}$
TEST_COMMAND3B$_{01}$	→	
	←	A(ACK)$_{01}$
TEST_COMMAND30$_{10}$	→	
	←	A(ACK)$_{10}$
TEST_COMMAND31$_{11}$	→	
	←	A(ACK)$_{11}$
TEST_COMMAND32$_{00}$	→	
	←	A(ACK)$_{00}$
TEST_COMMAND33$_{01}$	→	
	←	A(ACK)$_{01}$
TEST_COMMAND3E$_{10}$	→	
	←	TEST_RESPONSE3$_{10}$
TEST_COMMAND1$_{11}$	→	

Table 51 — Scenario I 12 — DEP_RES with more information bit set to ONE, erroneous transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	TEST_COMMAND3B$_{00}$ (~CRC)
A(NACK)$_{00}$	→	
	←	TEST_COMMAND3B$_{00}$
A(ACK)$_{01}$	→	
	←	TEST_COMMAND3E$_{01}$
TEST_RESPONSE3$_{10}$	→	

Table 52 — Scenario I 13 — DEP_RES with more information bit set to ONE, erroneous transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	TEST_COMMAND2$_{00}$
TEST_COMMAND3B$_{01}$	→	
	←	A(ACK)$_{01}$ (~CRC)
A(NACK)$_{01}$	→	
	←	A(ACK)$_{01}$
TEST_COMMAND3E$_{10}$	→	
	←	TEST_RESPONSE3$_{10}$
TEST_COMMAND1$_{11}$	→	

Table 53 — Scenario I 14 — DEP_RES with more information bit set to ONE, erroneous transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	TEST_COMMAND3B$_{00}$
A(ACK)$_{01}$	→	
	←	TEST_COMMAND30$_{01}$ (~CRC)
A(NACK)$_{01}$	→	
	←	Mute
A(NACK)$_{01}$	→	
	←	TEST_COMMAND30$_{01}$
A(ACK)$_{10}$	→	
	←	TEST_COMMAND3E$_{10}$
TEST_COMMAND1$_{11}$	→	

9.6.4.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

9.6.5 Handling of DEP_RES supervisory PDUs with timeout bit set to ONE

9.6.5.1 Purpose

The purpose of this test is to determine the correct handling of the DEP_RES with supervisory PDUs with timeout bit set to ONE (see ISO/IEC 18092: 2023, 12.7.1.3).

9.6.5.2 Procedure

Repeat steps a) to d) for each test scenario I 15, I 16 and I 17, for all specified data rate, communication mode and protocol activation procedure combinations. Test scenarios I 15, I 16 and I 17 are defined in Table 55, Table 56 and Table 57, respectively.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.2 for Passive communication mode at f_c/128, 9.1.3 for Passive communication mode at f_c/64 and f_c/32 and 9.1.4 for Active communication mode at all data rates.

c) Instruct the DUT to send an ATR_REQ and then the LT sends an ATR_RES.

d) Execute scenario I 15, I16 or I 17.

Table 54 — Scenario I 15 — DEP_RES with timeout bit set to ONE, correct transaction

DUT		LT
$TEST\_COMMAND1_{00}$	→	
	←	S(TO)
S(TO)	→	
	←	$TEST\_RESPONSE1_{00}$
$TEST\_COMMAND1_{01}$	→	

Table 55 — Scenario I 16 — DEP_RES with timeout bit set to ONE, erroneous transaction

DUT		LT
$TEST\_COMMAND1_{00}$	→	
	←	S(TO) (~CRC)
$A(NACK)_{00}$	→	
	←	S(TO)
S(TO)	→	
	←	$TEST\_RESPONSE1_{00}$
$TEST\_COMMAND1_{01}$	→	

Table 56 — Scenario I 17 — DEP_RES with timeout bit set to ONE, erroneous transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	S(TO) (~CRC)
A(NACK)$_{00}$	→	
	←	Mute
A(NACK)$_{00}$	→	
	←	S(TO)
S(TO)	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND1$_{01}$	→	

9.6.5.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

9.6.6 Handling of DEP_RES supervisory PDUs with timeout bit set to ZERO

9.6.6.1 Purpose

The purpose of this test is to determine the correct handling of the DEP_RES supervisory PDU with timeout bit set to ZERO (Attention) (see ISO/IEC 18092: 2023, 12.7.1.3).

9.6.6.2 Procedure

Repeat steps a) to d) for each test scenario I 18 and I 19, for all specified data rate, communication mode and protocol activation procedure combinations. Test scenarios I18 and I 19 are defined in Table 57 and Table 58, respectively.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.2 for Passive communication mode at f_c/128, 9.1.3 for Passive communication mode at f_c/64 and f_c/32 and 9.1.4 for Active communication mode at all data rates.

c) Instruct the DUT to send an ATR_REQ and then the LT sends an ATR_RES.

d) Execute scenario I 18 or I 19.

Table 57 — Scenario I 18 — DEP_RES with timeout bit set to ZERO, correct transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	Mute
S(A)	→	
	←	S(A)
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND1$_{01}$	→	

Table 58 — Scenario I 19 — DEP_RES with timeout bit set to ZERO, erroneous transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	Mute
S(A)	→	
	←	Mute
S(A)	→	
	←	S(A)
TEST_COMMAND1$_{00}$	→	
	←	TEST_RESPONSE1$_{00}$
TEST_COMMAND1$_{01}$	→	

9.6.6.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

9.6.7 Handling of DSL_RES

9.6.7.1 Purpose

The purpose of this test is to determine the correct handling of the DSL_RES of the DUT (see ISO/IEC 18092: 2023, 12.8.2.3).

9.6.7.2 Procedure

Repeat steps a) to d) for each test scenario I 20 and I 21, for all specified data rate, communication mode and protocol activation procedure combinations. Test scenarios I 20 and I 21 are defined in Table 59 and Table 60, respectively.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.2 for Passive communication mode at f_c/128, 9.1.3 for Passive communication mode at f_c/64 and f_c/32 and 9.1.4 for Active communication mode at all data rates.

c) Instruct the DUT to send an ATR_REQ and then the LT sends an ATR_RES.

d) Execute scenario I 20 or I 21.

Table 59 — Scenario I 20 — DSL_RES, correct transaction

DUT		LT
TEST_COMMAND1$_{00}$	→	
	←	TEST_COMMAND5$_{00}$
DSL_REQ	→	
	←	DLS_RES

Table 60 — Scenario I 21 — DSL_RES, erroneous transaction

DUT		LT
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_COMMAND5_{00}$
DSL_REQ	→	
	←	Mute
DSL_REQ (NOTE)	→	
	←	DSL_RES

NOTE This behaviour is valid but optional.

9.6.7.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

9.6.8 Handling of RLS_RES

9.6.8.1 Purpose

The purpose of this test is to determine the correct handling of the RLS_RES of the DUT (see ISO/IEC 18092: 2023, 12.8.3.3).

9.6.8.2 Procedure

Repeat steps a) to d) for each test scenario I 22 and I 23, for all specified data rate, communication mode and protocol activation procedure combinations. Test scenarios I 22 and I 23 are defined in Table 61 and Table 62, respectively.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.2 for Passive communication mode at $f_c/128$, 9.1.3 for Passive communication mode at $f_c/64$ and $f_c/32$ and 9.1.4 for Active communication mode at all data rates.

c) Instruct the DUT to send an ATR_REQ and then the LT sends an ATR_RES.

d) Execute scenario I 22 or I 23.

Table 61 — Scenario I 22 — RLS_RES, correct transaction

DUT		LT
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_COMMAND6_{00}$
RLS_REQ	→	
	←	RLS_RES

Table 62 — Scenario I 23 — RLS_RES, erroneous transaction

DUT		LT
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_COMMAND6_{00}$
RLS_REQ	→	
	←	Mute
RLS_REQ (NOTE)	→	
	←	RLS_RES

NOTE This behaviour is valid but optional.

9.6.8.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates and communication modes.

9.6.9 Handling of WUP_RES (Active communication mode only)

9.6.9.1 Purpose

The purpose of this test is to determine the correct handling of the WUP_RES of the DUT (see ISO/IEC 18092: 2023, 12.6.2.4).

9.6.9.2 Procedure

Repeat steps a) to d) for each test scenario I 24 and I 25, for all specified data rate, communication mode and protocol activation procedure combinations. Test scenarios I 24 and I 25 are defined in Table 63 and Table 64, respectively.

a) Place the LT into the operating volume of the DUT.

b) Execute 9.1.4 for Active communication mode at all data rates.

c) Instruct the DUT to send an ATR_REQ and then the LT sends an ATR_RES.

d) Execute scenario I 24 or I 25.

Table 63 — Scenario I 24 — WUP_RES, correct transaction

DUT		LT
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$
$TEST\_COMMAND1_{01}$	→	
	←	$TEST\_RESPONSE1_{01}$
DSL_REQ	→	
	←	DSL_RES
WUP_REQ	→	
	←	WUP_RES
$TEST\_COMMAND1_{00}$	→	

Table 64 — Scenario I 25 — WUP_RES, erroneous transaction

DUT		LT
$TEST\_COMMAND1_{00}$	→	
	←	$TEST\_RESPONSE1_{00}$
$TEST\_COMMAND1_{01}$	→	
	←	$TEST\_RESPONSE1_{01}$
DSL_REQ	→	
	←	DSL_RES
WUP_REQ	→	
	←	Mute
WUP_REQ	→	
	←	WUP_RES
$TEST\_COMMAND1_{00}$	→	

9.6.9.3 Test report

The test report shall indicate whether the DUT behaves correctly for all data rates.

Annex A
(normative)

Test report template for Target tests

Supplier:

Product:

Total number of passed tests / Total Number of tests:

Number of different samples:

Date of tests:

Legend:

A: f_c/128 Active communication mode at f_c/128

A: f_c/64 Active communication mode at f_c/64

A: f_c/32 Active communication mode at f_c/32

P: f_c/128 Passive communication mode at f_c/128

P: f_c/64 Passive communication mode at f_c/64

P: f_c/32 Passive communication mode at f_c/32

Command and ID definitions valid for all protocol tests

No	Command name	Description	Data used
1	TEST_COMMAND1	Default command used for test	
2	TEST_RESPONSE1	Default response used for TEST_COMMAND1	
3	TEST_COMMAND2	Default command used to force chaining Target to Initiator	
4	TEST_COMMAND3	Default command using chaining. This command is divided in more than one part.	
5	TEST_RESPONSE3	Default response used for TEST_COMMAND3	
6	TEST_COMMAND4	Default command which forces Response Waiting Time at Target side	
7	TEST_RESPONSE4	Default response to TEST_COMMAND4 after Response Waiting Time has been processed.	
8	DID	Identifier used for tests	
9	NAD	Tested only if Target supports NAD	Yes / No
10	Chaining	Tested only if Target supports commands longer than 63 bytes	Yes / No

Activation in Passive communication mode

No	Test name	Expected result according to ISO/IEC 18092: 2023	Reference clause in ISO/IEC 18092: 2023	Condition	Test results PASS/FAIL
1	8.4.1 SDD for transport protocol activation at f_c/128	The test passes if the DUT responds in the time defined in ISO/IEC 18092.	11.3.1	P: f_c/128	
2	8.5.1 Activation time	The test passes if the DUT responds in the time defined in ISO/IEC 18092.	11.3.2.3	P: f_c/64	
				P: f_c/32	
3	8.5.2 Frame format	The test passes if the Preamble, SYNC, Length and CRC are according to ISO/IEC 18092.	11.3.2.2	P: f_c/64	
				P: f_c/32	
4	8.5.3 SDD at f_c/64 and f_c/32	The test passes if the data and the response time are according to ISO/IEC 18092.	11.3.2.3	P: f_c/64	
				P: f_c/32	
5	8.5.4 SDD for transport protocol activation at f_c/64 and f_c/32	The test passes if the data and the response time are according to ISO/IEC 18092.	11.3.2.3 11.3.2.4	P: f_c/64	
				P: f_c/32	

Activation in Active communication mode

No	Test name	Expected result according to ISO/IEC 18092: 2023	Reference clause in ISO/IEC 18092: 2023	Condition	Test results PASS/FAIL
1	8.6.1 RFCA	The test passes if the DUT activates its RF field as specified in ISO/IEC 18092.	11.2.3	A: f_c/128	
				A: f_c/64	
				A: f_c/32	

Logical operation of the Target Transport Protocol						
No	**Test name**	**Expected result**	**Reference clause in ISO/IEC 18092: 2023**	**Scenario number**	**Condition**	**Test results PASS/FAIL**
1	8.7.1 Handling of ATR_REQ	The test passes if DUT behaves as described in the scenario.	12.6.1.3	T 1 T 2 T 3	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
2	8.7.2 Handling of PSL_REQ	The test passes if DUT behaves as described in the scenario.	12.6.3.3	T 4 T 5 T 6	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
3	8.7.3 Handling of DEP_REQ Information PDUs	The test passes if DUT behaves as described in the scenarios.	12.7.1.2	T 7 T 8 T 9	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
4	8.7.4 Handling of DEP_REQ Information PDUs with the more information bit set to ONE	The test passes if DUT behaves as described in the scenarios.	12.7.1.3	T 10 T 11 T 12 T 13 T 14 T 15	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
5	8.7.5 Handling of DEP_REQ supervisory PDUs with timeout bit set to ONE	The test passes if DUT behaves as described in the scenarios.	12.7.1.3	T 16 T 17	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
6	8.7.6 Handling of DEP_REQ supervisory PDUs with timeout bit set to ZERO	The test passes if DUT behaves as described in the scenarios.	12.7.1.3	T 18 T 19	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
7	8.7.7 Handling of DSL_REQ	The test passes if DUT behaves as	12.8.2.3	T 20 T 21	P: f_c/128	
					P: f_c/64	
					P: f_c/32	

		described in the scenarios.			A: f_c/128	
					A: f_c/64	
					A: f_c/32	
8	8.7.8 Handling of RLS_REQ	The test passes if DUT behaves as described in the scenarios.	12.8.3.3	T 22 T 23	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
9	8.7.9 Handling of WUP_REQ (Active communication mode only)	The test passes if DUT behaves as described in the scenarios.	12.6.2.4	T 24 T 25 T 26	A: f_c/128	
					A: f_c/64	
					A: f_c/32	

Annex B
(normative)

Test report template for Initiator tests

Supplier:

Product:

Total number of passed tests / Total Number of tests:

Number of different samples:

Date of tests:

Legend:

A: f_c/128 Active communication mode at f_c/128

A: f_c/64 Active communication mode at f_c/64

A: f_c/32 Active communication mode at f_c/32

P: f_c/128 Passive communication mode at f_c/128

P: f_c/64 Passive communication mode at f_c/64

P: f_c/32 Passive communication mode at f_c/32

Commands and ID definitions used for protocol tests			
No	**Command name**	**Description**	**Data used**
1	TEST_COMMAND1	Default command used for test	
2	TEST_RESPONSE1	Default response used for TEST_COMMAND1	
3	TEST_COMMAND2	Default command used to force chaining Initiator to Target	
4	TEST_COMMAND3	Default command using chaining. This command is divided in more than 1 part.	
5	TEST_RESPONSE3	Default response used for TEST_COMMAND3	
6	TEST_COMMAND4	Default command which forces Response Waiting Time at Target side	
7	TEST_RESPONSE4	Default response to TEST_COMMAND4 after Response Waiting Time has been processed.	
8	TEST_COMMAND5	Default command used for TEST_COMMAND1 to force sending a DSL_REQ	

9	TEST_COMMAND6	Default command used for TEST_COMMAND1 to force sending a RLS_REQ	
10	DID	Identifier used for tests	
11	NAD	Tested only if the Initiator uses NAD	Yes / No
12	Chaining	Tested only if the Initiator supports commands longer than 63 bytes	Yes / No
13	PSL_REQ	Tested only if the Initiator supports PSL_REQ	Yes / No
14	DSL_REQ	Tested only if the Initiator supports DSL_REQ	Yes / No
15	RLS_REQ	Tested only if the Initiator supports RLS_REQ	Yes / No

Activation in Passive communication mode

No	Test name	Expected result according to ISO/IEC 18092: 2023	Reference clause in ISO/IEC 18092: 2023	Condition	Test results PASS/FAIL
1	9.3.1 Initial RF Collision Avoidance at f_c/128	The test passes if the DUT activates its RF field as specified in ISO/IEC 18092.	11.2.2	P: f_c/128	
2	9.3.2 SDD for transport protocol activation at f_c/128	The test passes if the data and the response time are according to ISO/IEC 18092.	11.3.1	P: f_c/128	
3	9.4.1 Initial RF Collision Avoidance at f_c/64 and f_c/32	The test passes if the DUT activates its RF field as specified in ISO/IEC 18092.	11.2.2	P: f_c/64	
				P: f_c/32	
4	9.4.2 Frame format	If the Preamble, SYNC, Length and CRC are according to ISO/IEC 18092 the test is passed.	11.3.2.2	P: f_c/64	
				P: f_c/32	
5	9.4.3 SDD for transport protocol activation at f_c/64 and f_c/32	The test passes if the data and the response time are according to ISO/IEC 18092.	11.3.2.3 11.3.2.4	P: f_c/64	
				P: f_c/32	

Activation in Active communication mode

No	Test name	Expected result according to ISO/IEC 18092: 2023	Reference clause in ISO/IEC 18092: 2023	Condition	Test results PASS/FAIL
1	9.5.1 Initial RFCA	The test passes if the DUT activates its RF field as specified in ISO/IEC 18092.	11.2.1	A: f_c/128	
				A: f_c/64	
				A: f_c/32	
2	9.5.2 Response RFCA	The test passes if the DUT activates its RF field as specified in ISO/IEC 18092.	11.4.2	A: f_c/128	
				A: f_c/64	
				A: f_c/32	

Logical operation of the Transport Protocol

No	Test name	Expected result	Reference clause in ISO/IEC 18092: 2023	Scenario number	Condition	Test results PASS/FAIL
1	9.6.1 Handling of ATR_RES	The test passes if DUT behaves as described in the scenario.	12.6.1.3	I 1 I 2	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
2	9.6.2 Handling of PSL_RES	The test passes if DUT behaves as described in the scenario.	12.6.3.3	I 3 I 4	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
3	9.6.3 Handling of DEP_RES Information PDUs	The test passes if DUT behaves as described in the scenarios.	12.7.1.2	I 5 I 6 I 7	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
4	9.6.4 Handling of DEP_RES Information PDUs with more information bit set to ONE	The test passes if DUT behaves as described in the scenarios.	12.7.1.3	I 8 I 9 I 10 I 11 I 12 I 13 I 14	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
5	9.6.5 Handling of	The test passes if DUT behaves as	12.7.1.3		P: f_c/128	
					P: f_c/64	

	DEP_RES supervisory PDUs with timeout bit set to ONE	described in the scenarios.		I 15 I 16 I 17	P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
6	9.6.6 Handling of DEP_RES supervisory PDUs with timeout bit set to ZERO	The test passes if DUT behaves as described in the scenarios.	12.7.1.3	I 18 I 19	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
7	9.6.7 Handling of DSL_RES	The test passes if DUT behaves as described in the scenarios.	12.8.2.3	I 20 I 21	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
8	9.6.8 Handling of RLS_RES	The test passes if DUT behaves as described in the scenarios.	12.8.3.3	I 22 I 23	P: f_c/128	
					P: f_c/64	
					P: f_c/32	
					A: f_c/128	
					A: f_c/64	
					A: f_c/32	
9	9.6.9 Handling of WUP_RES	The test passes if DUT behaves as described in the scenarios.	12.6.2.4	I 24 I 25	A: f_c/128	
					A: f_c/64	
					A: f_c/32	