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GS1 EPC Compliant Generation-2 RFID Devices Conformance Requirements

specifies the conformance requirements for Generation-2 RFID system

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2.0.1	Oct 2015	David Buckley	Branding update for ratified version
3.0	April 2024	Claude Tételin	Alignment with Gen2v3 WR 24-041

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1 Introduction

This document specifies the conformance requirements for a passive-backscatter, Interrogator-talks-first (ITF), radio-frequency identification (RFID) system operating in the 860 MHz – 930 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 an RF signal in the 860 MHz – 930 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.

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2 Scope

This document specifies:

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

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3 Conformance

3.1 Claiming Conformance

A device shall not claim conformance with the Protocol unless it complies with ALL clauses in this document (except those marked as optional) and all local radio regulations. Conformance may also require a license from the owner of any intellectual property utilised by said device.

GS1 is proposing a certification program and is maintaining a list of certified devices. To be GS1 certified, a device shall conform with the Protocol and shall have been tested by a GS1 accredited laboratory.

To be certified as sensor conformant Tags and Interrogators shall additionally support the optional clause 8 or portions of optional clauses specified in clause 8.

To be certified as alteration-EAS conformant Tags and Interrogators shall additionally support the optional clauses or portions of optional clauses specified in Annex N under the item Alteration EAS.

To be certified consumer-electronics conformant Tags and Interrogators shall additionally support the optional clauses or portions of optional clauses specified in Annex N under the item Consumer Electronics.

To be certified as Tag-alteration conformant and Interrogators shall additionally support the optional clauses or portions of optional clauses specified in Annex N under the item Tag Alteration (Core). Additionally, tags may be conformant to Tag Alteration (Challenge), Tag Alteration (Authenticate) and or Tag Alteration (Full) by fulfilling the respective requirements of Annex N.

3.2 General Conformance Requirements

3.2.1 Interrogators

To conform to the Air Interface Standard, an Interrogator shall:

- Meet the requirements of the protocol,
- Implement the mandatory commands defined in the protocol,
- Modulate/transmit and receive/demodulate a sufficient set of the electrical signals defined in the signaling layer of the protocol to communicate with conformant Tags, and
- Conform to all local radio regulations.

To conform to the Air Interface Standard, an Interrogator may:

- Implement any subset of the optional commands defined in the protocol, and
- Implement any proprietary and/or custom commands in conformance with the protocol.

To conform to the Air Interface Standard, an Interrogator shall not:

- Implement any command that conflicts with the protocol, or
- Require using an optional, proprietary, or custom command to meet the requirements of the protocol.

3.2.2 Tags

To conform to the Air Interface Standard, a Tag shall:

- Meet the requirements of the protocol,
- Implement the mandatory commands defined in the protocol,
- Modulate a backscatter signal only after receiving the requisite command from an Interrogator, and
- Conform to all local radio regulations when appropriately commanded by an Interrogator.

To conform to the Air Interface Standard, a Tag may:

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- Implement any subset of the optional commands defined in the protocol, and
- Implement any proprietary and/or custom commands as defined in 3.3.3 and 3.3.4, respectively.

To conform to the Air Interface Standard, a Tag shall not:

- Implement any command that conflicts with the protocol,
- Require using an optional, proprietary, or custom command to meet the requirements of the protocol, or
- Modulate a backscatter signal unless commanded to do so by an Interrogator using the signaling layer defined in the protocol.

3.3 Command Structure and Extensibility

Subclause 6.3.2.12 of the Air Interface Standard defines the structure of the command codes used by Interrogators and Tags, as well as the availability of future extensions. Each command is defined and labelled as mandatory or optional.

3.3.1 Mandatory Commands

Conforming Tags and Interrogators shall support all mandatory commands.

3.3.2 Optional Commands

Conforming Interrogators may or may not support optional commands. Conforming Tags may or may not support optional commands. If an Interrogator or a Tag implements an optional command, it shall implement it in the manner specified.

3.3.3 Proprietary Commands

Proprietary commands may be enabled in conformance with the protocol but are not specified in the Air Interface Standard. All proprietary commands shall be capable of being permanently disabled. Proprietary commands are intended for manufacturing purposes and shall not be used in field-deployed RFID systems.

3.3.4 Custom Commands

Custom commands may be enabled in conformance with the protocol but are not specified in the Air Interface Standard. An Interrogator shall issue a custom command only after singulating a Tag and reading (or having prior knowledge of) the Tag manufacturer's identification in the Tag's TID memory. An Interrogator shall use a custom command only in accordance with the specifications of the Tag manufacturer identified in the TID.

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4 Normative References

The following referenced documents are indispensable to the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition (including any amendments) applies.

- GS1: EPC Tag Data Standard (TDS)
- GS1: EPC Radio-Frequency Identity Generation-2 UHF RFID Standard: specification for RFID Air Interface Protocol for Communications at 860 MHz – 930 MHz, Version 3.0
- European Telecommunications Standards Institute (ETSI), EN 302 208: Radio Frequency Identification Equipment operating in the band 865 MHz to 868 MHz with power levels up to 2 W and in the band 915 MHz to 921 MHz with power levels up to 4 W; Harmonised Standard for access to radio spectrum, V3.3.1
- ISO/IEC 18000-63: Information technology automatic identification and data capture techniques — Radio frequency identification for item management air interface — Part 63: Type C: Parameters for air interface communications at 860–960 MHz
- ISO/IEC 19762: *Information technology – Automatic identification and data capture (AIDC) techniques – Harmonized vocabulary*
- U.S. Code of Federal Regulations (CFR), Title 47, Chapter I, Part 15: *Radio-frequency devices, U.S. Federal Communications Commission*

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5 Terms and Definitions

The principal terms and definitions used in this document are described in the Air Interface Standard and in ISO/IEC 19762.

5.1 Additional Terms and Definitions

Terms and definitions specific to this document that supersede any normative references are as follows:

- **By design**

  Design parameters and/or theoretical analysis that ensure compliance. A vendor submitting a component or system for compliance testing shall provide the necessary technical information, in the form of a technical memorandum or similar. A test laboratory approved by GS1 shall certify the technical analysis as being sufficient to ensure conformance of the component or system.

  For Protocol requirements that are verified **by design**, the method of technical analysis is at the discretion of the submitting 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 convince a test engineer knowledgeable of the Protocol that the particular requirement has been met.

- **By demonstration**

  Laboratory testing of one, or if required for statistical reasons multiple, products, processes, or services to ensure compliance. A test laboratory certified by GS1 shall perform the indicated testing to ensure conformance of the component or system.

  For Protocol requirements that are verified **by demonstration**, the test conditions are specified by this document. The detailed test plan is at the discretion of the certifying test laboratory.

  Interrogators submitted for testing purposes shall include physical connections and test modes suitable for the certifying laboratory to evaluate Interrogator performance under the test conditions specified in this document.

  Tags submitted for testing purposes shall include all documentation required by 6.3.1.3.5 of the Protocol. The certifying laboratory's test plan will specify the submitted Tag's memory contents (i.e. the contents of Reserved, EPC, TID, and User memory as well as the lock status of these memory banks).

- **As implemented**

  If a Tag or Interrogator implements a subset of the Protocol, compliance shall be verified over the subset actually 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 which case compliance testing shall only use DSB-ASK modulation. For parameters that are continuously variable, compliance shall be verified at the minimum and maximum values of the implemented range, unless the test conditions specifically state otherwise.

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6 Symbols, Abbreviated Terms, and Notation

The principal symbols and abbreviated terms used in this document are detailed in

- ISO/IEC 19762: *Information technology – Automatic identification and data capture (AIDC) techniques – Harmonized vocabulary*
- GS1: EPC Radio-Frequency Identity Generation-2 UHF RFID Standard: specification for RFID Air Interface Protocol for Communications at 860 MHz – 930 MHz, Version 3.0

Symbols, abbreviated terms, and notation specific to this document are as follows:

6.1 Symbols

None

6.2 Abbreviated Terms

None

6.3 Notation

This protocol uses the following notational conventions:

- States and flags are denoted in bold. Some command parameters are also flags; a command parameter used as a flag will be bold. Example: **ready**.
- Command and Tag reply parameters are underlined. Some flags are also command parameters; a flag used as a command parameter will be underlined. Example: Pointer.
- Command parameters are upper-case and Tag reply parameters are lower-case. Example: Pointer and handle.
- Commands are denoted in italics. Variables are also denoted in italics. Where there might be confusion between commands and variables, this protocol will make an explicit statement. Example: *Query*.
- For logical negation, labels are preceded by '~'. Example: If **flag** is true, then **~flag** is false.
- The symbol, ⊗, refers to XOR.
- The symbol, ||, refers to concatenation.
- The symbol, ≠, refers to not equal.
- The symbol, R=>T, refers to commands or signaling from an Interrogator to a Tag (Reader-to-Tag).
- The symbol, T=>R, refers to commands or signaling from a Tag to an Interrogator (Tag-to-Reader).
- The numbering base is denoted with a subscript. Binary numbers are denoted with a subscript 2 ($xxxx_2$) and hexadecimal numbers are denoted with a subscript h ($xxxx_h$); the absence of a subscript denotes decimal numbering system.
- The symbol, &, refers to bitwise Boolean and operation.
- The capitalized AND refers to logical (true/false) and operation.
- The capitalized OR refers to logical (true/false) or operation.
- When used in conditions, three or more logical conditions separated the symbol, ;, share the same logical operation. For example, a condition represented as "condition1; condition2; AND condition3" is true if "condition1 AND condition2 AND condition3" is true. The symbol, ;, also represents three or more separate actions. For example, "action1; action2; and action3" represent invoking of action1, action2, and action3.

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- The symbols, (, and), are used to clarify the order of evaluation for more complex conditions or actions. For example, a condition represented as "(condition1 OR condition 2) AND condition3" is true if either "condition1 AND condition3" or "condition2 AND condition3" is true.

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7 Protocol Requirements

The column MO (Mandatory / Optional) has the following meaning:

- M mandatory
- EAS mandatory for EAS only, otherwise optional
- TAC mandatory for Tag Alteration (Core), otherwise optional
- TACC mandatory for Tag Alteration (Core + Challenge), otherwise optional
- TACA mandatory for Tag Alteration (Core + Authenticate), otherwise optional
- TACF mandatory for Tag Alteration (Core + Full), otherwise optional
- CE mandatory for Consumer Electronics, otherwise optional
- *O* *optional*
- *C* *required in respect to crypto suite*

To be certified as alteration-EAS, Tag-alteration, and/or consumer-electronics conformant, Tags and Interrogators shall support the optional clauses or portions of optional clauses cited in the corresponding Table 6-1, respectively, as mandatory. To be clear, those features in the cited optional clause or portion of optional clause specified with a "may" shall become a "shall"; those specified with a "shall" shall remain a "shall".

Unless otherwise specified, testing shall take place in an environment of temperature 23° C ± 3° C and of relative humidity 40 % to 60 %.

NOTE: In case an error condition has multiple choices for the error codes then either of the error codes may be seen as valid and the test has to be evaluated as pass for any of these codes.

Table 7-1 Protocol Requirements

Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
1	6.1.1	The communications link between Interrogators and Tags is half-duplex, meaning that Tags shall not be required to demodulate Interrogator commands while backscattering.	M	Tag	**By design**
2	6.1.1	A Tag shall not respond to a mandatory or optional command using full-duplex communications.	M	Tag	**By design**
3	6.3.1.1	Tags shall receive power from and communicate with Interrogators within the frequency range from 860 MHz to 930 MHz, inclusive.	M	Tag	**By demonstration** *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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_2
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 Annex G.	M	Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
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 4.1.	M	Interrogator	**By design**
6	6.3.1.2.1	Interrogators certified for operation in single- or multiple-Interrogator environments shall have a frequency accuracy that meets local regulations.	M	Interrogator	**By design**
7	6.3.1.2.1	Interrogators certified for operation in dense-Interrogator environments shall have a frequency accuracy of ± 10 ppm over the nominal temperature range (–25 °C to +40 °C) and ± 20 ppm over the extended temperature range (–40 °C to +65 °C). Interrogators rated by the manufacturer to have a temperature range wider than nominal but different from extended shall have a frequency accuracy of ± 10 ppm over the nominal temperature range and ± 20 ppm to the extent of their rated range. If local regulations specify tighter frequency accuracy then the Interrogator shall meet the local regulations.	M	Interrogator	**By demonstration** For dense-Interrogator certification, unless local regulations specify tighter frequency accuracy than the Protocol, in which case the Interrogator manufacturer shall provide evidence of certification by the local regulatory body in lieu of laboratory demonstration. *Test conditions:* Temp: max(–40 °C, minimum supported temperature) and min(+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 ± 3 °C. See Annex A, Q7. Freq: 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:* 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 Annex H.	M	Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
9	6.3.1.2.2	Tags shall demodulate all three modulation types.	M	Tag	**By demonstration** *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK, SSB-ASK, and PR-ASK Tari: 6.25, 12.5, and 25 µs RTcal: 2.5Tari PW: min and max Modulation depth: 90% ASK, 200% PR-ASK DSB-ASK rise/fall time: ≤ 0.33Tari SSB-ASK rise/fall time: ≤ 0.33Tari PR-ASK rise/fall time: ≤ 0.62PW TRcal: 2RTcal DR: 8 M: 1 TRext: 0_2
10	6.3.1.2.3	The R=>T link shall use PIE, shown in Figure 6.1.	M	Interrogator	**By design**
11	6.3.1.2.3	Pulse modulation depth, rise time, fall time, and PW shall be as specified in Table 6.5, and shall be the same for a data-0 and a data-1.	M	Interrogator	**By demonstration** *Test conditions:* Temp: +23 °C ± 3 °C Freq: At channel frequency closest to center of supported band. Power: Maximum Interrogator transmit power, as implemented. Other transmit parameters: As implemented See Annex A, Q10.
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	Interrogator	**By design**
13	6.3.1.2.3	The RF envelope shall be as specified in Figure 6-2a and Figure 6-2b.	M	Interrogator	**By demonstration** *Test conditions:* Temp: +23 °C ± 3 °C Freq: At channel frequency closest to center of supported band. Power: Maximum Interrogator transmit power, as implemented. Other transmit parameters: As implemented See Annex A, Q10.
14	6.3.1.2.4	Interrogators shall communicate using Tari values in the range of 6.25 µs to 25 µs.	M	Interrogator	**By design**
15	6.3.1.2.4	Interrogator compliance shall be evaluated using at least one Tari value between 6.25 µs and 25 µs with at least one value of the parameter *x*.	M	Interrogator	**By demonstration** This document uses vendor preferred Tari and x values as consistent with the Protocol.

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
16	6.3.1.2.4	The tolerance on all parameters specified in units of Tari shall be ± 1%.	M	Interrogator	**By demonstration** *Test conditions:* Temp: Either (a) or (b) shown below: a) Single and Multi-Interrogators: +23 ºC ± 3 °C b) Dense-Interrogators tested at modulation, data rate, and encoding parameters specified in Annex G of the Protocol specification: max(−40 °C, minimum supported temperature) and min(+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 ± 3 °C. See Annex A, Q7. Freq: 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	Interrogator	**By design**
18	6.3.1.2.5	The R=>T RF envelope shall comply with Figure 6-2a, Figure 6-2b and Table 6-5.	M	Interrogator	**By demonstration** Tested in compliance with 6.3.1.2.3
19	6.3.1.2.5	Unless permitted by field strength adjustment (6.3.1.2.9), an Interrogator shall implement the R=>T RF envelope between modulating pulses in an inventory round with a single nominal field strength (A) and a magnitude between A-M_l and A+M_h (see Figure 6-2a and Figure 6-2b).	M	Interrogator	**By design**
20	6.3.1.2.5	An Interrogator with an R=>T RF envelope using PR-ASK modulation shall comply with the ASK modulation mask with B+M_h ≤ 0.1A when modulating the delimiter shown in Figure 6-2.	M	Interrogator	**By demonstration** (if interrogator implements PSK) Tested in compliance with Item 13
21	6.3.1.2.6	The Interrogator power-up RF envelope shall comply with Figure 6-3a and Table 6-6.	M	Interrogator	**By demonstration** *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: At channel frequency closest to center of supported band. Power: Maximum Interrogator transmit power, as implemented. See Annex A, Q8.
22	6.3.1.2.6	Once the carrier level has risen above M_s, the power-up envelope shall monotonically increase to 0.1A.	M	Interrogator	**By demonstration** Tested in compliance with Item 21
23	6.3.1.2.6	During the T_{rp} interval the power-up envelope shall increase from 0.1A to 0.9A, and the increasing envelope may momentarily decrease at a rate ≤ 1%/10 µsec with a maximum decrease of 2.5%.	M	Interrogator	**By demonstration** Tested in compliance with Item 21

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
24	6.3.1.2.6	During the T_{sp} interval the power-up envelope shall not fall below 0.9A as in Figure 6-3a.	M	Interrogator	**By demonstration** Tested in compliance with Item 21
25	6.3.1.2.6	An Interrogator shall meet the frequency-accuracy requirement specified in 6.3.1.2.1 by the end of the T_{sp} interval.	M	Interrogator	**By design** Tested in compliance with Item 850
26	6.3.1.2.6	An Interrogator shall not issue commands before the minimum time of the T_{cp} interval in Table 6-6.	M	Interrogator	**By design**
27	6.3.1.2.6	Interrogators shall not begin field strength adjust (see 6.3.1.2.9) before the minimum time of the T_{cp} interval in Table 6-6.	M	Interrogator	**By design**
28	6.3.1.2.7	The Interrogator power-down RF envelope shall comply with Figure 6-3b and Table 6-7.	M	Interrogator	**By demonstration** *Test conditions:* Temp: +23 °C ± 3 °C Freq: At channel frequency closest to center of supported band. Power: Maximum Interrogator transmit power, as implemented.
29	6.3.1.2.7	Except as permitted by modulation and by field-strength adjust transmitted by an Interrogator, once the carrier level has fallen below the A-M_l level, the Interrogator shall decrease the RF envelope monotonically from 0.9A until the power-off limit M_s.	M	Interrogator	**By demonstration** Tested in compliance with Item 28
30	6.3.1.2.7	Once powered off, an Interrogator shall remain powered off for a least 1ms before powering up again.	M	Interrogator	**By design**
31	6.3.1.2.8	An Interrogator shall begin all R=>T signaling with either a preamble or a frame-sync, both of which are shown in Figure 6-4.	M	Interrogator	**By design**
32	6.3.1.2.8	An interrogator shall precede a *Query* command (see 6.3.2.12.2.1) and a *QueryX* command (see 6.3.2.12.2.2) with a preamble.	M	Interrogator	**By design** – inherently tested with other tests
33	6.3.1.2.8	All other signaling shall begin with a frame-sync.	M	Interrogator	**By design** – inherently tested with other tests
34	6.3.1.2.8	The tolerance on all parameters specified in units of Tari shall be ± 1%.	M	Interrogator	**By demonstration** Tested in compliance with 6.3.1.2.3
35	6.3.1.2.8	PW shall be as specified in Table 6-5.	M	Interrogator	**By demonstration** Tested in compliance with 6.3.1.2.3
36	6.3.1.2.8	The RF envelope shall be as specified in Figure 6-2a and Figure 6-2b.	M	Interrogator	**By design**
37	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	Interrogator	**By demonstration** *Test conditions:* Temp: +23 °C ± 3 °C Freq: At channel frequency closest to center of supported band. Power: Maximum Interrogator transmit power, as implemented. Other transmit parameters: As implemented
38	6.3.1.2.8	The rise time, fall time, and 12.5 µs pulse width delimiter shall comply with the R=>T RF envelope using the Tari defined after the delimiter.	M	Interrogator	**By demonstration** Tested in compliance with Item 11

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
39	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.	M	Interrogator	**By design**
40	6.3.1.2.8	A Tag shall measure the length of RTcal and compute *pivot* = RTcal / 2.	M	Tag	**By design**
41	6.3.1.2.8	A Tag shall interpret subsequent Interrogator symbols shorter than *pivot* to be data-0s, and subsequent Interrogator symbols longer than *pivot* to be data-1s.	M	Tag	**By design**
42	6.3.1.2.8	A Tag shall interpret symbols longer than 4 RTcal to be invalid.	M	Tag	**By design**
43	6.3.1.2.8	Prior to changing RTcal, an Interrogator shall transmit CW for a minimum of 8 RTcal.	M	Interrogator	**By design**
44	6.3.1.2.8	An Interrogator shall specify a Tag's backscatter link frequency (its FM0 data rate or the frequency of its Miller subcarrier) using the TRcal and divide ratio (DR) in the preamble and payload, respectively, of a *Query* or *QueryX* command that begins an inventory round.	M	Interrogator	**By design**
45	6.3.1.2.8	A Tag shall measure the length of TRcal, compute BLF, and adjust its T=>R link rate to be equal to BLF (Table 6-9 shows BLF values and tolerances).	M	Tag	**By demonstration** Tested in compliance with 6.3.1.3.3
46	6.3.1.2.8	The TRcal and RTcal that an Interrogator uses in any inventory round shall meet the constraints in Equation (2): 1.1xRTcal ≤ TRcal ≤ 3xRTcal	M	Interrogator	**By design** – inherently tested with other tests
47	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	Interrogator	**By design**
48	6.3.1.2.9	If an Interrogator adjusts the nominal field strength down, the Interrogator shall monotonically decrease the field strength from A-M_l to A_{adj} +M_{adjh}, and then the field strength shall remain within A_{adj} - M_{adjl} to A_{adj} + M_{adjh} for the minimum t_{lead} time before modulating the delimiter.	O	Interrogator	**By design**
49	6.3.1.2.9	If an Interrogator adjusts the nominal field strength down, the Interrogator shall use the adjusted nominal field strength (A_{adj}) and other adjusted envelope parameters (B_{adj}, M_{adjh}, M_{adjl}) in Table 6-5 to modulate the command and modulate the frame-sync or preamble that precedes the command.	O	Interrogator	**By design**
50	6.3.1.2.9	If an Interrogator adjusts the field strength up after the last transmitted bit, the Interrogator shall monotonically increase the field strength from the end of the pulsewidth to A-M_l within maximum t_{lag} time.	O	Interrogator	**By design**
51	6.3.1.2.9	Tags shall communicate with Interrogators that adjust the field strength of the R=>T envelope.	M	Tag	**By demonstration** Tested in compliance with Item 52

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
52	6.3.1.2.9	Using the parameters in Table 6-8 and an RF envelope sequence of power-up, field strength adjust down, a *QueryX* command, field strength adjust up, and then *ACK* command, then the minimum nominal field strength for a Tag to complete a reply to an *ACK* shall be less than 1.25 times the maximum nominal field strength with no reply to a *QueryX.*	M	Tag	**By demonstration** *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 MHz Use parameters of Table 6-8
53	6.3.1.2.10	When an Interrogator uses frequency-hopping spread spectrum (FHSS) signaling, the Interrogator's RF envelope shall comply with the power-up and power-down waveforms in Figure 6-3a, Figure 6-3b, Table 6-6 and Table 6-7.	M	Interrogator	**By demonstration** (if interrogator implements FHSS) Tested in compliance with Item 21 and Item 28
54	6.3.1.2.10	The maximum time between frequency hops and the minimum RF-off time during a hop shall meet local regulatory requirements.	M	Interrogator	**By design**
55	6.3.1.2.10	Interrogators certified for operation in single-Interrogator environments shall meet local regulations for spread-spectrum channelization.	M	Interrogator	**By design**
56	6.3.1.2.10	Interrogators certified for operation in multiple- or dense-Interrogator environments shall meet local regulations (see also Annex G, which describes multiple- and dense-Interrogator channelized signaling).	M	Interrogator	**By design**
57	6.3.1.2.11	Interrogators certified for operation according to this protocol shall meet local regulations for out-of-channel and out-of-band spurious radio-frequency emissions.	M	Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
58	6.3.1.2.11	Interrogators certified for operation in multiple-Interrogator environments shall meet both local regulations and the Multiple-Interrogator Transmit Mask described below and shown in Figure 6-6.	M	Interrogator	**By demonstration**, for multiple-Interrogator certification. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 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:* Repeated inventory command sequences without tags present, where each inventory command sequence comprises of 1) *Query* with Q=0; 2) unmodulated carrier to account for RN16 reply from a tag; 3) *ACK* command; 4) unmodulated carrier to account for 96bit EPC reply from a tag. *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
59	6.3.1.2.11	**Multiple-Interrogator Transmit Mask:** For an Interrogator modulating an R=>T inventory command sequence 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: □ $\lvert R - S \rvert = 1$: $10\log_{10}(P(S) / P(R)) < -20$ dB □ $\lvert R - S \rvert = 2$: $10\log_{10}(P(S) / P(R)) < -50$ dB □ $\lvert R - S \rvert = 3$: $10\log_{10}(P(S) / P(R)) < -60$ dB □ $\lvert R - S \rvert > 3$: $10\log_{10}(P(S) / P(R)) < -65$ dB	M	Interrogator	**By demonstration** *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 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:* See Item 58 *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
60	6.3.1.2.11	Each channel that exceeds the mask shall be counted as an exception.	M		**By demonstration** Tested in compliance with 6.3.1.2.11, Figure 6.6

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
61	6.3.1.2.11	Interrogators certified for operation in dense-Interrogator environments shall meet both local regulations and the Dense-Interrogator Transmit Mask described below and shown in Figure 6-7.	M	Interrogator	**By demonstration**, for dense-Interrogator certification. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: At channel frequency closest to center of supported band. Power: Maximum Interrogator transmit power, as implemented. Reference bandwidth: 2.5/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 Annex G of the Protocol specification, as implemented. *Modulation:* See Item 58 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 ≥ 20 µs: 1 MHz 20 µs > Tari ≥ 10 µs: 2 MHz Tari < 10 µs: 3 MHz Trace mode: Max hold sufficient to capture all emissions Detection mode: Averaging
62	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	Interrogator	**By demonstration** Tested in compliance with 6.3.1.2.11, Figure 6.7 *Modulation:* See Item 58 *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

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
63	6.3.1.2.11	**Dense-Interrogator Transmit Mask:** 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 modulating an R=>T inventory command sequence shall not exceed the specified values: □ $\lvert n \rvert = 1$: $10\log_{10}(P(S_{BW}) / P(R_{BW})) < -30$ dB □ $\lvert n \rvert = 2$: $10\log_{10}(P(S_{BW}) / P(R_{BW})) < -60$ dB □ $\lvert n \rvert > 2$: $10\log_{10}(P(S_{BW}) / P(R_{BW})) < -65$ dB	M	Interrogator	**By demonstration** Tested in compliance with 6.3.1.2.11, Figure 6.7 *Modulation:* See Item 58 *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
64	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 4.1.	M	Tag	**By design**
65	6.3.1.3.1	Tag backscatter shall use ASK and/or PSK modulation.	M	Tag	**By design**
66	6.3.1.3.1	Interrogators shall demodulate both modulation types.	M	Interrogator	**By design**
67	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	Tag	**By demonstration** Tested in compliance with 6.3.1.3.2.1 and 6.3.1.3.2.3
68	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	Tag	**By demonstration** *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari TRext: 0_2 *Test # 1* Tari: 6.25 µs RTcal: 18.75 µs TRcal: 33.3, 50 µs DR: 64/3 M: 1 *Test # 2* Tari: 12.5 µs RTcal: 31.25 µs TRcal: 66.7, 83.3 µs DR: 64/3 M: 1
69	6.3.1.3.2.1	FM0 signaling shall always end with an extra data-1 bit, known as a "dummy" bit, at the end of a transmission, as shown in Figure 6-10.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
70	6.3.1.3.2.2	T=>R FM0 signaling shall begin with one of the two preambles shown in Figure 6-11.	M	Tag	**By demonstration** *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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_2 and 1_2
71	6.3.1.3.2.2	The choice depends on the TRext value specified in the *Query* or *QueryX* that begins the inventory round, unless a Tag is replying to a command that uses a *delayed* or *in-process* reply (see 6.3.1.6), in which case a Tag shall use the extended preamble regardless of TRext (i.e. a Tag replies as if TRext=1_2 regardless of the TRext value specified in the *Query* (see 6.3.2.12.2.1) or in the *QueryX* (see 6.3.2.12.2.2).	M	Tag	**By demonstration** Tested in compliance with 6.3.2.6, Figure 6.21
72	6.3.1.3.2.3	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 *Query* or *QueryX* command that began the inventory round (see Table 6-10).	M	Tag	**By design**
73	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	Tag	**By demonstration** *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari TRext: 0_2 *Test # 1* Tari: 6.25 µs RTcal: 18.75 µs TRcal: 33.3, 50 µs DR: 64/3 M: 2, 4, 8 *Test # 2* Tari: 12.5 µs RTcal: 31.25 µs TRcal: 66.7, 83.3 µs DR: 64/3 M: 2, 4, 8 See Annex A, Q11.
74	6.3.1.3.2.3	Miller signaling shall always end with an extra data-1 bit, known as a "dummy" bit, at the end of a transmission, as shown in Figure 6-14.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
75	6.3.1.3.2.4	T=>R subcarrier signaling shall begin with one of the two preambles shown in Figure 6-15.	M	Tag	**By demonstration** *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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: 2, 4, 8 TRext: 0_2 and 1_2
76	6.3.1.3.2.4	The choice depends on the TRext value specified in the *Query* or *QueryX* that began the inventory round, unless a Tag is replying to a command that uses a *delayed* or *in-process* reply (see 6.3.1.6), in which case a Tag shall use the extended preamble regardless of TRext (i.e. a Tag replies as if TRext=1_2 regardless of the TRext value specified in the *Query* (see 6.3.2.12.2.1) or in the *QueryX* (see 6.3.2.12.2.2).	M	Tag	**By demonstration** Tested in compliance with 6.3.2.6, Figure 6.21
77	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 6.3.1.2.3.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
78	6.3.1.3.3	For inventory rounds beginning with a *Query*, Tags shall support the required T=>R backscatter link frequencies and tolerances (for *Query*) specified in Table 6-9 and the T=>R data rates specified in Table 6-10.	M	Tag	The FrT requirements (for *Query*) in Table 6-9 of the Protocol shall be verified **by design**. Tag manufacturers shall provide plots of worst-case FrT error (for *Query*) versus TRcal. Tag manufacturers shall also provide measured data used to generate the FrT plots (for *Query*), including: 1. Tag oscillator frequency tolerance 2. Tag oscillator frequency drift 3. TRcal measurement error budget 4. Other contributors to FrT error (for *Query*). The frequency-variation (for *Query*) during backscatter requirements in Table 6-9 of the Protocol shall be verified **by demonstration**. The testing laboratory shall send a *Query* with the following parameters and 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 EPC, and a CRC-16). The minimum and maximum values shall not deviate by more than 2.5% from the median. *Test conditions:* Temp: 23 °C ± 3 ºC Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari TRext: 0_2 *Test # 1* Tari: 6.25 µs RTcal: 18.75 µs TRcal: 33.3x0.99, 33.3, 33.3x1.01 µs DR: 64/3 M: 1, 2, 4, 8 For all 3 TRcal values above FrT shall be verified with the value for TRcal = 33.3 µs. *Test # 2* Tari: 6.25 µs RTcal: 18.75 µs TRcal: 50x0.99, 50, 50x1.01 µs DR: 64/3 M: 1, 2, 4, 8 For all 3 TRcal values above FrT shall be verified with the value for TRcal = 50 µs. *Test # 3* Tari: 25 µs RTcal: 75 µs TRcal: 200x0.99, 200, 200x1.01 µs DR: 8 M: 1, 2, 4, 8 For all 3 TRcal values above FrT shall be verified with the value for TRcal = 200 µs. For Miller 2, 4 and 8, see Annex A, Q11.

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79	6.3.1.3.3	For inventory rounds beginning with a *QueryX*, Tags shall support required T=>R backscatter link frequencies and tolerances (for *QueryX*) in Table 6-9 and the T=>R data rates specified in Table 6-10.	M	Tag	The FrT requirements (for *QueryX*) in Table 6-9 of the Protocol shall be verified **by design**. If a Tag supports a T=>R backscatter link frequency for *QueryX* using the TRcal value and the DR parameter ("analog BLF"), Tag manufacturers shall provide optional BLFs supported and also shall provide plots of worst-case analog BLF FrT error (for *QueryX*) versus TRcal. Tag manufacturers shall also provide measured data used to generate the analog BLF FrT plots (for *QueryX*), including: 1. Tag oscillator frequency tolerance 2. Tag oscillator frequency drift 3. TRcal measurement error budget 4. Other contributors to analog BLF FrT error (for *QueryX*). If a Tag supports a T=>R backscatter link frequency for *QueryX* using the DBLF parameter ("digital BLF"), Tag manufacturers shall provide optional BLFs supported and also shall provide plots of worst-case digital BLF FrT error (for *QueryX*) versus DBLF supported. Tag manufacturers shall also provide measured data used to generate the digital BLF FrT plots (for *QueryX*), including: 1. Tag oscillator frequency tolerance 2. Tag oscillator frequency drift 3. Other contributors to digital BLF FrT error (for *QueryX*). The frequency-variation (for *QueryX*) during backscatter requirements in Table 6-9 of the Protocol shall be verified **by demonstration**. The testing laboratory shall send a *QueryX* with the following parameters and 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 EPC, and a CRC-16). The minimum and maximum values shall not deviate by more than 2.5% from the median. *Test conditions:* Temp: 23 °C ± 3 ºC Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari Init: 1_2 Seltype: 011_2 Flx: 0_2 ReplyCRC: 1_2 AckData: 01_2 TRext: 0_2 *Test # 1(for analog BLF supported)* Tari: 6.25 µs RTcal: 18.75 µs TRcal: 33.3x0.99, 33.3, 33.3x1.01 µs DBLF: 001_2 DR: 64/3 M: 1, 2, 4, 8

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
					For all 3 TRcal values above FrT shall be verified with the value for TRcal = 33.3 µs. *Test # 2(for analog BLF supported)* Tari: 6.25 µs RTcal: 18.75 µs TRcal: 50x0.99, 50, 50x1.01 µs DBLF: 010_2 DR: 64/3 M: 1, 2, 4, 8 For all 3 TRcal values above FrT shall be verified with the value for TRcal = 50 µs. *Test # 3(for analog BLF supported)* Tari: 12.5 µs RTcal: 37.5 µs TRcal: 50x0.99, 50, 50x1.01 µs DBLF: 111_2 DR: 8 M: 1, 2, 4, 8 For all 3 TRcal values above FrT shall be verified with the value for TRcal = 50 µs. *Test # 4(for only digital BLF supported)* Tari: 6.25 µs RTcal: 18.75 µs TRcal: 33.3 µs DBLF: 001_2 DR: 64/3 M: 1, 2, 4, 8 *Test # 5(for only digital BLF supported)* Tari: 6.25 µs RTcal: 18.75 µs TRcal: 50 µs DBLF: 010_2 DR: 64/3 M: 1, 2, 4, 8 *Test # 6(for only digital BLF supported)* Tari: 12.5 µs RTcal: 37.5 µs TRcal: 50 µs DBLF: 111_2 DR: 8 M: 1, 2, 4, 8 For Miller 2, 4 and 8, see Annex A, Q11.
80	6.3.1.3.3	A Tag shall support the required T=>R backscatter link frequencies for a *QueryX* by using the DBLF parameter (“digital BLF”) and/or by using the TRcal value and the DR parameter (“analog BLF”): Tags may support T=>R backscatter link frequencies specified in Table 6-9 that are optional for inventory rounds beginning with a *QueryX*. If a Tag does not support an optional *QueryX* T=>R backscatter link frequency, then the Tag shall not participate in the inventory round (see 6.3.1.12.2.2). A Tag that supports a T=>R backscatter link frequency using analog BLF may ignore DBLF values.	M	Tag	**By design** The Tag manufacturer shall provide the types of BLFs supported.

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
81	6.3.1.3.4	Tags energized by an Interrogator shall be capable of receiving and acting on Interrogator commands within a period not to exceed the minimum time before command, power-up (i.e. by minimum T_{cp}), specified in Table 6-6.	M	Tag	**By demonstration** Verify Tag acts on Interrogator commands correctly by minimum T_{cp}. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860 and 930 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 T_{cp}: 2500 µs *Test # 1* Issue a *Query* command as specified, right after T_{cp} and verify the tag replies with an RN16. *Query*: TRcal: 200 µs DR: 8 TRext: 1_2 Sel: 00_2 Session: 00_2 Target: A Q: 0 *Test # 2* Issue a *QueryX* command as specified, right after T_{cp} and verify the tag replies with an RN16. *QueryX* with Init=1_2: Init: 1_2 DR: 64/3 TRCal: 133.3 µs Session: 00_2 Action: 000_2 Seltype: 011_2 Flx: 0_2 ReplyCRC: 1_2 AckData: 01_2 DBLF: 111_2 TRext: 1_2 Sel: 00_2 Target: A Q: 0
82	6.3.1.3.5	For a Tag certified to this protocol, the Tag manufacturer shall specify: 1. free-space, sensitivity, 2. minimum backscattered modulated power (ASK modulation) or change in radar cross-section or equivalent (phase modulation), and 3. the manufacturer's normal operating conditions for the Tag mounted on one or more manufacturer-selected materials.	M	Tag	**By design** The Tag manufacturer shall provide this specification in the supplied documents.
83	6.3.1.4	The transmission order for all R=>T and T=>R communications shall be most-significant bit (MSB) first.	M	Tag and Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
84	6.3.1.4	Within each message, the most-significant word shall be transmitted first.	M	Tag and Interrogator	**By design**
85	6.3.1.4	Within each word, the MSB shall be transmitted first.	M	Tag and Interrogator	**By design**
86	6.3.1.5	To generate a CRC-16 a Tag or Interrogator shall first generate a checksum residue using the CRC-16 parameters in Table 6-11.	M	Tag and Interrogator	**By design**
87	6.3.1.5	The Tag or Interrogator shall then take the ones-complement of the computed residue to form the CRC-16.	M	Tag and Interrogator	**By design**
88	6.3.1.5	A Tag or Interrogator shall verify the integrity of a received message that uses a CRC-16.	M	Tag and Interrogator	**By design**
89	6.3.1.5	Tags shall append a CRC-16 to those replies that use a CRC-16 or a CRC-5 to those replies that use a CRC-5.	M	Tag	**By design**
90	6.3.1.5	To generate a CRC-5 an Interrogator shall use the definition in Table 6-12.	M	Interrogator	**By design**
91	6.3.1.5	A Tag shall verify the integrity of a received message that uses a CRC-5.	M	Tag	**By design**
92	6.3.1.5	Interrogators shall append the appropriate CRC to R=>T transmissions as specified in Table 6-29.	M	Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
93	6.3.1.6	Tags and Interrogators that support *immediate* reply type (see Table 6-29) shall meet all timing requirements shown in Table 6-16.	M	Tag and Interrogator	**By demonstration** *Interrogator test conditions:* Verify Interrogator meets T_2, T_3, and T_4 Temp: +23 °C ± 3 °C Freq: 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_1 over T_2 extremes Temp: +23 °C ± 3 °C Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari TRext: 0_2 Minimum T_2 condition: Tari: 6.25 µs RTcal: 18.75 µs TRcal: 33.3, 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

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
94	6.3.1.6	Tags and Interrogators that support *delayed* reply type (see Table 6-29) shall meet all timing requirements shown in Table 6-16.		Tag and Interrogator	**By demonstration** *Interrogator test conditions:* Verify Interrogator meets T_2 and T_4 Temp: +23 ºC ± 3 ºC Freq: 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 Temp: +23 ºC ± 3 ºC Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari TRext: 1_2 Minimum T_2 condition: Tari: 6.25 µs RTcal: 18.75 µs TRcal: 33.3, 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 *Test #1* Issue a *Write* command to write the PC with 3000_h. *Test #2* Issue a *Lock* command to permanently unlock the EPC memory bank. *Lock* command payload is: $0C010_h$. If the Tag only supports to permanently lock all memory banks at once, issue a *Lock* command with payload: $FFFFF_h$. NOTE: in case of zero valued password, the Tag will backscatter an error code.

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
95	6.3.1.6	Tags and Interrogators that support *in-process* reply type (see Table 6-29) shall meet all timing requirements shown in Table 6-16.	M	Tag and Interrogator	**By demonstration** *Interrogator test conditions:* Verify Interrogator meets T_2 and T_4 Temp: +23 ºC ± 3 ºC Freq: 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 Temp: +23 ºC ± 3 ºC Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari TRext: 1_2 Minimum T_2 condition: Tari: 6.25 µs RTcal: 18.75 µs TRcal: 33.3, 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
96	6.3.1.6	As described in 6.3.1.2.8, an Interrogator shall use a fixed R=>T link rate for the duration of an inventory round	M	Interrogator	**By design**
97	6.3.1.6	Prior to changing the R=>T link rate, an Interrogator shall transmit CW for a minimum of 8 RTcal.	M	Interrogator	**By design**
98	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 6.3.2.6.3 and 6.3.2.6.4).	M	Tag	**By demonstration** Issue a *Read* command in **secured** state. T_2 before the *Read* command shall be at least 10 ms. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860, 895, and 930 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: 8 TRext: 1_2

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
99	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 6.3.2.6.2)	M	Tag	**By Design**
100	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	Tag	**By Design**
101	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	Tag	**By Design**
102	6.3.1.6 Table 6.16	In all other states the maximum value for T_2 shall be unrestricted.	M	Tag	**By demonstration** Tested in compliance with Item 98
103	6.3.1.6 Table 6.16	A Tag shall be allowed a tolerance of $20.0T_{pri} \leq T_{2(max)} \leq 32.0T_{pri}$ in determining whether T_2 has expired.	M	Tag	**By demonstration** Issue a *Query*/*ACK*/*Req_RN* command sequence as following specified. *Test conditions:* Verify Tag meets $T_{2(max)}$ Temp: +23 ºC ± 3 ºC Freq: 860 and 930 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 *Query*: TRcal: 200 µs DR: 8 TRext: 1_2 Sel: 00_2 Session: 00_2 Target: A Q: 0 *Test # 1* T_2: $20.0T_{pri}$ M: 2, 4, 8 *Test # 2* T_2: $32.0T_{pri}$ M: 2, 4, 8
104	6.3.1.6 Table 6.16	T_1+T_3 shall not be less than T_4	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
105	6.3.1.6 Table 6.16	A Tag shall be allowed a tolerance of 4.0RTcal < $T_{8(max)}$ < 6.0RTcal in determining whether T_8 has expired.	M	Tag	**By demonstration** Issue a *QueryY* with Init=1_2 after a *QueryX* with Init=0_2 at T_8 timing as following specified. *Test conditions:* Verify Tag meets $T_{8(max)}$ Temp: +23 ºC ± 3 ºC Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari *QueryX* with Init=0_2: Init: 0_2 Session: 00_2 Action: 000_2 Seltype: 011_2 Flx: 0_2 ReplyCRC: 1_2 AckData: 01_2 TRext: 1_2 Sel: 00_2 Target: A Q: 0 *QueryY* with Init=1_2: Init: 1_2 Session: 00_2 Action: 000_2 Seltype: 011_2 Flx: 0_2 *Test # 1* Tari: 6.25 µs RTcal: 15.625 µs TRcal: 33.3 µs DBLF: 001_2 DR: 64/3 M: 1, 2, 4, 8 T_8: 4.0RTcal, 6.0RTcal *Test # 2* Tari: 25 µs RTcal: 75 µs TRcal: 133.3 µs DBLF: 111_2 DR: 64/3 M: 1, 2, 4, 8 T_8: 4.0RTcal, 6.0RTcal
106	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 $T_{5(max)}$, where T_{REPLY} is the time between the Interrogator's command and the Tag's backscattered reply.	M	Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
107	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 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	Tag	**By demonstration** Write the PC with value 3000_h. 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:* Temp: +23 ºC ± 3 ºC Freq: 860, 895, and 930 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: 8 TRext: 1_2
108	6.3.1.6.2	The reply shall meet the T_5 limits in Table 6-16.	M	Tag	**By demonstration** Tested in compliance with Item 107
109	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 Annex I) during the CW period rather than the reply shown in Table 6-13.	M	Tag	**By demonstration** Write the Stored-CRC with value 0000_h. Verify that the Tag respond with an error message. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860, 895, and 930 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: 8 TRext: 1_2
110	6.3.1.6.2	The error reply shall meet the T_5 limits in Table 6-16.	M	Tag	**By demonstration** Tested in compliance with Item 109
111	6.3.1.6.2	A Tag shall ignore Interrogator commands while processing a prior command that specified a *delayed* reply.	M	Tag	**By design**
112	6.3.1.6.2	A *delayed* Tag reply shall use the extended preamble shown in Figure 6-11 or Figure 6-15, as appropriate (i.e. the Tag shall reply as if TRext=1_2 regardless of the TRext value in the *Query* or *QueryX* that began the inventory round).	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
113	6.3.1.6.3	An *in-process* reply may include multiple backscatter transmissions from Tag to Interrogator.	O	Interrogator	**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:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
114	6.3.1.6.3	The first transmission shall meet the T_6 limits specified in Table 6-16; subsequent transmissions (if any) shall meet T_7.	M	Tag	**By design**
115	6.3.1.6.3	A Tag shall backscatter a transmission at least once every $T_{7(max)}$ while processing the command.	M	Tag	**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 (Max. Number of backscatter transmissions, 4). *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
116	6.3.1.6.3	A Tag's *in-process* reply or replies shall be as shown in Table 6-14.	M	Tag	**By demonstration** Tested in compliance with Item 115
117	6.3.1.6.3	The Tag replies shall be consistent for first and subsequent Tag transmissions – i.e. if the first reply includes length then all subsequent replies shall include length.	M	Tag	**By design**
118	6.3.1.6.3	While processing the command the Tag backscatters a transmission as shown in 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	Tag	**By demonstration** Tested in compliance with Item 115

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
119	6.3.1.6.3	All replies shall meet the T_6 and T_7 limits specified in Table 6-16. If the Interrogator observes a final reply with header=0_2 then the command completed successfully.	M	Tag	**By demonstration** Tested in compliance with Item 115.
120	6.3.1.6.3	All replies shall meet the T_6 and T_7 limits specified in Table 6-16. If the Interrogator observes a final reply with header=1_2 then the Tag encountered an error (see Annex I).	M	Tag	**By demonstration** Issue a command with an unsupported parameter that employs an *in-process* reply. Verify that the Tag replies an error (see Table 6-14 and Annex I). T_6 and T_7 shall meet limits specified in Table 6-16. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860, 895, and 930 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: 8 TRext: 1_2
121	6.3.1.6.3	Length shall comprise a 15-bit value field followed by an even parity bit (the number of 1's in the 16-bit length field shall be an even number, with length=0000_h an allowed value).	M	Tag	**By design**
122	6.3.1.6.3	A Tag shall ignore Interrogator commands while processing a prior command that specified an *in-process* reply.	M	Tag	**By design**
123	6.3.1.6.3	After issuing a command that uses an *in-process* reply an Interrogator shall transmit CW until the Interrogator either (a) observes a reply with done=1_2 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	Interrogator	**By design**
124	6.3.1.6.3	An *in-process* Tag reply shall use the extended preamble shown in Figure 6-11 or Figure 6-15, as appropriate (i.e. the Tag shall reply as if TRext=1_2 regardless of the TRext value in the *Query* or *QueryX* that began the inventory round).	M	Tag	**By design**
125	6.3.1.6.4	A Tag that implements a *Challenge* command, or supports SenRep=0_2 in an access command that employs an *in-process* reply, shall implement a **C** flag and a ResponseBuffer	TACC TACA TACF CE	Tag	**By design** See Annex B.3

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
126	6.3.1.6.4	A Tag shall set **C**=1_2 after storing a response (result or error code) in its ResponseBuffer.	TACC TACA* TACF* CE	Tag	**By demonstration** *Test # 1 (TACC or TACF)* Issue a *Challenge* command and inventory the Tag. Verify that the Tag replies to the *ACK* command with **C**=1_2. *Test # 2 (TACA* or TACF*)* * only tested if SenRep=0_2 is supported for commands that require *in-process* reply, see Annex B.3 Issue a command that required an *in-process* reply with SenRep=0_2. Read XPC_W1 to verify that **C**=1_2.
127	6.3.1.6.4	A Tag shall set **C**=0_2 upon either (1) receiving an access command containing SenRep=0_2 (c.f. 6.3.2.12.3), (2) receiving a *Challenge* command, or (3) when specified by a cryptographic suite.	TACC TACA* TACF* CE	Tag	**By design** * only if SenRep=0_2 is supported for commands that require *in-process* reply, see Annex B.3
128	6.3.1.6.4	The **C** flag shall be selectable using a *Select*, *QueryX* or *QueryY* command.	TACC TACA* TACF* CE	Tag	**By demonstration** * only if SenRep=0_2 is supported for commands that require *in-process* reply see Annex B.3 *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
129	6.3.1.6.4	If an access command with SenRep=0_2 or a *Challenge* command specifies IncRepLen=0_2 then a Tag shall not include a length field with its stored response, so the first word of the stored response shall be at ResponseBuffer location 00_h.	TACC TACA* TACF* CE	Tag	**By demonstration** * only if SenRep=0_2 is supported for commands that require *in-process* reply see Annex B.3 Issue a *Challenge* or an *Authenticate* command with SenRep=0_2 and IncRepLen=0_2. Verify that no length field is contained in the ResponseBuffer, by using the *ReadBuffer* or *ACK* command. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
130	6.3.1.6.4	If the command specifies IncRepLen=1_2 then ResponseBuffer bits 00_h – $0E_h$ shall contain the length of the stored response 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 response shall be at ResponseBuffer location 10_h. See Figure 6-17.	TACC TACA* TACF* CE	Tag	**By demonstration** * only if SenRep=0_2 is supported for commands that require *in-process* reply see Annex B.3 Issue a *Challenge* or an *Authenticate* command with SenRep=0_2 and IncRepLen=1_2. Verify that the length field is contained in the ResponseBuffer, by using the *ReadBuffer* or *ACK* command. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
131	6.3.1.6.4	The maximum size of a stored response shall be 32 kbits.	TACC TACA TACF CE	Tag	**By design**
132	6.3.1.6.4	The maximum ResponseBuffer size shall be 32,784 bits (15 length bits, 1 parity bit, 32k response bits). A Tag manufacturer may limit the ResponseBuffer to a size less than this maximum.	TACC TACA TACF CE	Tag	**By design**
133	6.3.1.6.4	A Tag shall dynamically adjust its ResponseBuffer, on a command-by-command basis, to the required size.	TACC TACA TACF CE	Tag	**By design**
134	6.3.1.6.4	The ResponseBuffer shall be read-only to an Interrogator.	TACC TACA TACF CE	Tag	**By Design**
135	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 response will overflow the ResponseBuffer (see Annex I).	TACC TACA TACF CE	Tag	**By Design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
136	6.3.1.6.4	A Tag shall retain data in its ResponseBuffer with the persistence of its **C** flag (see Table 6-21).	TACC TACA* TACF* CE	Tag	**By demonstration** * only if SenRep=0_2 is supported for commands that require *in-process* reply see Annex B.3 Issue a *Challenge* or an *Authenticate* command with SenRep=0_2. Switch off the carrier after successful Tag response. Read XPC_W1 after the persistence of the **C** flag. Verify that **C**=0_2. Issue a *ReadBuffer* command to verify that the Tag deallocated its ResponseBuffer. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860, 895, and 930 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: 8 TRext: 1_2
137	6.3.1.6.4	When **C**=1_2 then a Tag shall maintain the data in its ResponseBuffer.	TACC TACA TACF CE	Tag	**By demonstration** Tested in compliance with Item 130
138	6.3.1.6.4	When **C** is or becomes 0_2 then a Tag shall deallocate its ResponseBuffer.	TACC TACA TACF CE	Tag	**By demonstration** Tested in compliance with Item 137

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139	6.3.1.6.5	A Tag shall process a T_8 timeout as shown in Figure 6-24 and Figure 6-25.	M	Tag	**By demonstration** *Test # 1* Issue a matching *QueryY* with Init=1_2 after a matching *QueryX* with Init=0_2 before T_8 timeout expires as following specified to verify Tag meets $T_{8(min)}$ timeout and transition from **arbitrate** to **reply**. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari *QueryX* with Init=0_2: Init: 0_2 Session: 00_2 Action: 000_2 Seltype: 011_2 Flx: 0_2 ReplyCRC: 1_2 AckData: 01_2 TRext: 1_2 Sel: 00_2 Target: A Q: 0 *QueryY* with Init=1_2: Init: 1_2 Session: 00_2 Action: 000_2 Seltype: 011_2 Flx: 0_2 *Test # 1-1* Tari: 6.25 µs RTcal: 15.625 µs TRcal: 33.3 µs DBLF: 001_2 DR: 64/3 M: 1, 2, 4, 8 T_8: 2.0RTcal *Test # 1-2* Tari: 25 µs RTcal: 75 µs TRcal: 133.3 µs DBLF: 111_2 DR: 64/3 M: 1, 2, 4, 8 T_8: 2.0RTcal *Test # 2* Issue a matching *QueryY* with Init=1_2 after a not-matching *QueryX* with Init=0_2 before T_8 timeout expires as following specified to verify Tag meets T_8 timeout specification and transition from **ready** to **reply**. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari

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					QueryX with Init=0_2: Init: 0_2 Session: 00_2 Action: 000_2 Seltype: 011_2 Flx: 0_2 ReplyCRC: 1_2 AckData: 01_2 TRext: 1_2 Sel: 00_2 Target: B Q: 0 *QueryY* with Init=1_2: Init: 1_2 Session: 00_2 Action: 100_2 Seltype: 011_2 Flx: 0_2 *Test # 2-1* Tari: 6.25 µs RTcal: 15.625 µs TRcal: 33.3 µs DBLF: 001_2 DR: 64/3 M: 1 T_8: 3.0RTcal *Test # 2-2* Tari: 25 µs RTcal: 75 µs TRcal: 133.3 µs DBLF: 111_2 DR: 64/3 M: 1 T_8: 3.0RTcal *Test # 3* Issue a matching *Query* after a matching *QueryX* with Init=0_2 before T_8 timeout expires as following specified to verify Tag meets T_8 timeout specification and executes exempt command rather than *QueryY* correctly. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari *QueryX* with Init=0_2: Init: 0_2 Session: 00_2 Action: 000_2 Seltype: 011_2 Flx: 0_2 ReplyCRC: 1_2 AckData: 01_2 TRext: 1_2 Sel: 00_2 Target: A Q: 4 *Query*: TRext: 1_2 Sel: 00_2 Session: 01_2

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					Target: A Q: 0 *Test # 3-1* Tari: 6.25 µs RTcal: 15.625 µs TRcal: 33.3 µs DBLF: 001_2 DR: 64/3 M: 1 T_8: 3.0RTcal *Test # 3-2* Tari: 25 µs RTcal: 75 µs TRcal: 133.3 µs DBLF: 111_2 DR: 64/3 M: 1 T_8: 3.0RTcal *Test # 4* Issue *QueryAdjust* (with no change to the Q value) after a matching *QueryX* with Init=0_2 before T_8 timeout expires as following specified to verify Tag meets T_8 timeout specification and ignores the not-exempt command. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari *QueryX* with Init=0_2: Init: 0_2 Session: 00_2 Action: 000_2 Seltype: 011_2 Flx: 0_2 ReplyCRC: 1_2 AckData: 01_2 TRext: 1_2 Sel: 00_2 Target: A Q: 0 *QueryAdjust*: Session: 00_2 Updn: 000_2 *Test # 4-1* Tari: 6.25 µs RTcal: 15.625 µs TRcal: 33.3 µs DBLF: 001_2 DR: 64/3 M: 1 T_8: 2.0RTcal *Test # 4-2* Tari: 25 µs RTcal: 75 µs TRcal: 133.3 µs DBLF: 111_2 DR: 64/3 M: 1

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
					T_8: 2.0RTcal
140	6.3.1.6.5	Interrogators and Tags shall implement the *QueryX* (6.3.2.12.2.2) and *QueryY* (6.3.2.12.2.3) commands.	M	Tag and Interrogator	**By design**
141	6.3.1.6.5	If within time $T_{8(max)}$: ■ the Tag fails to receive a command, then the Tag shall transition to **ready**; ■ the Tag receives a command that is not-exempt (see 6.3.2.12), then the Tag shall ignore the command and transition to **ready**; ■ the Tag receives an exempt command (see 6.3.2.12), then the Tag shall execute the command.	M	Tag	**By demonstration** Tested in compliance with Item 105
142	6.3.2.1	Tag memory shall be logically separated into the four distinct memory banks shown in Figure 6-19, each of which may comprise zero or more memory words.	M	Tag	**By demonstration** Tested in compliance with Item 151
143	6.3.2.1	Reserved memory shall contain the kill and and/or access passwords, if passwords are implemented on the Tag.	M	Tag	**By demonstration** Tested in compliance with Item 151
144	6.3.2.1	The kill password shall be stored at memory addresses 00_h to $1F_h$.	M	Tag	**By design**
145	6.3.2.1	The access password shall be stored at memory addresses 20_h to $3F_h$.	M	Tag	**By design**
146	6.3.2.1	EPC memory shall contain a StoredCRC at memory addresses 00_h to $0F_h$, a StoredPC at addresses 10_h to $1F_h$, a code (such as an EPC, and hereafter referred to as an EPC) that identifies the object to which the Tag is or will be attached beginning at address 20_h, and if the Tag implements Extended Protocol Control (XPC) then either one or two XPC word(s) beginning at address 210_h.	M	Tag	**By design**
147	6.3.2.1	TID memory shall contain an 8-bit ISO/IEC 15963 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	Tag	**By demonstration** Singulate the Tag, read its TID memory, and verify the contents. *Tag test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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_2
148	6.3.2.1	The logical addressing of all memory banks and User-memory files shall begin at 00_h.	M	Tag	**By design**
149	6.3.2.1	The backscatter shall fall on word boundaries (except for a truncated reply – see 6.3.2.12.1.1, 6.3.2.12.2.2, and 6.3.2.12.2.3).	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
150	6.3.2.1	MemBank shall be defined as follows: 00_2 Reserved 01_2 EPC 10_2 TID 11_2 User	M	Tag	**By design**
151	6.3.2.1	Operations that modify memory contents in one logical memory bank shall not modify memory locations in another bank.	M	Tag	**By demonstration** "Check for memory overruns" Initialise all (writable) memory locations in each bank with the value 0000_h. Issue a sequence of *Write* commands to write the PC with 3000_h and the remaining EPC memory with 1111_h. Verify, using the *Read* command, that no memory location in another bank has been overwritten. Issue a sequence of *Write* commands to write the entire USER memory bank with 2222_h. Verify, using the *Read* command, that no memory location in another bank has been overwritten. Issue a sequence of *Write* commands to write the entire RESERVED memory bank with 3333_h. Verify, using the *Read* command, that no memory location in another bank has been overwritten. Issue a sequence of *Write* commands to attempt to write the entire TID memory bank with 4444_h. Verify, using the *Read* command, that no memory location in TID or another bank has been overwritten. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860, 895, and 930 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: 8 TRext: 1_2
152	6.3.2.1	A *Write*, *BlockWrite*, or *BlockErase* shall not alter a Tag's killed status regardless of the memory address (whether valid or invalid) specified in the command.	M	Tag	**By demonstration** Tested in compliance with Item 151
153	6.3.2.1	A Tag shall use the same block size for file allocation (see 6.3.2.11.3) as it does for the *BlockPermalock* command (see 6.3.2.12.3.10).	M	Tag	**By design**
154	6.3.2.1.1	If a Tag does not implement the kill and/or access password(s) then the Tag shall logically operate as though it has zero-valued password(s) that are permanently read/write locked (see 6.3.2.12.3.6), and the corresponding physical memory locations in Reserved memory need not exist.	M	Tag	**By design**
155	6.3.2.1.1.1	The default (unprogrammed) value shall be zero.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
156	6.3.1.1.1.1	A Tag that does not implement a kill password shall behave as though it has a zero-valued kill password that is permanently read/write locked.	M	Tag	**By demonstration** Tested in compliance with Item 157
157	6.3.2.1.1	A Tag shall not execute a password-based kill if its kill password is zero (see 6.3.2.12.3.5).	M	Tag	**By demonstration** Issue a *Kill* command to a Tag with a zero-valued kill password. Verify that the Tag backscatters an error code and does not execute the kill. *Tag test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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_2
158	6.3.2.1.1.2	The default (unprogrammed) value shall be zero.	M	Tag	**By design**
159	6.3.2.1.1.2	A Tag that does not implement an access password shall behave as though it has a zero-valued access password that is permanently read/write locked	M	Tag	**By Demonstration** Attempt to write the access password. A Tag that does not implement an access password shall respond with an error message. A Tag that implements an access password shall respond with a valid response. Attempt to read the access password. A Tag that does not implement an access password shall respond with an error message. A Tag that implements an access password shall respond with a valid response. *Tag test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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_2
160	6.3.2.1.2	The StoredCRC, StoredPC, EPC, and XPC word(s) shall be stored MSB first (i.e. the EPC's MSB is at location 20_h).	M	Tag	**By design**
161	6.3.2.1.2.1	A Tag shall implement both a StoredCRC and a PacketCRC.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
162	6.3.2.1.2.1	A Tag shall compute and store its StoredCRC either (i) when an Interrogator writes or overwrites bits in the EPC (including in the StoredPC), or (ii) every time the Tag powers up.	M	Tag	**By design**
163	6.3.2.1.2.1	The Tag manufacturer shall choose whether the Tag implements (i) or (ii),	M	Tag	**By design**
164	6.3.2.1.2.1	A Tag shall perform its computing and storing for these two cases as follows: i. The Tag first writes or overwrites the bits, then computes and stores a new StoredCRC, all within the reply times specified in Table 6-16 for the command (*Write*, *BlockWrite*, *BlockErase*, or *Untraceable*) that wrote or overwrote the bits. A Tag shall delay backscattering the success reply shown in Table 6-13 or Table 6-14 for the command that wrote or overwrote the bits until it has stored the new StoredCRC. The Tag shall store its StoredCRC in nonvolatile memory so that the StoredCRC persists through subsequent Tag power cycles. ii. The Tag computes and stores the StoredCRC before the end of interval T_{cp} in Figure 6-3. The Tag may store its StoredCRC in volatile or nonvolatile memory. If an Interrogator modifies a Tag's StoredPC or EPC after Tag powerup then the StoredCRC may be incorrect until the Interrogator power-cycles the Tag.	M	Tag	**By design**
165	6.3.2.1.2.1	For both cases (i) and (ii) the Tag shall implement the StoredCRC by first calculating a CRC-16 (see 6.3.1.5) over the StoredPC and the EPC specified by the length (**L**) bits in the StoredPC, and then storing the thus-computed StoredCRC into EPC memory 00_h to $0F_h$, MSB first.	M	Tag	**By demonstration** *Test for rewriteable Tags:* Sequentially write a Tag's EPC, one 16-bit word at a time. Following each write, update the length field specified in the PC bits, power down the Tag, then power it up again and singulate it. Verify that the backscattered CRC-16 matches the backscattered EPC after each write operation. *Test for prewritten Tags:* Power up the Tag and singulate it. Verify that the backscattered CRC-16 matches the backscattered EPC. *Tag test conditions for either case:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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_2

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
166	6.3.2.1.2.1	The Tag shall calculate the StoredCRC on word boundaries, and before performing the calculation, the Tag shall: ■ assert or deassert **RUM** in the StoredPC (see Table 6-17); ■ deassert **XI**; ■ omit XPC_W1 and XPC_W2 from the calculation.	M	Tag	**By design**
167	6.3.2.1.2.1	If an Interrogator attempts to write to EPC memory 00_h – $0F_h$ then the Tag shall not execute the write and instead treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By demonstration** Issue a *Write* command on the specified memory location. Verify that the Tag responds with an error message. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
168	6.3.2.1.2.1	The TID is the traceable part of TID memory starting at address 00h and ending at the last word of serialization in the TID memory, and if the entire TID memory is untraceably hidden then the Tag shall not backscatter any TID contents in the reply.	M	Tag	**By design**
169	6.3.2.1.2.1	A Tag shall compute the PacketCRC as specified in 6.3.1.5 over the PC word, optional XPC word(s), and backscattered EPC or backscattered TID, and the Tag shall send the PacketCRC MSB first.	M	Tag	**By design**
170	6.3.2.1.2.1	As required by 6.3.1.5 an Interrogator shall verify the integrity of the received PC word, optional XPC word or words, and EPC or TID using the PacketCRC.	M	Interrogator	**By design**
171	6.3.2.1.2.2	A Tag shall implement a StoredPC in addresses 10_h–$1F_h$ of EPC memory. The bit assignments for this StoredPC shall be as shown in Table 6-19 and defined in Table 6-20.	M	Tag	**By design**
172	6.3.2.1.2.2	The StoredPC bits and values shall be as follows: Bits 10_h – 14_h are written by an Interrogator and specify the length of the EPC that a Tag backscatters in response to an *ACK*, in words.	M	Interrogator	**By design**
173	6.3.2.1.2.2	If a Tag only supports **XI**=0_2 then the maximum value for the EPC length field in the StoredPC shall be 11111_2 (allows a 496-bit EPC), as shown above. If a Tag supports **XI**=1_2 then the maximum value for the EPC length field in the StoredPC shall be 11101_2 (allows a 464-bit EPC).	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
174	6.3.2.1.2.2	A Tag that supports **XI**=1_2 shall not execute a *Write*, *BlockWrite*, or *Untraceable* that attempts to write an EPC length field larger than 11101_2 and shall instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
175	6.3.2.1.2.2	A Tag shall compute **RUM** according to Table 6-17 regardless of the lock or permalock status of EPC memory or the untraceability status of File_0.	M	Tag	**By design**, also **by demonstration** for a tag that supports setting of UWC, use the *QueryX* command: ■ Perform the demonstration with UWC set to zero. The returned **RUM** bit shall be set to 0_2. ■ Perform the demonstration with UWC set to a non-zero value supported by the tag. The returned **RUM** bit shall be set to 1_2. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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_2 *QueryX*: Init: 1_2 DR: 64/3 TRcal: 133.3 µs Session: 00_2 Action: 000_2 Seltype: 011_2 Flx: 0_2 ReplyCRC: 1_2 AckData: 01_2 DBLF: 111_2 TRext: 1_2 Sel: 00_2 Target: A Q: 0
176	6.3.2.1.2.2	If a Tag does not implement XPC_W1 then bit 16_h shall be fixed at 0_2 by the Tag manufacturer.	M	Tag	**By design**
177	6.3.2.1.2.2	If a Tag implements XPC_W1 then a Tag shall compute **XI** both at powerup and upon changing any bits of XPC_W1 (whether these bits are written or computed) and map the computed value into bit 16_h as follows: If **T**=0_2 then **XI** may be either (i) the logical OR of bits 210_h–217_h of EPC memory or (ii) the logical OR of bits 210_h–218_h of EPC memory; the Tag manufacturer shall choose whether the Tag implements (i) or (ii).	EAS TAC TACC TACA TACF CE O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
178	6.3.2.1.2.2	Regardless of whether XI is fixed or computed, when an Interrogator writes the StoredPC the Tag shall not write and instead ignore the data value the Interrogator provides for bit 16_h.	M	Tag	**By design**
179	6.3.2.1.2.2	If bit 17_h is 0_2 then the application is referred to as a GS1 EPCglobal Application and PC bits 18_h – $1F_h$ shall be as defined in this protocol. If bit 17_h is 1_2 then the application is referred to as a non-GS1 EPCglobal Application and bits 18_h – $1F_h$ shall be as defined in ISO/IEC 15961.	M	Tag	**By demonstration** *Tag test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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_2
180	6.3.2.1.2.2	RFU or AFI (Reserved for Future Use or Application Family Identifier, bits 18_h – $1F_h$): If **T**=0_2 then the Tag shall set these bits to 00_h. If **T**=1_2 then the Tag (if the bits are not writable) or an Interrogator (if the bits are writable) shall set these bits as specified in ISO/IEC 15961.	M	Tag	**By design**
181	6.3.2.1.2.2	If an Interrogator attempts to write **L** bit values that the Tag does not support then the Tag shall not execute the write operation and instead treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By design**
182	6.3.2.1.2.2	A Tag shall implement a PacketPC in addition to a StoredPC.	M	Tag	**By design**
183	6.3.2.1.2.2	Which PC word a Tag backscatters in reply to an *ACK* shall be as defined in Table 6-18.	M	Tag	**By design**
184	6.3.2.1.2.2	A PacketPC differs from a StoredPC in its **L** bits, which a Tag adjusts to match the length of the backscattered data that follow the PC word. A *QueryX* with AckData=10_2 instructs a Tag to reply to an *ACK* with TID until the end of serialization, and the Tag adjusts the **L** bits in the PacketPC to match the length of the backscattered TID. If **XI**=1_2 but **XEB**=0_2 then a Tag backscatters an XPC_W1 before the EPC or TID, so the Tag shall add one to (i.e. increment) its **L** bits for EPC or add one to the length of the backscattered TID. If both **XI**=1_2 and **XEB**=1_2 then the Tag backscatters both an XPC_W1 and an XPC_W2 before the EPC or TID, so the Tag shall add two to (i.e. double increments) its **L** bits for EPC or add two to the length of the backscattered TID. Because Tags that support XPC functionality have a maximum **L** value of 11101_2, double incrementing increases the value to 11111_2.	EAS TAC TACC TACA TACF CE O	Tag	**By design**
185	6.3.2.1.2.2	A Tag shall not, under any circumstances, allow its L bits to roll over to 00000_2.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
186	6.3.2.1.2.2	If a Tag has **T**=0_2, **XI**=0_2, implements an XPC_W1, and is not truncating then the Tag substitutes the 8 LSBs of XPC_W1 (i.e. EPC memory 218_h – $21F_h$) for the 8 LSBs of the StoredPC (i.e. PC memory 18_h – $1F_h$) in its reply. Because a Tag calculates its PacketCRC over the backscattered data bits (see 6.3.2.1.2.1), when the Tag does this substitution then it shall calculate its PacketCRC over the 8 substituted XPC_W1 LSBs rather than over the 8 StoredPC LSBs.	EAS TAC TACC TACA TACF CE O	Tag	**By design**
187	6.3.2.1.2.2	An Interrogator shall support Tag replies with **XI**=0_2, **XI** =1_2, or both **XI**=1_2 and **XEB**=1_2.	M	Interrogator	**By design**
188	6.3.2.1.2.2	If a Tag has a response (result or error code) in its ResponseBuffer (i.e. **C**=1_2) and the Interrogator set Immed=1_2 in the *Challenge* command that preceded the inventory round then a Tag shall concatenate response and a CRC-16 calculated over response to its reply to an *ACK* (see Table 6-18).	O	Tag	**By design**
189	6.3.2.1.2.3	The EPC for an EPCglobal Application shall be as defined in the GS1 EPC Tag Data Standard.	O	Tag	**By design**
190	6.3.2.1.2.4	The EPC for a non-EPCglobal Application shall be as defined in ISO/IEC 15962.	O	Tag	**By design**
191	6.3.2.1.2.5	A Tag shall not implement an XPC_W2 without also implementing an XPC_W1.	O	Tag	**By design**
192	6.3.2.1.2.5	If implemented, these XPC words shall be exactly 16 bits in length and stored MSB first.	O	Tag	**By design**
193	6.3.2.1.2.5	When an Interrogator writes the XPC_W1 a Tag shall not write and shall instead ignore the data values the Interrogator provides for **XEB**, **SA**, **C**, **SLI**, and **K**.	O	Tag	**By demonstration** Issue a *Read* command to read XPC_W1 and note the values of **XEB**, **SA**, **C**, **SLI**, and **K**. Issue a *Write* command to invert the value of those bits. Verify that the bits have not been changed by the *Write* command. *Tag test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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_2
194	6.3.2.1.2.5	A Tag shall not implement any non-XPC memory element at EPC memory locations 210_h to $22F_h$, inclusive. This requirement shall apply both to Tags that support an XPC word or words and to those that do not.	M	Tag	**By design**
195	6.3.2.1.2.5	If a Tag implements an XPC_W1 then the Tag shall compute **XI** as described in 6.3.2.1.2.2.	O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
196	6.3.2.1.2.5	If a Tag implements an XPC_W2 then the Tag shall compute **XEB** as the logical OR of bits 220_h to $22F_h$ of EPC memory, inclusive. A Tag shall perform these calculations both at powerup and upon changing any bits 220_h to $22F_h$ of EPC memory.	O	Tag	**By design**
197	6.3.2.1.2.5	A Tag shall perform its **XEB** calculation prior to performing its **XI** calculation so that if **XEB**=1_2 then **XI**=1_2.	O	Tag	**By design**
198	6.3.2.1.2.5	If a Tag computes a bit in XPC_W1 or XPC_W2 and, as a result of a commanded operation, the Tag alters the bit value then the Tag shall map the new value into memory prior to executing a subsequent command.	O	Tag	**By design**
199	6.3.2.1.2.5	The XPC_W1 bits and values shall be as follows (see also Table 6-19 and Table 6-20): ■ **XEB** (bit 210_h): If bit 210_h is 0_2 then either a Tag has no XPC_W2 or all bits of XPC_W2 are zero-valued. If bit 210_h is 1_2 then a Tag has an XPC_W2 and at least one bit of XPC_W2 is nonzero. ■ RFU (bit 211_h): The Tag manufacturer (if the bit is not writable) or an Interrogator (if the bit is writable) shall set bit 211_h to zero. ■ RFU or as defined in ISO/IEC 18000-63 (bit 212_h): If **T**=0_2 then the Tag manufacturer (if the bit is not writable) or an Interrogator (if the bit is writable) shall set bit 212_h to zero. If **T**=1_2 then bit 212_h is defined by ISO/IEC 18000-63. ■ RFU (bit 213_h): The Tag manufacturer (if the bit is not writable) or an Interrogator (if the bit is writable) shall set bit 213_h to zero. ■ **SN** (bit 217_h): If bit 217_h is 0_2 then a Tag does not have a Snapshot Sensor. If bit 217_h is 1_2 then a Tag has one or more Snapshot Sensors as defined in 8.7. If a Tag has at least one Snapshot Sensor then the Tag shall implement XPC_W2 and XPC_W2 shall be used as the interface to all Snapshot Sensors on the Tag (see 8.7). ■ **SLI** (**SL**-flag indicator, bit $21A_h$): If bit $21A_h$ is 0_2 then a Tag has a deasserted **SL** flag or does not support an **SL** indicator. If bit $21A_h$ is 1_2 then a Tag has an asserted **SL** flag. Upon receiving a *Query* or *QueryX*, a Tag that implements the **SL** indicator shall map its **SL** flag into the **SLI** and shall retain this **SLI** setting until starting a subsequent inventory round.	O	Tag	**By design**
200	6.3.2.1.2.5	If **SN**=1_2 then XPC_W2 shall be set as defined in 8.7.2_and 8.7.3. If **SN**=0_2 then all XPC_W2 bits are RFU, in which case a Tag manufacturer (if XPC_W2 exists but is not writable) or an Interrogator (if XPC_W2 exists and is writable) shall set all XPC_W2 bits to 0_2.	O	Tag	**By demonstration** Tested in compliance with Item 822

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
201	6.3.2.1.3	TID memory locations 00_h to 07_h shall contain either an $E0_h$ or $E2_h$ ISO/IEC 15963 class identifier value.	M	Tag	**By design**
202	6.3.2.1.3	TID memory locations above 07_h shall be defined according to the registration authority defined by this class-identifier value and shall contain, at a minimum, sufficient information for an Interrogator to uniquely identify the custom commands and/or optional features that a Tag supports.	O	Tag	**By design**
203	6.3.2.1.3	As per ISO/IEC 15963, if the class identifier is $E2_h$ then TID memory above 07_h shall be configured as follows: ■ 08_h: XTID (**X**) indicator (whether a Tag implements an XTID – see 5.1) ■ 09_h: Security (**S**) indicator (whether a Tag supports the *Authenticate* and/or *Challenge* commands) ■ $0A_h$: File (**F**) indicator (whether a Tag supports the *FileOpen* command) ■ $0B_h$ to 13_h: A 9-bit Tag mask-designer identifier (MDID – see 5.2) ■ 14_h to $1F_h$: A Tag-manufacturer-defined 12-bit Tag model number ■ Above $1F_h$: As defined in the GS1 EPC Tag Data Standard	O	Tag	**By design**
204	6.3.2.1.3	If the class identifier is $E2_h$ then TID memory locations 00_h to $1F_h$ shall be permalocked at time of manufacture. If the Tag implements an XTID then the entire XTID shall also be permalocked at time of manufacture.	O	Tag	**By design**
205	6.3.2.1.3	Tags shall support a serialized TID by using either: ■ class identifier $E0_h$, or ■ class identifier $E2_h$ with **X**=1_2 and a unique serial number as defined in the GS1 EPC Tag Data Standard.	M	Tag	**By design**
206	6.3.2.1.4	If File_0 of User memory exists then a Tag shall implement UWC (see 6.3.2.12.3.3).	O	Tag	**By design**
207	6.3.2.1.4	If File_0 of User memory exists and has not yet been written then the Tag shall set the first byte (i.e. File_0 memory addresses 00_h to 07_h) to the default value 00_h as specified in ISO/IEC 15961.	O	Tag	**By design**
208	6.3.2.1.4.1	If a Tag implements User memory then the file encoding shall be as defined in the GS1 EPC Tag Data Standard.	O	Tag	**By design**
209	6.3.2.1.4.2	If a Tag implements User memory then the file encoding shall be as defined in ISO/IEC 15961 and 15962.	O	Tag	**By design**
210	6.3.2.2	Interrogators shall support and Tags shall provide 4 sessions (denoted S0, S1, S2, and S3).	M	Tag and Interrogator	**By design**
211	6.3.2.2	Tags shall participate in one and only one session during an inventory round.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
212	6.3.2.2	A Tag shall maintain an independent **inventoried** flag for each of its four sessions.	M	Tag	**By design**
213	6.3.2.2	Tags participating in an inventory round in one session shall neither use nor modify the **inventoried** flag for a different session.	M	Tag	**By design**
214	6.3.2.2	A Tag's **inventoried** flags shall have the set and persistence times shown in Table 6-21.	M	Tag	**By design**
215	6.3.2.2	A Tag shall power-up with its **inventoried** flags set as follows: the S0 **inventoried** flag shall be set to *A*.	M	Tag	**By design** Tested in compliance with 6.3.2.3, Table 6.21
216	6.3.2.2	A Tag shall power-up with its **inventoried** flags set as follows: the S1 **inventoried** flag shall be set to either *A* or *B*, depending on its stored value, unless the flag was set longer in the past than its persistence time, in which case the Tag shall power-up with its S1 **inventoried** flag set to *A*.	M	Tag	**By design**
217	6.3.2.2	A Tag shall power-up with its **inventoried** flags set as follows: the S2 **inventoried** flag shall be set to either *A* or *B*, depending on its stored value, unless the Tag has lost power for a time greater than its persistence time, in which case the Tag shall power-up with the S2 **inventoried** flag set to *A*.	M	Tag	**By design**
218	6.3.2.2	A Tag shall power-up with its **inventoried** flags set as follows: the S3 **inventoried** flag shall be set to either *A* or *B*, depending on its stored value, unless the Tag has lost power for a time greater than its persistence time, in which case the Tag shall power-up with its S3 **inventoried** flag set to *A*.	M	Tag	**By design**
219	6.3.2.2	A Tag shall refresh its S2 and S3 flags while powered, meaning that every time a Tag loses power its S2 and S3 **inventoried** flags shall have the set and persistence times shown in Table 6-21.	M	Tag	**By design**
220	6.3.2.2	A Tag shall not change the value of its S1 **inventoried** flag from *B* to *A*, as the result of a persistence timeout, while the Tag is participating in an inventory round, is in the midst of being inventoried, or is in the midst of being accessed.	M	Tag	**By design**
221	6.3.2.2	If a Tag's S1 flag persistence time expires during an inventory round then the Tag shall change the flag to *A* only (i) as instructed by an Interrogator (e.g. by a *QueryAdjust* or *QueryRep* with matching Session at the end of an inventory or access operation), or (ii) at the end of the round (i.e. upon receiving a *Select*, *Query*, or *QueryX*). In case (i), if the Tag's S1 flag persistence time expires while the Tag is in the midst of being inventoried or accessed then the Tag shall change the flag to *A* at the end of the inventory or access operation. In case (ii), the Tag shall invert its S1 flag prior to evaluating the *Select*, *Query*, or *QueryX*.	M	Tag	**By design**
222	6.3.2.3	A Tag shall implement a selected flag, **SL**, which an Interrogator may assert or deassert using a *Select* command.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
223	6.3.2.3	A Tag's **SL** flag shall have the set and persistence times shown in Table 6-21.	M	Tag	**By design** Tested in compliance with 6.3.2.3, Table 6.21
224	6.3.2.3	A Tag shall power-up with its **SL** flag either asserted or deasserted, depending on the stored value, unless the Tag has lost power for a time greater than the **SL** persistence time, in which case the Tag shall power-up with its **SL** flag deasserted (set to ~**SL**).	M	Tag	**By design**
225	6.3.2.3	A Tag shall refresh its **SL** flag when powered, meaning that every time a Tag loses power its **SL** flag shall have the persistence times shown in Table 6-21.	M	Tag	**By design**
226	6.3.2.3, Table 6-21	For a randomly chosen and sufficiently large Tag population, 95% of the Tag persistence times shall meet the persistence requirement, with a 90% confidence interval.	M	Tag	**By design** Tag manufacturers shall provide data and analysis demonstrating that Tags meet the persistence requirements of Table 6-21.
227	6.3.2.4	A Tag's **C** flag (see 6.3.2.1.2.5) shall have the set and persistence times shown in Table 6-21.	O	Tag	**By design** Tested in compliance with 6.3.2.3, Table 6-21
228	6.3.2.4	A Tag shall refresh its **C** flag when powered, meaning that every time a Tag loses power its **C** flag shall have the persistence shown in Table 6-21 (of course, if a Tag has a zero-second persistence time then even if the Tag powers down momentarily its **C** flag will be deasserted).	C	Tag	**By design**
229	6.3.2.5	If a Tag implements a security timeout then it shall use a single timeout timer, so a security timeout caused by one command failure (such as a failed *Challenge*) shall cause a Tag to disallow all commands for which the Tag implements a security timeout until the end of the timeout period.	EAS TAC TACC TACA TACF CE O	Tag	**By design**
230	6.3.2.6	A Tag shall implement the states and slot counter shown in Figure 6-21.	M	Tag	**By demonstration** Tag manufacturers shall supply a population of Tags for testing. The testing laboratory shall exercise all of the states and state transitions shown in Figure 6-21 by selecting, singulating, inventorying, reading, writing, accessing, and (for Tags that implement kill) killing the Tags. *Tag test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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_2

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
231	6.3.2.6.1	Tags shall implement a **ready** state.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6.21
232	6.3.2.6.1	Upon entering an energizing RF field a Tag that is not killed shall enter **ready**.	M	Tag	**By design**
233	6.3.2.6.1	The Tag shall remain in **ready** until it receives a *Query* command (see 6.3.2.12.2.1) or *QueryX* command (see 6.3.2.12.2.2) whose inventoried parameter (for the Session specified in the *Query* or *QueryX*) and Sel parameter match its current flag values.	M	Tag	**By design**
234	6.3.2.6.1	Matching Tags shall load a number into their slot counter and transition to the **arbitrate** state if the number is nonzero, or to the **reply** state if the number is zero.	M	Tag	**By design**
235	6.3.2.6.1	If a Tag in any state except **killed** loses power it shall return to **ready** upon regaining power.	M	Tag	**By design**
236	6.3.2.6.2	Tags shall implement an **arbitrate** state.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
237	6.3.2.6.2	A Tag in **arbitrate**, for example, shall decrement its slot counter every time it receives a *QueryRep* command (see 6.3.2.12.2.5) whose Session parameter matches the session for the inventory round currently in progress, and it shall transition to the **reply** state and backscatter an RN16 when its slot counter reaches 0000_h.	M	Tag	**By design**
238	6.3.2.6.2	If a Tag in **arbitrate** with an active T_8 timeout fails to receive a *QueryY* or other exempt command within $T_{8(max)}$, then the Tag shall return to **ready**.	M	Tag	**By demonstration** Tested in compliance with Item 105
239	6.3.2.6.2	Tags that return to **arbitrate** (for example, from the **reply** state) with a slot value of 0000_h shall decrement their slot counter from 0000_h to $7FFF_h$ at the next *QueryRep* (with matching Session) and, because their slot value is now nonzero, shall remain in **arbitrate**.	M	Tag	**By design**
240	6.3.2.6.3	Tags shall implement a **reply** state.	M	Tag	**By demonstration** Tested in compliance with 6.3.2.6, Figure 6-21
241	6.3.2.6.3	Upon entering **reply** a Tag shall backscatter an RN16 if a *Query* or *QueryX* with ReplyCRC=0_2 began the inventory round or shall backscatter RN16||CRC-5 if a *QueryX* with ReplyCRC=1_2 began the inventory round.	M	Tag	**By design** Tested in compliance with 6.3.2.12.2.2
242	6.3.2.6.3	If the Tag receives a valid acknowledgement (*ACK*) then it shall transition to the **acknowledged** state, backscattering the reply shown in Table 6-18.	M	Tag	**By design**
243	6.3.2.6.3	If the Tag fails to receive an *ACK* within time $T_{2(max)}$, or receives an invalid *ACK* or an *ACK* with an erroneous RN16, it shall return to **arbitrate**.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
244	6.3.2.6.3	Tag and Interrogator shall meet all timing requirements specified in Table 6-16.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.1.6, Table 6-16
245	6.3.2.6.4	Tags shall implement an **acknowledged** state.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
246	6.3.2.6.4	If a Tag in the **acknowledged** state receives a valid *ACK* containing the correct RN16 then it shall re-backscatter the reply shown in Table 6-18.	M	Tag	**By design**
247	6.3.2.6.4	If a Tag in the **acknowledged** state fails to receive a valid command within time $T_{2(max)}$ it shall return to **arbitrate**.	M	Tag	**By design**
248	6.3.2.6.4	Tag and Interrogator shall meet all timing requirements specified in Table 6-16.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.1.6, Table 6-16
249	6.3.2.6.5	Tags shall implement an **open** state.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
250	6.3.2.6.5	A Tag in the **acknowledged** state whose access password is nonzero shall transition to **open** upon receiving a *Req_RN* command, backscattering a new RN16 (denoted handle) that the Interrogator shall use in subsequent commands and the Tag shall use in subsequent replies.	M	Tag	**By design**
251	6.3.2.6.5	If a Tag in the **open** state receives a valid *ACK* containing the correct handle then it shall re-backscatter the reply shown in Table 6-18.	M	Tag	**By design**
252	6.3.2.6.5	Tag and Interrogator shall meet all timing requirements specified in Table 6-16 except $T_{2(max)}$; in the **open** state the maximum delay between Tag response and Interrogator transmission is unrestricted.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.1.6, Table 6-16
253	6.3.2.6.6	Tags shall implement a **secured** state.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
254	6.3.2.6.6	A Tag in the **acknowledged** state whose access password is zero shall transition to **secured** upon receiving a *Req_RN* command, backscattering a new RN16 (denoted handle) that the Interrogator shall use in subsequent commands and the Tag shall use in subsequent replies.	M	Tag and Interrogator	**By design**
255	6.3.2.6.6	A Tag in the **open** state shall transition to **secured** following a successful *Access*-command sequence or Interrogator authentication (where success in the latter case is defined by the cryptographic suite specified in the *Authenticate* command that initiated the authentication), maintaining the same handle that it previously backscattered when it transitioned from the **acknowledged** state to the **open** state.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
256	6.3.2.6.6	If a Tag in the **secured** state receives a valid *ACK* containing the correct handle then it shall re-backscatter the reply shown in Table 6-18.	M	Tag	**By design**
257	6.3.2.6.6	Tag and Interrogator shall meet all timing requirements specified in Table 6-16 except $T_{2(max)}$; in the **secured** state the maximum delay between Tag response and Interrogator transmission is unrestricted.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.1.6, Table 6-16
258	6.3.2.6.7	Tags shall implement a **killed** state.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
259	6.3.2.6.7	A Tag in either the **open** or **secured** state shall enter the **killed** state upon receiving a successful password-based *Kill*-command sequence with a correct nonzero kill password and handle.	M	Tag	**By design**
260	6.3.2.6.7	A Tag in the **secured** states shall enter the **killed** state upon a successful authenticated *Kill* (see 6.3.2.12.3.5).	TACA, TACC	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
261	6.3.2.6.7	Upon entering the **killed** state a Tag shall notify the Interrogator that the kill operation was successful, and shall not respond to an Interrogator thereafter.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
262	6.3.2.6.7	Killed Tags shall remain in the killed state under all circumstances, and shall immediately enter killed upon subsequent power-ups.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
263	6.3.2.6.8	Tags shall implement a 15-bit slot counter.	M	Tag	**By design**
264	6.3.2.6.8	Upon receiving a *Query*, *QueryX* with Init=1_2, *QueryY* with Init=1_2 or *QueryAdjust* command a Tag shall load into its slot counter a value between 0 and 2^Q-1, drawn from the Tag's RNG (see 6.3.2.7).	M	Tag	**By design**
265	6.3.2.6.8	Tags whose slot counter reached 0000_h, who replied, and who were not acknowledged (including Tags that responded to an original *Query*, *QueryX* or *QueryY* and that were not acknowledged) shall return to **arbitrate** with a slot value of 0000_h and shall decrement this slot value from 0000_h to $7FFF_h$ at the next *QueryRep*.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
266	6.3.2.6.8	The slot counter shall be capable of continuous counting, meaning that, after the slot counter rolls over to $7FFF_h$ it begins counting down again, thereby effectively preventing subsequent replies until the Tag loads a new random value into its slot counter.	M	Tag	**By design** Test in compliance with 6.3.2.6, Figure 6-21
267	6.3.2.7	Tags shall implement a random or pseudo-random number generator (RNG).	M	Tag	**By design**
268	6.3.2.7	The RNG shall meet the following randomness criteria independent of the strength of the energizing RF field, the R=>T link rate, and the data stored in the Tag (including but not limited to the StoredPC, XPC word or words, EPC, and StoredCRC).	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
269	6.3.2.7	Tags shall generate 16-bit random or pseudo-random numbers (RN16) using the RNG, and shall have the ability to extract *Q*-bit subsets from its RNG to preload the Tag's slot counter (see 6.3.2.6.8).	M	Tag	**By design**
270	6.3.2.7	Tags shall have the ability to temporarily store at least two RN16s while powered, to use, for example, as a handle and a 16-bit cover-code during password transactions (see Figure 6-26 or Figure 6-28).	M	Tag	**By design**
271	6.3.2.7	The probability that any RN16 drawn from the RNG has value RN16 = *j*, for any *j*, shall be bounded by $0.8/2^{16} < P(RN16 = j) < 1.25/2^{16}$.	M	Tag	**By design** Tag manufacturers shall provide data and analysis demonstrating that Tags meet the requirements of 6.3.2.7.
272	6.3.2.7	For a Tag population of up to 10,000 Tags, the probability that any two or more Tags simultaneously generate the same sequence of RN16s shall be less than 0.1%, regardless of when the Tags are energized.	M	Tag	**By design** Tag manufacturers shall provide data and analysis demonstrating that Tags meet the requirements of 6.3.2.7.
273	6.3.2.7	An RN16 drawn from a Tag's RNG 10 ms after the end of T_{rp} in Figure 6-3 shall not be predictable with a probability greater than 0.025% if the outcomes of prior draws from the RNG, performed under identical conditions, are known.	M	Tag	**By design** Tag manufacturers shall provide data and analysis demonstrating that Tags meet the requirements of 6.3.2.7.
274	6.3.2.11	A Tag shall execute access commands only in the states shown in Table 6-28.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
275	6.3.2.11	A Tag shall treat as invalid (see Table C-34) optional access commands that it does not support.	M	Tag	**By design**
276	6.3.2.11	An Interrogator shall verify the correctness of the handle in a Tag's response to an access command.	M	Interrogator	**By design**
277	6.3.2.11.1	A Tag, once killed, shall not respond to an Interrogator thereafter.	M	Tag	**By design**
278	6.3.2.11.1	If the Interrogator issues a command with new data or half-password, then it shall first issue a *Req_RN* to obtain a new RN16 and shall use this RN16 for the cover-coding.	M	Interrogator	**By design**
279	6.3.2.11.1	Neither Tag nor Interrogator shall consider themselves authenticated following an *Access*-command sequence.	M	Tag and Interrogator	**By design**
280	6.3.2.11.1	A Tag or an Interrogator shall only consider themselves authenticated after executing a cryptographic authentication in accordance with a cryptographic suite.	M	Tag and Interrogator	**By design**
281	6.3.2.11.2	Table 6-29 shows which commands an Interrogator may, and an authenticated Interrogator shall, encapsulate in an *AuthComm*.	M	Interrogator	**By design**
282	6.3.2.11.2	Table 6-29 shows which commands an Interrogator may, and an authenticated Interrogator shall, encapsulate in a *SecureComm*.	M	Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
283	6.3.2.11.2	The Tag manufacturer shall choose the number and type of cryptographic suites that a Tag supports; this assignment shall not be alterable in the field. An Interrogator selects one from among the implemented cryptographic suites using the CSI field in the *Challenge* and *Authenticate* commands.	M	Tag and Interrogator	**By design**
284	6.3.2.11.2	The Tag manufacturer shall choose the number of available keys and assign them to the cryptographic suite(s); this assignment shall not be alterable in the field.	M	Tag	**By design**
285	6.3.2.11.2	No two keys shall have the same number, even if used for different cryptographic suites.	M	Tag	**By design**
286	6.3.2.11.2	A Tag shall not indicate where in memory it stores its keys, nor shall it allow an Interrogator to read this memory location.	M	Tag	**By design**
287	6.3.2.11.2	A Tag that supports the *Untraceable* command shall provide the Tag privileges shown in Table 6-23.	O	Tag	**By design**
288		A Tag that supports one or more cryptographic suites shall provide the Tag privileges shown in Table 6-24.	O	Tag	**By design**
289	6.3.2.11.2	A Tag that implements the *TagPrivilege* command shall permit an Interrogator that authenticated itself as a crypto superuser in a cryptographic suite to: ■ change the value of any key in that cryptographic suite, including its own, using a *KeyUpdate*. ■ read or modify privileges (value in Table 6-24) for any key in that cryptographic suite, including its own.	O	Tag	**By design**
290	6.3.2.11.2	A Tag shall not permit an Interrogator that did not authenticate itself as a crypto superuser to: ■ change the value of any key other than the one it used to authenticate itself. ■ read or modify privileges (value in Table 6-24) for any key other than the one it used to authenticate itself. ■ assert a deasserted privilege (value in Table 6-24) for the key it used to authenticate itself.	O	Tag	**By design**
291	6.3.2.11.2	A Tag that supports the *TagPrivilege* command shall permit an Interrogator that supplies the access password (even if zero-valued) or a key to deassert a privilege for the access password or that key, respectively, regardless of the CryptoSuperuser value.	O	Tag	**By design**
292	6.3.2.11.2	A Tag that receives a *TagPrivilege* that attempts to change an unchangeable Tag privilege value shall not execute the *TagPrivilege* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
293	6.3.2.11.2	After a successful Interrogator authentication a Tag in the **open** state shall transition to the **secured** state.	M	Tag	**By design**
294	6.3.2.11.2	The authenticated Interrogator shall subsequently encapsulate all commands designated "Mandatory Encapsulation" in Table 6-29 in an *AuthComm* or *SecureComm*.	M	Tag	**By design**
295	6.3.2.11.2	If a Tag receives such a command from an authenticated Interrogator without encapsulation then it shall not execute the command and instead treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By design**
296	6.3.2.11.2	A Tag shall transition back to the **open** state, reset its cryptographic engine, and revert to **open**-state file privileges (see below) when an authenticated Interrogator loses its authentication.	M	Tag	**By design**
297	6.3.2.11.2	If the Tag was not previously authenticated by a *Challenge* or *Authenticate* command then it shall not execute the *AuthComm* or a *SecureComm* command and instead treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By design**
298	6.3.2.11.2	If a condition of a cryptographic suite causes a Tag to transition from the **open** or **secured** state to the **arbitrate** state then the Tag (i) shall not change the value of its inventoried flag, and (ii) shall reset its cryptographic engine.	M	Tag	**By design**
299	6.3.2.11.3	A Tag that supports File_N, N>0 shall implement *FileOpen*; it may implement *FileList*, *FileSetup, and FilePrivilege* as well.	O	Tag	**By design**
300	6.3.2.11.3	If a Tag implements a single file then that file shall be File_0.	O	Tag	**By design**
301	6.3.2.11.3	A Tag with User memory shall open File_0 upon first entering the **open** or **secured** state.	O	Tag	**By design**
302	6.3.2.11.3	A Tag shall have only a single file open at any time. All access commands operate on the currently open file.	O	Tag	**By design**
303	6.3.2.11.3	Each file shall have an 8-bit FileType and a 10-bit FileNum, unless a Tag does not support any file-management access commands, in which case a Tag that implements File_0 may omit FileType and FileNum.	O	Tag	**By design**
304	6.3.2.11.3	A Tag manufacturer shall preassign a FileType to each file supported by the Tag.	O	Tag	**By design**
305	6.3.2.11.3	A Tag manufacturer shall preassign a unique FileNum to each file supported by the Tag.	O	Tag	**By design**
306	6.3.2.11.3	The files may have different size (including zero size). FileNum=0000000000_2 shall be reserved for the base file (File_0) of User memory	O	Tag	**By design**
307	6.3.2.11.3	FileNum=1111111111_2 shall be RFU. This protocol recommends, but does not require, that Tag manufacturers number files sequentially.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
308	6.3.2.11.3	Upon receiving a *FileOpen* a Tag shall first close the currently open file and then open the new file, with the new file's starting address mapped to 00_h of User memory.	O	Tag	**By design**
309	6.3.2.11.3	A Tag manufacturer shall precreate all files; the number of files shall not be changeable in the field.	O	Tag	**By design**
310	6.3.2.11.3	Static: A manufacturer of a *static* Tag shall preallocate all User memory to files.	O	Tag	**By design**
311	6.3.2.11.3	A *static* Tag may permit changing a file's FileType but shall not permit file resizing.	O	Tag	**By design**
312	6.3.2.11.3	A Tag manufacturer shall decide where a Tag stores its FileType and FileNum data and may choose a readable portion of memory (if desired). Regardless of the location, a Tag shall not allow an Interrogator to modify a file's type by any command except *FileSetup*, and shall not allow an Interrogator to modify a FileNum by any means.	O	Tag	**By design**
313	6.3.2.11.3	Files may range in size from a minimum of zero to a maximum of 1022 blocks. Commands that include a FileSize parameter use 10 bits to specify sizes from zero to 1022 blocks (0000000000_2 – 1111111110_2, respectively). FileSize 1111111111_2 shall be RFU.	O	Tag	**By design**
314	6.3.2.11.3	A Tag manufacturer shall predefine a single fixed, unchangeable block size that the Tag shall use for all file allocation as well as for the *BlockPermalock* command.	O	Tag	**By design**
315	6.3.2.11.3	Tag manufacturers shall not use block sizes exceeding 1024 words. Tag replies that return a BlockSize value use 10 bits to specify the size from one (0000000000_2) to 1024 (1111111111_2) words. BlockSize does not have an RFU value.	O	Tag	**By design**
316	6.3.2.11.3	If a Tag supports File_0 then it shall provide the file privileges shown in Table 6-25.	O	Tag	**By design**
317	6.3.2.11.3	If a Tag supports File_N, N>0 then it shall also provide the file privileges shown in Table 6-26.	O	Tag	**By design**
318	6.3.2.11.3	A Tag with M files shall implement M 4-bit **open**-state file privileges, one for each file.	O	Tag	**By design**
319	6.3.2.11.3	A Tag with M files shall implement M 4-bit **secured**-state access-password file privileges, one for each file.	O	Tag	**By design**
320	6.3.2.11.3	A Tag with M files and N keys shall implement M×N 4-bit **secured**-state key file privileges.	O	Tag	**By design**
321	6.3.2.11.3	In this latter case, if an Interrogator sends a 4-bit privilege with either MSB being nonzero then the Tag shall not execute the *FilePrivilege* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
322	6.3.2.11.3	A Tag shall permit an Interrogator that accessed or authenticated itself as a file superuser to: ■ read or assign a new 4-bit privilege for the **open** state, access password, or any key (including its own) regardless of the cryptographic suite to which the key is assigned, for the currently open file, using a *FilePrivilege* command. ■ change the FileType of the currently open file using a *FileSetup* command, for a *static* or a *dynamic* Tag. ■ resize the currently open file using a *FileSetup* command, but only if the file contains no permalocked or permaunlocked memory and only if the Tag is *dynamic*.	O	Tag	**By design**
323	6.3.2.11.3	A Tag shall not permit an Interrogator that did not access or authenticate itself as a file superuser to: ■ read or assign the 4-bit privilege for the **open** state, for the currently open file. ■ read or assign the 4-bit privilege for the access password or for any key other than the one it used to enter the **secured** state, for the currently open file. ■ increase the privileges (move down one or more rows in Table 6-25 or Table 6-26) for the access password or for any key, for the currently open file.	O	Tag	**By design**
324	6.3.2.11.3	If the access password or key that a Tag used to enter the **secured** state has DecFilePriv=1_2 (see Table 6-23 and Table 6-24) then a Tag shall permit an Interrogator to self-reduce its privileges (move up one or more rows in Table 6-25 or Table 6-26) to the currently open file for this access password or key.	O	Tag	**By design**
325	6.3.2.11.3	If *Read* is "×" for a privilege value then a Tag shall behave as if the memory location does not exist.	O	Tag	**By design**
326	6.3.2.11.3	Otherwise, if *Write*, *BlockWrite*, or *BlockErase* are "×" then the Tag shall behave as if the memory location is permalocked; and if *Lock* or *BlockPermalock* are "×" then the Tag shall behave as if the memory location is neither lockable nor unlockable.	O	Tag	**By design**
327	6.3.2.11.3	If *FilePrivilege* or *FileSetup* are "×" then the Tag shall behave as if the Interrogator has insufficient privileges.	O	Tag	**By design**
328	6.3.2.11.3	If a Tag implements the *BlockPermalock* command then all files shall support the *BlockPermalock* command.	O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
329	6.3.2.11.3	If a Tag's User memory is untraceably hidden then the Tag shall only execute a *FileOpen*, *FileList*, *FileSetup*, or *FilePrivilege* issued by an Interrogator with an asserted Untraceable privilege (see Table 6-23 and Table 6-2); if the Interrogator has a deasserted Untraceable privilege then the Tag shall treat these commands' parameters as unsupported (see Table C-34).	O	Tag	**By design**
330	6.3.2.11.3	A Tag shall not permit a permalocked portion of memory to be erased or overwritten, except for the **L** and **U** bits in EPC memory, which an Interrogator with an asserted Untraceable privilege may overwrite, and XPC_W2 when **SN**=1_2.	M	Tag	**By design**
331	6.3.2.11.3	In some instances a *dynamic* Tag may allow file resizing. Whether a Tag allows resizing shall depend on whether the Tag accepts a *FileSetup* command (varies by privilege and state), whether the Tag has free memory available for the resizing, and whether the file or any blocks in it are permalocked or permaunlocked. See Table 6-27.	O	Tag	**By design**
332	6.3.2.12	Interrogator-to-Tag commands shall use the command codes, protection, and parameters shown in Table 6-29.	M	Interrogator	**By design**
333	6.3.2.12	*QueryRep*, *ACK*, *Query*, *QueryAdjust*, and *NAK* have the unique command lengths shown in Table 6-29. No other commands shall have these lengths.	M	Interrogator	**By design**
334	6.3.2.12	If a Tag receives one of these commands with an incorrect length then it shall treat the command as invalid (see Table C-34).	M	Tag	**By design**
335	6.3.2.12 Table 6-29	An authenticated *Kill* shall be encapsulated in a *SecureComm* or an *AuthComm*; a password-based *Kill* shall not be encapsulated.	M	Interrogator	**By design**
336	6.3.2.12.1.1	Interrogators and Tags shall implement the *Select* command shown in Table 6-30.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
337	6.3.2.12.1.1	A *Select* that modifies the **SL** flag shall not modify an **inventoried** flag, and vice versa.	M	Tag	**By design**
338	6.3.2.12.1.1	A Tag shall ignore a *Select* whose Target is 101_2, 110_2, or 111_2.	M	Tag	**By design**
339	6.3.2.12.1.1	If MemBank=00_2 and the Tag does not support File_N, N>0, then the Tag shall ignore the *Select*.	M	Tag	**By design**
340	6.3.2.12.1.1	If MemBank=00_2 then an Interrogator shall set Pointer to 00_h	M	Interrogator	**By design**
341	6.3.2.12.1.1	If a Tag supports File_N, N>0, receives a *Select* with MemBank=00_2, and receives a nonzero Pointer value then the Tag shall ignore the *Select*.	M	Tag	**By design**

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342	6.3.2.12.1.1	If Length=00_h and MemBank≠00_2 then the Tag shall treat the condition as matching, unless Pointer references a memory location that does not exist, or Pointer references a memory location that is untraceably hidden, or Truncate=1_2 and Mask is outside the EPC specified in the length field in the StoredPC, in which case the Tag is not-matching.	M	Tag	**By demonstration** Encode a Tag with a 96-bit EPC with last 2 words of EEEE FFFF$_h$. *Test #1* Issue a *Select* command as follow: Target=100_2 Action=000_2 MemBank=01_2 Pointer=20_h Length=00_h Truncate=0_2 The Tag shall be matching and its **SL** flag shall be asserted. Inventory Tags that have **SL** flag asserted and verify the Tag is properly inventoried. *Test #2* Issue a *Select* command as follow: Target=100_2 Action=000_2 MemBank=01_2 Pointer=8430_h (EBV-8 value for memory address 230_h) Length=00_h Truncate=0_2 The Tag shall be not-matching and its **SL** flag shall be deasserted. Inventory Tags that have **SL** flag asserted and verify the Tag is not inventoried. *Test #3* Set the **L** bits of StoredPC to 00101_2, and issue a *Select* command as follow: Target=100_2 Action=000_2 MemBank=01_2 Pointer=60_h Length=20_h (32 bits) Mask=EEEE FFFF$_h$ Truncate=1_2 The Tag shall be not-matching and its **SL** flag shall be deasserted. Inventory Tags that have **SL** flag asserted and verify the Tag is not inventoried. If the Tag supports untraceably hidden memory, additionally do the 2 following tests. Set untraceably hidden EPC memory, starting at address 30_h. *Test #4-1* Issue a *Select* command as follow: Target=100_2 Action=000_2 MemBank=01_2 Pointer=20_h Length=00_h Truncate=0_2 The Tag shall be matching and its **SL** flag shall be asserted. Inventory Tags that have **SL** flag asserted and verify the Tag is properly inventoried. *Test #4-2* Issue a *Select* command as follow: Target=100_2 Action=000_2

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
					MemBank=01_2 Pointer=40_h Length=00_h Truncate=0_2 The Tag shall be not-matching and its **SL** flag shall be deasserted. Inventory Tags that have **SL** flag asserted and verify the Tag is not inventoried. *Tag test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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_2
343	6.3.2.12.1.1	If MemBank=00_2 then an Interrogator shall set Length=00001000_2	M	Interrogator	**By design**
344	6.3.2.12.1.1	If a Tag supports File_N, N>0 and receives a *Select* with MemBank=00_2 and Length≠00001000_2 then the Tag shall ignore the *Select*.	M	Tag	**By design**
345	6.3.2.12.1.1	An untraceable Tag that supports File_N, N>0, shall process a *Select* with MemBank=00_2 whose User memory is traceable; an untraceable Tag shall process a *Select* with MemBank≠00_2 whose Mask operates on a completely traceable bit string.	M	Tag	**By design**
346	6.3.2.12.1.1	A Tag shall treat as not-matching a *Select* command whose Mask includes untraceably hidden memory.	M	Tag	**By design**
347	6.3.2.12.1.1	Truncate indicates whether a Tag's backscattered reply shall be truncated to those EPC bits that follow Mask.	M	Tag	**By design**
348	6.3.2.12.1.1	If an Interrogator asserts Truncate, and if a subsequent *Query* specifies Sel=10_2 or Sel=11_2, then a matching Tag shall truncate its *ACK* reply to the portion of the EPC immediately following Mask, followed by a PacketCRC.	M	Tag	**By design**
349	6.3.2.12.1.1	If an Interrogator asserts Truncate then the Tag shall assert it: □ in the last *Select* that the Interrogator issues prior to sending a *Query*, □ only if the *Select* has Target=100_2, and □ only if Mask ends in the EPC.	M	Tag and Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
350	6.3.2.12.1.1	Tags shall decide whether to truncate its backscattered EPC on the basis of the most recently received valid *Select* (i.e. not ignored and matching or not-matching).	M	Tag	**By demonstration** Issue a *Select* command and a *Query* command to a Tag with a 96 bit EPC and the EPC starting with 001 and the parameters as follows: *Select* Command = 1010 Target: 100_2 Action: 000_2 MemBank: 01_2 Pointer: 00100000_2 Length: 00000011_2 Mask: 001_2 Truncate: 1_2 *Query* Command = 1000 DR: 0_2 M: 00_2 TRext: 0_2 Sel: 11_2 Session: 00_2 Target: 0_2 Q: 0000_2 Verify that the tag replies with a truncated EPC. Issue a *Select* command and a *Query* command to a Tag with a 96 bit EPC and the EPC starting with 001 and the parameters as follows: *Select* Command = 1010 Target: 100_2 Action: 100_2 MemBank: 01_2 Pointer: 00100000_2 Length: 00000011_2 Mask: 000_2 Truncate: 1_2 *Query* Command = 1000 DR: 0_2 M: 00_2 TRext: 0_2 Sel: 11_2 Session: 00_2 Target: 0_2 Q: 0000_2 Verify that the tag replies with a non-truncated EPC. *Tag test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 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_2

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
351	6.3.2.12.1.1	If a Tag receives a *Select* with Truncate=1_2 and: ■ Target≠100_2 or MemBank≠01_2 then the Tag shall ignore the *Select*.	M	Tag	**By design**
352	6.3.2.12.1.1	If a Tag receives a *Select* with Truncate=1_2 and: ■ MemBank=01_2 but Mask ends outside the EPC specified by the **L** bits in the StoredPC then the Tag shall be not-matching.	M	Tag	**By design**
353	6.3.2.12.1.1	A Tag shall preface its truncated reply with five leading zeros (00000_2) inserted between the preamble and the truncated reply.	M	Tag	**By design**
354	6.3.2.12.1.1	A Tag shall power-up with truncate disabled.	M	Tag	**By design**
355	6.3.2.12.1.1	Mask may end at the last bit of the EPC, in which case a truncating Tag shall backscatter 00000_2 followed by a PacketCRC.	M	Tag	**By design**
356	6.3.2.12.1.1	An Interrogator shall prepend a *Select* command with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**
357	6.3.2.12.1.1	A Tag shall not reply to a *Select*.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
358	6.3.2.12.1.2	Interrogators and Tags may implement the *Challenge* command; if they do then they shall implement it as shown in Table 6-32.	O	Tag and Interrogator	**By design**
359	6.3.2.12.1.2	Unless otherwise specified by the cryptographic suite, a Tag shall support Immed=1_2 and may support Immed=0_2.	M	Tag	**By design**
360	6.3.2.12.1.2	Upon receiving a *Challenge* a Tag that supports the command shall return to the **ready** state and deassert its **C** flag.	M	Tag	**By design**
361	6.3.2.12.1.2	If the Tag supports the CSI and can execute Message then it shall perform the requested action(s); otherwise the Tag shall not execute Message.	M	Tag	**By design**
362	6.3.2.12.1.2	A Tag shall not reply to a *Challenge*.	M	Tag	**By design**
363	6.3.2.12.1.2	A *Challenge* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	M	Interrogator	**By design**
364	6.3.2.12.1.2	If a Tag receives a *Challenge* containing nonzero RFU bits then it shall return to the **ready** state and deassert its **C** flag but not execute Message.	M	Tag	**By design**
365	6.3.2.12.1.2	An Interrogator shall prepend a *Challenge* command with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**
366	6.3.2.12.1.2	If a Tag supports the *Challenge* command then it shall implement the security (**S**) indicator (see 6.3.2.1.3).	M	Tag	**By design**
367	6.3.2.12.1.2	After executing a *Challenge* a Tag shall store its response (result or error code) in its ResponseBuffer.	M	Tag	**By design**
368	6.3.2.12.1.2	After executing and storing a response a Tag shall assert its **C** flag.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
369	6.3.2.12.1.2	A Tag shall not assert its **C** flag until after it has computed and stored the entire response.	M	Tag	**By design**
370	6.3.2.12.1.2	A Tag shall deassert its **C** flag upon (a) receiving a subsequent *Challenge*, or (b) exceeding the **C** flag persistence time in Table 6-21.	M	Tag	**By design**
371	6.3.2.12.1.2	A Tag shall not permit an Interrogator to read its ResponseBuffer when **C**=0_2.	M	Tag	**By design**
372	6.3.2.12.1.2	If the most recent *Challenge* received and executable by a Tag asserts Immed, and if the Tag's **C** flag is asserted when it receives a subsequent *ACK*, then when replying to the *ACK* the Tag shall concatenate its ResponseBuffer contents to its EPC and backscatter the concatenated reply. See Table 6-18. See also Figure 6-23.	M	Tag	**By design**
373	6.3.2.12.1.2	If a Tag observes a properly formatted *Challenge* but there is a cryptographic error, and the cryptographic suite specifies that the error requires a security timeout, then the Tag shall return to **ready** and enforce a security timeout as specified in 6.3.2.5.	M	Tag	**By design**
374	6.3.2.12.1.2	If a Tag that supports security timeouts for a *Challenge* receives a *Challenge* during a timeout then it shall return to **ready** but not act on or otherwise execute any portion of the *Challenge*.	M	Tag	**By design**
375	6.3.2.12.2.1	Interrogators and Tags shall implement the *Query* command shown in Table 6-33.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
376	6.3.2.12.2.1	An Interrogator shall prepend a *Query* with a preamble (see 6.3.1.2.8).	M	Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
377	6.3.2.12.2.1	An Interrogator shall not encapsulate a *Query* in a *SecureComm* or *AuthComm* (see Table 6-29).	M	Interrogator	**By design**
378	6.3.2.12.2.1	If a Tag receives a *Query* with a CRC-5 error then it shall treat the command as invalid (see Table C-34).	M	Tag	**By design**
379	6.3.2.12.2.1	Upon receiving a *Query*, Tags with matching Sel and Target shall pick a random value in the range (0, 2^Q-1), inclusive, and shall load this value into their slot counter.	M	Tag	**By design**
380	6.3.2.12.2.1	If a Tag, in response to the *Query*, loads its slot counter with zero, then its reply to a *Query* shall be as shown in Table 6-34 using the *immediate* reply type specified in 6.3.1.6.1; otherwise the Tag shall remain silent.	M	Tag	**By design**
381	6.3.2.12.2.1	If a Tag in the **acknowledged**, **open**, or **secured** states receives a *Query* whose Session parameter matches the prior session it shall invert its **inventoried** flag (i.e. *A*→*B* or *B*→*A*) for the session before it evaluates whether to transition to **ready**, **arbitrate**, or **reply**.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
382	6.3.2.12.2.1	If a Tag in the **acknowledged**, **open**, or **secured** states receives a *Query* whose Session parameter does not match the prior session it shall leave its **inventoried** flag for the prior session unchanged when beginning the new round.	M	Tag	**By design**
383	6.3.2.12.2.1	A Tag shall support all DR and M values specified in Table 6-9 and Table 6-10, respectively.	M	Tag	**By design**
384	6.3.2.12.2.1	A Tag in any state other than **killed** shall execute a *Query* command, starting a new round in the specified session and transitioning to **ready**, **arbitrate**, or **reply**, as appropriate (see Figure 6-21).	M	Tag	**By design**
385	6.3.2.12.2.1	A Tag in the **killed** state shall ignore a *Query*.	M	Tag	**By design**
386	6.3.2.12.2.2	Interrogators and Tags shall implement the *QueryX* command shown in Table 6-35.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
387	6.3.2.12.2.2	Upon receiving a *QueryX*, a Tag shall follow the procedure outlined in Figure 6-24 and Figure 6-25.	M	Tag	**By design**
388	6.3.2.12.2.2	A Tag shall compute matching or not-matching for Action as specified in Table 6-37.	M	Tag	**By design**
389	6.3.2.12.2.2	Based on Table 6-37, a Tag shall compute the Action on the **inventoried** flag as specified by Session before comparing to Target.	M	Tag	**By design**
390	6.3.2.12.2.2	If Flx=1_2 then an Interrogator shall include the Comp, MemBank, Pointer, Length, Mask, and Truncate fields, and if Flx=0_2 then these fields are excluded.	M	Interrogator	**By design**
391	6.3.2.12.2.2	If a Tag receives MemBank=00_2, then the Tag shall transition to **ready**.	M	Tag	**By design**
392	6.3.2.12.2.2	If Length=00_h and MemBank≠00_2 then the Tag shall treat the Flexible condition as matching, unless Pointer references a memory location that does not exist, or Pointer references a memory location that is untraceably hidden, or Truncate=1_2 and Mask is outside the EPC specified in the length field in the StoredPC, in which case the Tag is not-matching.	M	Tag	**By design**
393	6.3.2.12.2.2	Truncate indicates whether a Tag's backscattered reply shall be truncated to those EPC bits that follow Mask.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
394	6.3.2.12.2.2	If an Interrogator sets Init=1_2, Flx=1_2, Truncate=1_2, MemBank=01_2, and AckData=01_2, then a matching Tag shall truncate its *ACK* reply to the portion of the EPC immediately following Mask, followed by a PacketCRC.	M	Tag	**By demonstration** Issue a *QueryX* command to a Tag with a 96 bit EPC and the EPC starting with 001 and the parameters as follows: *QueryX* Command = 1011 Init :1_2 Session: 00_2 Action: 000_2 SelType: 011_2 FastMask: 0_2 Flx: 1_2 Comp: 11_2 MemBank: 01_2 Pointer: 00100000_2 Length: 00000011_2 Mask: 001_2 Truncate: 1_2 ReplyCRC: 0_2 AckData: 01_2 DBLF: 011_2 Sel: 11_2 Target: 0_2 Q: 0000_2 Verify that the tag replies with a truncated EPC. Issue a *QueryX* command to a Tag with a 96 bit EPC and the EPC starting with 001 and the parameters as follows: *QueryX* Command = 1011 Init: 1_2 Session: 00_2 Action: 100_2 SelType: 011_2 FastMask: 0_2 Flx: 1_2 Comp: 11_2 MemBank: 01_2 Pointer: 00100000_2 Length: 00000011_2 Mask: 000_2 Truncate: 1_2 ReplyCRC: 0_2 AckData: 01_2 DBLF: 011_2 Sel: 11_2 Target: 0_2 Q: 0000_2 Verify that the tag replies with a non-truncated EPC. *Tag test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari Tari: 12.5 µs RTcal: 31.25 µs TRcal: 66.7 µs DR: 64/3 M: 1 TRext: 0_2

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
395	6.3.2.12.2.2	If an Interrogator sets Init=0_2, or Flx=0_2, or Truncate=0_2, or MemBank≠01_2, or AckData=10_2, then the Tag shall disable truncation and the Tag is not-matching.	M	Tag	**By design**
396	6.3.2.12.2.2	ReplyCRC (reply with CRC-5) indicates whether a Tag shall calculate a CRC-5 over the RN16.	M	Tag	**By design**
397	6.3.2.12.2.2	If ReplyCRC=1_2 then the Tag shall backscatter the RN16 followed by the CRC-5, and if ReplyCRC=0_2 then the Tag shall backscatter the RN16 without a CRC-5.	M	Tag	**By demonstration** Issue a matching *QueryX* command with Init=1_2, Q=0000_2 and ReplyCRC=1_2. Verify that the tag backscatters a RN16 with a CRC-5. Issue a matching *QueryX* command with Init=1_2, Q=0000_2 and ReplyCRC=0_2. Verify that the tag backscatter a RN16 without a CRC-5. *Tag test conditions:* Temp: +23 °C ± 3 °C Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari Tari: 12.5 µs RTcal: 31.25 µs TRcal: 66.7 µs DR: 64/3 M: 1 TRext: 0_2
398	6.3.2.12.2.2	AckData (data for *ACK*) indicates whether a Tag shall backscatter an EPC or TID (see Table 6-18) in reply to an *ACK*.	M	Tag	**By design**
399	6.3.2.12.2.2	If AckData=01_2 then a Tag shall backscatter an EPC.	M	Tag	**By design**
400	6.3.2.12.2.2	If AckData=10_2 then a Tag shall backscatter the traceable part of TID memory starting at address 00_h and ending at the last word of serialization.	M	Tag	**By design**
401	6.3.2.12.2.2	If AckData=00_2 or if AckData=11_2 then a Tag shall stop any T_8 timeout and transition to **ready**.	M	Tag	**By design**
402	6.3.2.12.2.2	If a Tag does not support a T=>R backscatter link frequency that is not required by *QueryX* (DBLF=000_2, =101_2, or =110_2) then the Tag shall stop (if active) T_8 timeout and transition to **ready**.	M	Tag	**By design**
403	6.3.2.12.2.2	An Interrogator shall prepend a *QueryX* with a preamble (see 6.3.1.2.8).	M	Interrogator	**By design**
404	6.3.2.12.2.2	An Interrogator shall not encapsulate a *QueryX* in a *SecureComm* or *AuthComm* (see Table 6-29).	M	Interrogator	**By design**
405	6.3.2.12.2.2	If a Tag receives a *QueryX* with a CRC-16 error then it shall treat the command as invalid (see Table C-34).	M	Tag	**By design**
406	6.3.2.12.2.2	A Tag shall stop any T_8 timeout (if active) upon receiving a *QueryX* with Init=1_2 or Init=0_2.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
407	6.3.2.12.2.2	If a Tag receives *QueryX* with Init=1_2: Tags with matching Sel and Target shall pick a random value in the range (0, 2^Q–1), inclusive, and shall load this value into their slot counter, and then: □ if the Tag loads its slot counter with zero, then the Tag shall transition to **reply** and shall backscatter an RN16 followed by CRC-5 if ReplyCRC=1_2 or shall (only) backscatter an RN16 if ReplyCRC=0_2 as shown in Table 6-39 using the *immediate* reply type specified in 6.3.1.6.1; or □ if the Tag loads a non-zero value into its slot counter, the Tag shall remain silent and transition to **arbitrate**.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
408	6.3.2.12.2.2	If a Tag receives *QueryX* with Init=1_2: Tags with not-matching Sel or not-matching Target shall remain silent and transition to **ready**.	M	Tag	**By design**
409	6.3.2.12.2.2	If a Tag receives *QueryX* with Init=0_2: Tags with matching Sel and Target shall start a T_8 timeout (see Table 6-16), load their slot counter with $7FFF_h$, remain silent, and transition to **arbitrate**.	M	Tag	**By design**
410	6.3.2.12.2.2	If a Tag receives *QueryX* with Init=0_2: Tags with matching Sel and not-matching Target shall start a T_8 timeout, remain silent and transition to **ready**.	M	Tag	**By design**
411	6.3.2.12.2.2	If a Tag receives *QueryX* with Init=0_2: Tags with not-matching Sel shall remain silent and transition to **ready**.	M	Tag	**By design**
412	6.3.2.12.2.2	If a Tag receives *QueryX* with Init=0_2: If a Tag starts a T_8 timeout (e.g. Init=0_2 and matching Sel) then the Tag shall process the T_8 timeout and subsequent commands as described in 6.3.1.6.5.	M	Tag	**By design**
413	6.3.2.12.2.2 Table 6-36	A Tag shall be not-matching if the Tag does not support a cryptographic suite. The Tag may or may not check if the CSI transmitted in a previous *Challenge* command is the same as that transmitted in the *QueryX* command.	M	Tag	**By design**
414	6.3.2.12.2.2 Table 6-36	A Tag shall be not-matching if the Tag does not support at least one bit in $EPC_{214h\text{-}21Fh}$.	M	Tag	**By design**
415	6.3.2.12.2.2 Table 6-36	If a Tag supports one or more bits in $EPC_{214h\text{-}21Fh}$ then the Tag shall treat unsupported bits in $EPC_{218h\text{-}21Fh}$ as zero in the '&' Boolean bitwise 'and' operation.	M	Tag	**By design**
416	6.3.2.12.2.2 Table 6-36	A tag shall be not-matching if the allocation class identifier (see 6.3.2.1) is not $E2_h$ or if the MDID is untraceably hidden.	M	Tag	**By design**
417	6.3.2.12.2.2	If a Tag in the **acknowledged**, **open**, or **secured** states receives a *QueryX* whose Session parameter matches the prior session, the Tag shall invert its **inventoried** flag (i.e. $A \rightarrow B$ or $B \rightarrow A$) for the session before evaluating the transition to **ready**, **arbitrate**, or **reply**.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
418	6.3.2.12.2.2	If a Tag in the **acknowledged**, **open**, or **secured** states receives a *QueryX* whose Session parameter does not match the prior session, it shall leave its **inventoried** flag from the prior session unchanged when beginning the new round.	M	Tag	**By design**
419	6.3.2.12.2.2	A Tag shall support DBLF, DR, and M values specified in 6.3.1.3.3, Table 6-9 and Table 6-10, respectively.	M	Tag	**By design**
420	6.3.2.12.2.2	A Tag in any state other than **killed** shall execute a *QueryX* command, begin a new round in the specified session and transition to **ready**, **arbitrate**, or **reply**, as appropriate (see Figure 6-21).	M	Tag	**By design**
421	6.3.2.12.2.2	A Tag in the **killed** state shall ignore a *QueryX*.	M	Tag	**By design**
422	6.3.2.12.2.3	Interrogators and Tags shall implement the *QueryY* command shown in Table 6-40.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
423	6.3.2.12.2.3	A Tag shall follow the procedure outline in Figure 6-24 and Figure 6-25.	M	Tag	**By design**
424	6.3.2.12.2.3	An Interrogator shall transmit a *QueryY* within T_8 after a previous *QueryX* with Init=0_2 or a previous *QueryY* with Init=0_2.	M	Interrogator	**By design**
425	6.3.2.12.2.3	A *QueryY* with Init=0_2 indicates that a following *QueryY* will continue initializing the inventory round, and a Tag shall start a (new) T_8 timeout when Init=0_2.	M	Tag	**By design**
426	6.3.2.12.2.3	An Interrogator shall transmit Session in *QueryY* equal to the Session of the *QueryX* that began initializing the inventory round.	M	Interrogator	**By design**
427	6.3.2.12.2.3	Based on Table 6-37, a Tag shall compute the Action on the **inventoried** flag as specified by Session before comparing to Target.	M	Tag	**By design** Tested in compliance with Item 389
428	6.3.2.12.2.3	If Flx=1_2 then an Interrogator shall include the Comp, MemBank, Pointer, Length, Mask, and Truncate fields, and if Flx=0_2 then these fields are excluded.	M	Tag	**By design** Tested in compliance with Item 390
429	6.3.2.12.2.3	If a Tag receives MemBank=00_2, then the Tag shall transition to **ready**.	M	Tag	**By design** Tested in compliance with Item 391
430	6.3.2.12.2.3	Truncate indicates whether a Tag's backscattered reply shall be truncated to those EPC bits that follow Mask.	M	Tag	**By design**

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431	6.3.2.12.2.3	If an Interrogator sets Init=1_2, Flx=1_2, Truncate=1_2, and MemBank=01_2 in a *QueryY* and if AckData=01_2 in the *QueryX* that began the inventory round, then a matching Tag shall truncate its *ACK* reply to the portion of the EPC immediately following Mask, followed by a PacketCRC.	M	Tag	**By demonstration** Issue a *QueryX* command and a *QueryY* command to a Tag with a 96 bit EPC and the EPC starting with 001 and the parameters as follows: *QueryX* Command = 1011 Init: 0_2 Session: 00_2 Action: 000_2 SelType: 011_2 FastMask: 0_2 Flx: 0_2 Comp: 11_2 ReplyCRC: 0_2 AckData: 01_2 DBLF: 011_2 Sel: 11_2 Target: 0_2 Q: 0000_2 *QueryY* Command = 1011 Init: 1_2 Session: 00_2 Action: 000_2 SelType: 011_2 FastMask: 0_2 Flx: 1_2 Comp: 11_2 MemBank: 01_2 Pointer: 00100000_2 Length: 00000011_2 Mask: 001_2 Truncate: 1_2 Verify that the tag replies with a truncated EPC. Issue a *QueryX* command and a *QueryY* command to a Tag with a 96 bit EPC and the EPC starting with 001 and the parameters as follows: *QueryX* Command = 1011 Init: 0_2 Session: 00_2 Action: 000_2 SelType: 011_2 FastMask: 0_2 Flx: 0_2 Comp: 11_2 ReplyCRC: 0_2 AckData: 01_2 DBLF: 011_2 Sel: 11_2 Target: 0_2 Q: 0000_2 *QueryY* Command = 1011 Init: 1_2 Session: 00_2 Action: 100_2 SelType: 011_2 FastMask: 0_2 Flx: 1_2 Comp: 11_2 MemBank: 01_2 Pointer: 00100000_2 Length: 00000011_2 Mask: 000_2 Truncate: 1_2 Verify that the tag replies with a non-truncated EPC.

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
					Tag test conditions: Temp: +23 ºC ± 3 ºC Freq: 860 and 930 MHz Power: 0 dBm at Tag antenna Modulation: DSB-ASK PW: 0.5 Tari Modulation depth: 90% Rise/fall time: ≤ 0.33 Tari Tari: 12.5 µs RTcal: 31.25 µs TRcal: 66.7 µs DR: 64/3 M: 1 TRext: 0_2
432	6.3.2.12.2.3	If an Interrogator sets Init=0_2, Flx=0_2, Truncate=0_2, or MemBank≠01_2 in a *QueryY* or if AckData=10_2, in the *QueryX* that began the inventory round, then the Tag shall disable truncation.	M	Tag	**By design**
433	6.3.2.12.2.3	An Interrogator shall prepend a *QueryY* with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**
434	6.3.2.12.2.3	An Interrogator shall not encapsulate a *QueryY* in a *SecureComm* or *AuthComm* (see Table 6-29).	M	Interrogator	**By design**
435	6.3.2.12.2.3	If a Tag receives a *QueryY* with a CRC-16 error then it shall treat the command as invalid (see Table C-34).	M	Tag	**By design**
436	6.3.2.12.2.3	If Tags in the **ready** or **arbitrate** states receive a *QueryY* within $T_{8(max)}$ and if the *QueryY* has a Session that matches the inventory round and has Init=1_2, then: ■ Tags with matching Target from the prior *QueryX* shall pick a random value in the range (0, 2^Q–1), inclusive, and shall load this value into their slot counter, and then: □ if the Tag loads its slot counter with zero, then the Tag shall transition to **reply** and shall backscatter as shown in Table 6-41 using the *immediate* reply type specified in 6.3.1.6.1 and using the ReplyCRC specified in the prior *QueryX*; or □ if the Tag loads a non-zero value into it slot counter, the Tag shall remain silent and transition to **arbitrate**. ■ Tags with not-matching Target from the prior *QueryX* shall remain silent and transition to **ready**.	M	Tag	**By design** Tested in compliance with 6.3.2.6 Figure 6-21

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
437	6.3.2.12.2.3	If Tags in the **ready** or **arbitrate** states receive a *QueryY* within $T_{8(max)}$ and if the *QueryY* has a Session that matches the inventory round and has Init=0_2, then: ■ Tags with matching Target from the prior *QueryX* shall start a (new) T_8 timeout (see Table 6-16), load their slot counter with $7FFF_h$, remain silent, and transition to **arbitrate**. ■ Tags with not-matching Target from the prior *QueryX* shall start a T_8 timeout, remain silent and transition to **ready**. ■ If a Tag starts a T_8 timeout (e.g., Init=0_2) then the Tag shall process the T_8 timeout and subsequent commands as described in 6.3.1.6.5.	M	Tag	**By design** Tested in compliance with 6.3.2.6 Figure 6-21
438	6.3.2.12.2.3	A Tag that receives a *QueryY* in the **ready** or **arbitrate** states shall stop (if active) the T_8 timeout, remain silent, and transition to **ready** if the Tag receives the *QueryY* after a T_8 timeout, if the Session does not match the inventory round, or if MemBank=00_2.	M	Tag	**By design**
439	6.3.2.12.2.3	If a Tag in the **reply, acknowledged, open, or secured** states receives a *QueryY* shall stop (if active) the T_8 timeout, and if: ■ the Session in the *QueryY* does not match the Session of the inventory round, then the Tag shall ignore the *QueryY* and remain in the same state; ■ the Session in the *QueryY* matches the Session of the inventory round, then the Tag shall ignore the *QueryY* and transition to **ready**.	M	Tag	**By design**
440	6.3.2.12.2.3	A Tag in the **killed** state shall ignore a *QueryY*.	M	Tag	**By design**
450	6.3.2.12.2.4	Interrogators and Tags shall implement the *QueryAdjust* command shown in Table 6-42.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
451	6.3.2.12.2.4	If a Tag receives a *QueryAdjust* whose session number is different from the session number in the *Query* or *QueryX* that began the inventory round, the Tag shall ignore the command.	M	Tag	**By design**
452	6.3.2.12.2.4	If a Tag receives a *QueryAdjust* with an UpDn value different from those specified above then it shall treat the command as invalid (see Table C-34).	M	Tag	**By design**
453	6.3.2.12.2.4	If a Tag whose *Q* value is 15 receives a *QueryAdjust* with UpDn=110_2 then it shall change UpDn to 000_2 prior to executing the command; likewise, if a Tag whose *Q* value is 0 receives a *QueryAdjust* with UpDn=011_2 then it shall change UpDn to 000_2 prior to executing the command.	M	Tag	**By design**
454	6.3.2.12.2.4	A Tag shall maintain a running count of the current *Q* value.	M	Tag	**By design**
455	6.3.2.12.2.4	An Interrogator shall prepend a *QueryAdjust* with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
456	6.3.2.12.2.4	An Interrogator shall not encapsulate a *QueryAdjust* in a *SecureComm* or *AuthComm* (see Table 6-29).	M	Interrogator	**By design**
457	6.3.2.12.2.4	If a Tag, in response to the *QueryAdjust*, loads its slot counter with zero, then its reply to a *QueryAdjust* shall be shown in Table 6-43 using the *immediate* reply type specified in 6.3.1.6.1; otherwise, the Tag shall remain silent.	M	Tag	**By design**
458	6.3.2.12.2.4	When a Tag replies to a *QueryAdjust*, the Tag shall backscatter a CRC-5 after the RN16 if a *QueryX* with ReplyCRC=1_2 began the inventory round; otherwise the Tag shall backscatter only the RN16.	M	Tag	**By demonstration** Tested in compliance with Item 397
459	6.3.2.12.2.4	A Tag shall respond to a *QueryAdjust* only if it received a prior *Query*, *QueryX* (Init=1_2), or *QueryY* (Init=1_2).	M	Tag	**By design**
460	6.3.2.12.2.4	A Tag in any state except **ready** or **killed** shall execute a *QueryAdjust* command if, and only if, (i) the Session parameter in the command matches the Session parameter in the *Query* or the *QueryX* that began the inventory round, and (ii) the Tag is not in the middle of a *Kill*- or *Access*-command sequence (see 6.3.2.12.3.5 or 6.3.2.12.3.7, respectively).	M	Tag	**By design**
461	6.3.2.12.2.4	A Tag in the **acknowledged**, **open**, or **secured** state that receives a *QueryAdjust* whose Session parameter matches the Session parameter in the prior *Query* or *QueryX*, and that is not in the middle of a *Kill*- or *Access*-command sequence (see 6.3.2.12.3.5 or 6.3.2.12.3.7, respectively), shall invert its **inventoried** flag (i.e. *A*→*B* or *B*→*A*, as appropriate) for the current session and transition to **ready**.	M	Tag	**By design**
462	6.3.2.12.2.5	Interrogators and Tags shall implement the *QueryRep* command shown in Table 6-44.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
463	6.3.2.12.2.5	If a Tag receives a *QueryRep* whose session number is different from the session number in the *Query* or *QueryX* that began the inventory round it shall ignore the command.	M	Tag	**By design**
464	6.3.2.12.2.5	An Interrogator shall prepend a *QueryRep* with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**
465	6.3.2.12.2.5	An Interrogator shall not encapsulate a *QueryRep* in a *SecureComm* or *AuthComm* (see Table 6-29).	M	Interrogator	**By design**
466	6.3.2.12.2.5	If a Tag, in response to the *QueryRep*, decrements its slot counter and the decremented slot value is zero, then its reply to a *QueryRep* shall be as shown in Table 6-45 using the *immediate* reply type specified in 6.3.1.6.1; otherwise the Tag shall remain silent.	M	Tag	**By design**
467	6.3.2.12.2.5	When a Tag replies to *QueryRep*, the Tag shall backscatter a CRC-5 after the RN16 if a *QueryX* with ReplyCRC=1_2 began the inventory round; otherwise the Tag shall backscatter only the RN16.	M	Tag	**By demonstration** Tested in compliance with Item 397

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
468	6.3.2.12.2.5	A Tag shall respond to a *QueryRep* only if it received a prior *Query* or prior *QueryX*.	M	Tag	**By design**
469	6.3.2.12.2.5	A Tag in any state except **ready** or **killed** shall execute a *QueryRep* command if, and only if, (i) the Session parameter in the command matches the Session parameter in the *Query* or *QueryX* that started the round, and (ii) the Tag is not in the middle of a *Kill*- or *Access*-command sequence (see 6.3.2.12.3.5 or 6.3.2.12.3.7, respectively).	M	Tag	**By design**
470	6.3.2.12.2.5	A Tag in the **acknowledged**, **open**, or **secured** state that receives a *QueryRep* whose Session parameter matches the Session parameter in the prior *Query* or *QueryX*, and that is not in the middle of a *Kill*- or *Access*-command sequence (see 6.3.2.12.3.5 or 6.3.2.12.3.7, respectively), shall invert its **inventoried** flag (i.e. *A*→*B* or *B*→*A*, as appropriate) for the current session and transition to **ready**.	M	Tag	**By design**
471	6.3.2.12.2.6	Interrogators and Tags shall implement the *ACK* command shown in Table 6-46.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
472	6.3.2.12.2.6	If an Interrogator issues an *ACK* to a Tag in the **reply** or **acknowledged** state, then the echoed RN16 shall be the RN16 that the Tag previously backscattered as it transitioned from the **arbitrate** state to the **reply** state.	M	Tag	**By design**
473	6.3.2.12.2.6	If an Interrogator issues an *ACK* to a Tag in the **open** or **secured** state then the echoed RN16 shall be the Tag's handle (see 6.3.2.12.3.1).	M	Tag	**By design**
474	6.3.2.12.2.6	An Interrogator shall prepend an *ACK* with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**
475	6.3.2.12.2.6	The Tag reply to a successful *ACK* shall be as shown in Table 6-47, using the immediate reply type specified in 6.3.1.6.1.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
476	6.3.2.12.2.6	A Tag in **reply** or **acknowledged** that receives an *ACK* with an incorrect RN16 shall return to **arbitrate** without responding.	M	Tag	**By design**
477	6.3.2.12.2.6	A Tag in **open** or **secured** that receives an *ACK* with an incorrect handle shall ignore the *ACK* and remain in its current state.	M	Tag	**By design**
478	6.3.2.12.2.6	In either case a Tag's reply to an *ACK* shall not exceed 528 bits for the PC||EPC||PacketCRC, optionally followed by a response field and its associated CRC-16 (see Table 6-18).	M	Tag	**By design**
479	6.3.2.12.2.7	Interrogators and Tags shall implement the *NAK* command shown in Table 6-48.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
480	6.3.2.12.2.7	A Tag that receives a *NAK* shall return to the **arbitrate** state without changing its **inventoried** flag, unless the Tag is in **ready** or **killed**, in which case it shall ignore the *NAK* and remain in its current state.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
481	6.3.2.12.2.7	An Interrogator shall prepend a *NAK* with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**
482	6.3.2.12.2.7	An Interrogator shall not encapsulate a *NAK* in a *SecureComm* or *AuthComm* (see Table 6-29).	M	Interrogator	**By design**
483	6.3.2.12.2.7	A Tag shall not reply to a *NAK*.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
484	6.3.2.12.3	A Tag in the **open** or **secured** state that receives an access command with an incorrect handle but a correct CRC-16 shall behave as specified in Table C-34.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
485	6.3.2.12.3.1	Interrogators and Tags shall implement the *Req_RN* command shown in Table 6-49.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
486	6.3.2.12.3.1	When issuing a *Req_RN* to a Tag in the **acknowledged** state, an Interrogator shall include the Tag's last backscattered RN16 as a parameter in the *Req_RN*.	M	Interrogator	**By design**
487	6.3.2.12.3.1	If a Tag receives a *Req_RN* with a correct RN16 and a correct CRC-16 then it shall generate and store a new RN16 (denoted handle), backscatter this handle, and transition to the **open** or **secured** state.	M	Tag	**By design**
488	6.3.2.12.3.1	A Tag in the **acknowledged** state that receives the *Req_RN* with an incorrect RN16 but a correct CRC-16 shall ignore the *Req_RN* and remain in the **acknowledged** state.	M	Tag	**By design**
489	6.3.2.12.3.1	When issuing a *Req_RN* to a Tag in the **open** or **secured** state, an Interrogator shall include the Tag's handle as a parameter in the *Req_RN*.	M	Interrogator	**By design**
490	6.3.2.12.3.1	If a Tag receives the *Req_RN* with a correct handle and a correct CRC-16 then it shall generate and backscatter a new RN16, remaining in its current state (**open** or **secured**, as appropriate). .	M	Tag	**By design**
491	6.3.2.12.3.1	The first bit of the backscattered RN16 shall be denoted the MSB; the last bit shall be denoted the LSB.	M	Tag	**By design**
492	6.3.2.12.3.1	An Interrogator shall prepend a *Req_RN* with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**
493	6.3.2.12.3.1	A Tag's reply to a *Req_RN* shall be as shown in Table 6-50, using the *immediate* reply type specified in 6.3.1.6.1. The RN16 or handle are protected by a CRC-16.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
494	6.3.2.12.3.2	Interrogators and Tags shall implement the *Read* command shown in Table 6-52.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
495	6.3.2.12.3.2	*Read* commands shall apply to a single memory bank.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
496	6.3.2.12.3.2	If WordCount=00_h then a Tag shall backscatter the contents of the chosen memory bank or file starting at WordPtr and ending at the end of the memory bank or file, however: □ if MemBank=01_2 then a Tag shall backscatter the memory contents specified in Table 6-51. □ if MemBank=10_2, part of TID memory is untraceably hidden (see 6.3.2.12.3.17), the Interrogator has a deasserted Untraceable privilege, and the memory address specified by WordPtr is in the traceable part of TID memory, then a Tag may either (i) backscatter the traceable part of TID memory starting at WordPtr, or (ii) treat the command's parameters as unsupported (see Table C-34), depending on the Tag manufacturer's implementation.	M	Tag	**By design**
497	6.3.2.12.3.2	An Interrogator shall prepend a *Read* with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**
498	6.3.2.12.3.2	An unauthenticated Interrogator may, and an authenticated Interrogator shall, encapsulate a *Read* command in a *SecureComm* or *AuthComm* (see Table 6-29).	M	Interrogator	**By design**
499	6.3.2.12.3.2	A Tag shall reply to a *Read* using the *immediate* reply type specified in 6.3.1.6.1.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
500	6.3.2.12.3.2	If all memory words specified in a *Read* exist, none are read-locked, all are traceable or the Interrogator has an asserted Untraceable privilege, and for User memory the Interrogator has read privileges to the currently open file (see 6.3.2.11.3), then a Tag's reply to a *Read* shall be as shown in Table 6-53 comprising a header (a 0-bit), the requested memory words, and the Tag's handle.	M	Tag	**By design**
501	6.3.2.12.3.2	The reply includes a CRC-16 calculated over the 0-bit, memory words, and handle, otherwise the Tag shall not execute the *Read* and instead treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By design**
502	6.3.2.12.3.3	Interrogators and Tags shall implement the *ReadVar* command shown in Table 6-55.	M	Tag and Interrogator	**By Design** When verifying the Tag, the Tag manufacturer shall provide the stated capability of the tag. See Annex B.4. When verifying the Interrogator, the reader manufacturer shall provide the stated capability of the reader. See Annex B.5.
503	6.3.2.12.3.3	*ReadVar* commands shall apply to a single memory bank.	M	Tag	**By design**
504	6.3.2.12.3.3	If a Tag receives a *ReadVar* with MemBank=00_2 or 01_2 then the Tag shall treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
505	6.3.2.12.3.3	If WordCount=00_h then the Interrogator shall set WordPtr=00_h.	M	Interrogator	**By design**
506	6.3.2.12.3.3	If WordCount=00_h and WordPtr≠00_h, then the Tag shall treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By design**
507	6.3.2.12.3.3	A Tag shall reply with the number of words in memory up to the limit specified by WordCount.	M	Tag	**By design**
508	6.3.2.12.3.3	If WordCount=00_h then the Tag shall execute the *ReadVar* command as specified in Table 6-54.	M	Tag	**By design**
509	6.3.2.12.3.3	An Interrogator shall prepend a *ReadVar* with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**
510	6.3.2.12.3.3	An unauthenticated Interrogator may, and an authenticated Interrogator shall, encapsulate a *ReadVar* command in a *SecureComm* or *AuthComm* (see Table 6-29).	M	Interrogator	**By design**
511	6.3.2.12.3.3	A Tag shall reply to a *ReadVar* using the *immediate* reply type specified in 6.3.1.6.1.	M	Tag	**By design** Also tested in compliance with 6.3.2.6
512	6.3.2.12.3.3	If all memory words specified in a *ReadVar* exist, none are read-locked, all are traceable or the Interrogator has an asserted Untraceable privilege, and the Interrogator has read privileges for the memory bank (see 6.3.2.11.3), then a Tag's reply to a *ReadVar* shall be as shown in Table 6-56	M	Tag	**By design**
513	6.3.2.12.3.3	When Wordcount>0, a Tag shall backscatter NumWords where NumWords≤WordCount.	M	Tag	**By design**
514	6.3.2.12.3.3	The number of 1's in the 16-bit length field NumWords||MoreWords||Parity shall be an even number, with NumWords||MoreWords||Parity=0000_h an allowed value.	M	Tag	**By design**
515	6.3.2.12.3.3	If a Tag has File_0, then the Tag shall support a UWC.	M	Tag	**By design**
516	6.3.2.12.3.3	A Tag shall have a UWC that is less than or equal to the number of memory words allocated to File_0.	M	Tag	**By design**
517	6.3.2.12.3.3	The reply includes a CRC-16 calculated over the 0-bit, number of memory words backscattered, the number of additional words available for reading, the parity bit, memory words, and the Tag's handle. Otherwise, the Tag shall not execute the *ReadVar* and instead treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By design**
518	6.3.2.12.3.4	Interrogators and Tags shall implement the *Write* command shown in Table 6-57.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
519	6.3.2.12.3.4	*Write* commands shall apply to a single memory bank.	M	Tag and Interrogator	**By design**
520	6.3.2.12.3.4	Before each and every *Write* the Interrogator shall first issue a *Req_RN* command; the Tag replies by backscattering a new RN16.	M	Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
521	6.3.2.12.3.4	The Interrogator shall cover code the Data by XORing it with this new RN16 prior to transmission.	M	Interrogator	**By design**
522	6.3.2.12.3.4	A Tag shall only execute a *Write* in the **open** or **secured** state.	M	Tag	**By design**
523	6.3.2.12.3.4	If a Tag in the **open** or **secured** state receives a *Write* before which the immediately preceding command was not a *Req_RN* then it shall not execute the *Write* and instead treat the command as invalid (see Table C-34).	M	Tag	**By design**
524	6.3.2.12.3.4	If an Interrogator attempts to write to the kill or access password, EPC or TID memory banks, or File_0 and these memory locations are permalocked; or to the kill or access password, EPC or TID memory banks, or File_0 and these memory locations are locked unwritable and the Tag is in the **open** state; or to a permalocked block in File_N, N≥0 of User memory; or to memory that is untraceably hidden and the Interrogator has a deasserted Untraceable privilege; or to a file for which the Interrogator does not have sufficient privileges; then the Tag shall not execute the *Write* and instead treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By demonstration** – see state machine 1. Attempt to write the PC value in **open** state, while the EPC memory is locked. Verify that the Tag replies with an error message and that the memory has not been written. 2. Attempt to write a permalocked memory location from **secured** state. Verify that the Tag replies with an error message and that the memory has not been written. 3. Attempt to write a permalocked block in File_N, N>0 of USER memory. Verify that the Tag replies with an error message and that the memory has not been written. 4. Attempt to write to a memory location that is untraceably hidden with a deasserted Untracable privilege. Verify that the Tag replies with an error message and that the memory has not been written. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
525	6.3.2.12.3.4	An Interrogator shall prepend a *Write* with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**
526	6.3.2.12.3.4	An Interrogator shall not encapsulate a *Write* in a *SecureComm* or *AuthComm* (see Table 6-29).	M	Interrogator	**By design**
527	6.3.2.12.3.4	Upon receiving a valid *Write* command a Tag shall write the commanded Data into memory.	M	Tag	**By design**
528	6.3.2.12.3.4	A Tag shall reply to a *Write* using the *delayed* reply specified in 6.3.1.6.2.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
529	6.3.2.12.3.5	Interrogators and Tags shall implement the *Kill* command shown in Table 6-58.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
530	6.3.2.12.3.5	To kill a Tag, an Interrogator shall follow the kill procedure shown in Figure 6-26.	M	Interrogator	**By design**
531	6.3.2.12.3.5	A Tag shall implement the password-based kill sequence shown in the left-side branch of the kill procedure in Figure 6-26.	M	Tag	**By design**
532	6.3.2.12.3.5	A *Kill* contains 3 RFU bits. An Interrogator shall set these bits to 000_2.	M	Interrogator	**By design**
533	6.3.2.12.3.5	A Tag shall ignore these bits.	M	Tag	**By design**
534	6.3.2.12.3.5	An Interrogator shall prepend an unencapsulated *Kill* command with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**
535	6.3.2.12.3.5	Each XOR operation shall be performed MSB first (i.e. the MSB of each half-password shall be XORed with the MSB of its respective RN16).	M	Interrogator	**By design**
536	6.3.2.12.3.5	A Tag shall be capable of successively accepting two 16-bit subportions of the 32-bit kill password.	M	Tag	**By design**
537	6.3.2.12.3.5	An Interrogator shall not intersperse commands other than *Req_RN* between the two successive *Kill* commands.	M	Interrogator	**By design**
538	6.3.2.12.3.5	If a Tag, after receiving a first *Kill*, receives any valid command other than *Req_RN* before the second *Kill* then it shall not execute the command and instead treat is as improper (see Table C-34), unless the intervening command is a *Query* or *QueryX*, in which case the Tag shall execute the *Query* or *QueryX*; if the intervening command is a *Query* or *QueryX*, then the Tag shall invert its **inventoried** flag if the Session parameter in the *Query* or *QueryX* matches that in the prior session.	M	Tag	**By design**
539	6.3.2.12.3.5	A Tag with a zero-valued kill password shall disallow itself from being killed by a password-based kill operation.	M	Tag	**By demonstration** Tested in compliance with Item 157
540	6.3.2.12.3.5	A Tag with a zero-valued kill password shall respond to a password-based kill by not executing the kill operation, backscattering an error code, and remaining in its current state. See Figure 6-26.	M	Tag	**By demonstration** Tested in compliance with Item 157
541	6.3.2.12.3.5	A Tag shall reply to a first *Kill* using the *immediate* reply specified in 6.3.1.6.1.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
542	6.3.2.12.3.5	The Tag's first reply shall be as shown in Table 6-59.	M	Tag	**By design**
543	6.3.2.12.3.5	The reply shall use the TRext value specified in the *Query* or *QueryX* command that initiated the round.	M	Tag	**By design**
544	6.3.2.12.3.5	A Tag shall reply to the second *Kill* using the *delayed* reply specified in 6.3.1.6.2.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6.21
545	6.3.2.12.3.5	If the kill succeeds then the Tag, after sending the final reply shown in Table 6-13, shall render itself silent and shall not respond to an Interrogator thereafter.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
546	6.3.2.12.3.5	If a Tag observes a properly formatted password-based *Kill*-command sequence but the kill fails (e.g., if the Interrogator sends an incorrect kill password) then the Tag shall return to **arbitrate** and may enforce a security timeout as specified in 6.3.2.5.	M, O	Tag	**By design**
547	6.3.2.12.3.5	If a Tag that supports security timeouts for a password-based *Kill*-command sequence receives such a sequence during a timeout then it shall behave as though it is not killable, backscatter an error code (see Annex I), and remain in its current state.	O	Tag	**By design**
548	6.3.2.12.3.5	A Tag shall authenticate an Interrogator via Interrogator or mutual authentication prior to executing an authenticated kill.	O	Tag	**By design**
549	6.3.2.12.3.5	The Interrogator may use any 16-bit value in the password field of the *Kill* command because a Tag shall ignore the kill password for an authenticated kill.	O	Tag	**By design**
550	6.3.2.12.3.5	A Tag shall only execute an authenticated kill if the Interrogator possesses an asserted AuthKill privilege (see Table 6-24) and the Tag is in the **secured** state.	O	Tag	**By design**
551	6.3.2.12.3.5	A Tag shall reply to an authenticated kill using an in-process reply (as required by a *SecureComm* or *AuthComm*), but with SenRep=1_2 regardless of the SenRep value actually specified in the *SecureComm* or *AuthComm*.	O	Tag	**By design**
552	6.3.2.12.3.5	If the kill succeeds then the Tag, after sending the final reply shown in Table 6-14, shall transition to the **killed** state and not respond to an Interrogator thereafter.	O	Tag	**By design**
553	6.3.2.12.3.5	If the kill fails then the Tag shall remain in its current state and backscatter an error code (see Annex I), unless the Tag is in the **open** state, the Interrogator is not authenticated, or the Interrogator does not have an asserted AuthKill privilege (see Table 6-24), in which case the Tag shall return to **arbitrate** and may enforce a security timeout as specified in 6.3.2.5.	O	Tag	**By design**
554	6.3.2.12.3.5	If a Tag that supports security timeouts for an authenticated *Kill* command receives an authenticated *Kill* command during a timeout then it shall behave as though it is not killable, backscatter an error code (see Annex I), and remain in its current state.	O	Tag	**By design**
555	6.3.2.12.3.6	Interrogators and Tags shall implement the *Lock* command shown in Table 6-60 and Figure 6-27.	M	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
556	6.3.2.12.3.6	The first 10 payload bits are Mask bits. A Tag shall interpret these bit values as follows: □ Mask=0_2: Ignore the associated Action field and retain the current lock setting. □ Mask=1_2: Implement the associated Action field and overwrite the current lock setting.	M	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
557	6.3.2.12.3.6	The last 10 payload bits are Action bits. A Tag shall interpret these bit values as follows: □ Action=0_2: Deassert lock for the associated memory location. □ Action=1_2: Assert lock or permalock for the associated memory location.	M	Tag	**By design**
558	6.3.2.12.3.6	The payload of a *Lock* command shall always be 20 bits in length.	M	Tag	**By design**
559	6.3.2.12.3.6	If an Interrogator issues a *Lock* whose Mask and Action fields attempt to change the lock status of a non-existent memory bank, nonexistent File_0, or non-existent password then a Tag shall not execute the *Lock* and instead treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By design**
560	6.3.2.12.3.6	If a Tag receives a *Lock* whose payload attempts to deassert a previously asserted permalock bit then the Tag shall not execute the *Lock* and instead treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By design**
561	6.3.2.12.3.6	If a Tag receives a *Lock* whose payload attempts to reassert a previously asserted permalock bit, then the Tag shall simply ignore this particular Action field and implement the remainder of the *Lock* payload.	M	Tag	**By design**
562	6.3.2.12.3.6	Regardless of the location, a field-deployed Tag shall not permit an Interrogator to change its lock bits except by means of a *Lock* command	M	Tag	**By design**
563	6.3.2.12.3.6	A Tag shall implement memory locking and the *Lock* command.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
564	6.3.2.12.3.6	If a Tag receives a *Lock* it cannot execute because one or more memory locations do not exist, or one or more of the Action fields attempt to change a permalocked value, or one or more of the memory locations are either not lockable or not unlockable, then the Tag shall not execute the *Lock* and instead treat the command's parameters as unsupported (see Table C-34).	M	Tag	**By design**
565	6.3.2.12.3.6	The only exception to this general rule is for a Tag that (a) does not support File_N, N>0 and (b) whose only lock functionality is to permanently lock **all** memory (i.e. all memory banks and all passwords) at once; such a Tag shall execute a *Lock* whose payload is $FFFFF_h$, and shall backscatter an error code for any payload other than $FFFFF_h$.	M	Tag	**By design**
566	6.3.2.12.3.6	A Tag in the **secured** state shall permit an Interrogator to write or erase memory locations with (pwd-write=1_2 AND permalock=0_2) or (pwd-read/write=1_2 AND permalock=0_2) without first issuing a *Lock* to change these fields.	M	Tag	**By design**
567	6.3.2.12.3.6	An Interrogator shall prepend a *Lock* with a frame-sync (see 6.3.1.2.8).	M	Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
568	6.3.2.12.3.6	An unauthenticated Interrogator may, and an authenticated Interrogator shall, encapsulate a *Lock* command in a *SecureComm* or *AuthComm* (see Table 6-29).	M	Interrogator	**By design**
569	6.3.2.12.3.6	Upon receiving an executable *Lock* a Tag shall perform the commanded lock operation.	M	Tag	**By design**
570	6.3.2.12.3.6	A Tag shall reply to a *Lock* using the *delayed* reply specified in 6.3.1.6.2.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
571	6.3.2.12.3.7	Interrogators and Tags may implement an *Access* command; if they do, they shall implement it as shown in Table 6-62.	O	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
572	6.3.2.12.3.7	To access a Tag, an Interrogator shall follow the multi-step procedure outlined in Figure 6-28.	O	Interrogator	**By design**
573	6.3.2.12.3.7	Each XOR operation shall be performed MSB first (i.e. the MSB of each half-password shall be XORed with the MSB of its respective RN16).	O	Interrogator	**By design**
574	6.3.2.12.3.7	A Tag shall be capable of successively accepting two 16-bit subportions of the 32-bit access password.	O	Tag	**By design**
575	6.3.2.12.3.7	An Interrogator shall not intersperse commands other than a *Req_RN* between the two successive *Access* commands.	O	Interrogator	**By design**
576	6.3.2.12.3.7	If a Tag, after receiving a first *Access*, receives any valid command other than *Req_RN* before the second *Access* then it shall not execute the command and instead treat it as improper (see Table C-34), unless the intervening command is a *Query* or *QueryX*, in which case the Tag shall execute the *Query* or *QueryX*; if the intervening command is a *Query* or *QueryX*, then the Tag shall invert its **inventoried** flag if the Session parameter in the *Query* or *QueryX* matches that in the prior session.	O	Tag	**By design**
577	6.3.2.12.3.7	An Interrogator shall prepend an *Access* with a frame-sync (see 6.3.1.2.8).	O	Interrogator	**By design**
578	6.3.2.12.3.7	An Interrogator shall not encapsulate an *Access* in a *SecureComm* or *AuthComm* (see Table 6-29).	O	Interrogator	**By design**
579	6.3.2.12.3.7	A Tag shall reply to an *Access* using the *immediate* reply specified in 6.3.1.6.1.	O	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
580	6.3.2.12.3.7	The reply shall be as shown in Table 6-63.	O	Tag	**By design**
581	6.3.2.12.3.7	If the *Access* is the second in the sequence and the received 32-bit access password is correct then the Tag shall backscatter its handle to acknowledge that it has executed the command successfully and shall transition to the **secured** state; otherwise the Tag shall not reply and returns to **arbitrate**.	O	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
582	6.3.2.12.3.7	If a Tag observes a properly formatted *Access* sequence but the Interrogator sends an incorrect access password then the Tag shall return to **arbitrate** and may enforce a security timeout as specified in 6.3.2.5.	O	Tag	**By design** Tested in compliance with Annex N, Item 870
583	6.3.2.12.3.7	If a Tag that supports security timeouts for an *Access*-command sequence receives such a sequence during a timeout then it shall behave as though Tag access was disallowed, backscatter an error code (see Annex I), and remain in its current state.	O	Tag	**By design** Tested in compliance with Annex N, Item 870
584	6.3.2.12.3.8	Interrogators and Tags may implement a *BlockWrite* command; if they do, they shall implement it as shown in Table 6-64.	O, TACF	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
585	6.3.2.12.3.8	*BlockWrite* commands shall apply to a single memory bank.	O, TACF	Tag	**By design**
586	6.3.2.12.3.8	If WordCount=00_h then a Tag shall treat the *BlockWrite* as invalid.	O, TACF	Tag	**By design**
587	6.3.2.12.3.8	If WordCount=01_h then a Tag shall write a single data word.	O, TACF	Tag	**By design**
588	6.3.2.12.3.8	Data contains the 16-bit words to be written, and shall be 16 × WordCount bits in length.	O, TACF	Interrogator	**By design**
589	6.3.2.12.3.8	A Tag shall only execute a *BlockWrite* in the **open** or **secured** state.	O, TACF	Tag	**By design**
590	6.3.2.12.3.8	If an Interrogator attempts to write to the kill or access password, EPC or TID memory banks, or File_0 and these memory locations are permalocked; or to the kill or access password, EPC or TID memory banks, or File_0 and these memory locations are locked unwritable and the Tag is in the **open** state; or to memory that is untraceably hidden and the Interrogator has a deasserted Untraceable privilege; or to a file for which the Interrogator does not have sufficient privileges; or if WordPtr and WordCount include one or more permalocked blocks in File_N, N≥0 of User memory; then the Tag shall not execute the *BlockWrite* and instead treat the command's parameters as unsupported (see Table C-34).	O, TACF	Tag	**By design**
591	6.3.2.12.3.8	An Interrogator shall prepend a *BlockWrite* with a frame-sync (see 6.3.1.2.8).	O, TACF	Interrogator	**By design**
592	6.3.2.12.3.8	An unauthenticated Interrogator may, and an authenticated Interrogator shall, encapsulate a *BlockWrite* in a *SecureComm* or *AuthComm* (see Table 6-29).	O, TACF	Interrogator	**By design**
593	6.3.2.12.3.8	Upon receiving an executable *BlockWrite* a Tag shall write the commanded Data into memory.	O, TACF	Tag	**By design**
594	6.3.2.12.3.8	A Tag shall reply to a *BlockWrite* using the *delayed* reply specified in 6.3.1.6.2.	O, TACF	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
595	6.3.2.12.3.9	Interrogators and Tags may implement a *BlockErase* command; if they do, they shall implement it as shown in Table 6-65.	O	Tag and Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
596	6.3.2.12.3.9	*BlockErase* commands shall apply to a single memory bank.	O	Tag	**By design**
597	6.3.2.12.3.9	If WordCount=00_h then a Tag shall treat the *BlockErase* as invalid.	O	Tag	**By design**
598	6.3.2.12.3.9	If WordCount=01_h then a Tag shall erase a single data word.	O	Tag	**By design**
599	6.3.2.12.3.9	A Tag shall only execute a *BlockErase* in the **open** or **secured** state.	O	Tag	**By design**
600	6.3.2.12.3.9	If an Interrogator attempts to erase the kill or access password, EPC or TID memory banks, or File_0 and these memory locations are permalocked; or the kill or access password, EPC or TID memory banks, or File_0 and these memory locations are locked unwritable and the Tag is in the **open** state; or to memory that is untraceably hidden and the Interrogator has a deasserted Untraceable privilege; or a file for which the Interrogator does not have sufficient privileges; or if WordPtr and WordCount include one or more permalocked blocks in File_N, N≥0 of User memory; then the Tag shall not execute the *BlockErase* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
601	6.3.2.12.3.9	An Interrogator shall prepend a *BlockErase* with a frame-sync (see 6.3.1.2.8).	O	Interrogator	**By design**
602	6.3.2.12.3.9	An unauthenticated Interrogator may, and an authenticated Interrogator shall, encapsulate a *BlockErase* in a *SecureComm* or *AuthComm* (see Table 6-29).	O	Interrogator	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
603	6.3.2.12.3.9	Upon receiving an executable *BlockErase* command a Tag shall erase the commanded memory words.	O	Tag	**By design**
604	6.3.2.12.3.9	A Tag shall reply to a *BlockErase* using the *delayed* reply specified in 6.3.1.6.2.	O	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
605	6.3.2.12.3.10	Interrogators and Tags may implement a *BlockPermalock* command; if they do, they shall implement it as shown in Table 6-67.	O, CE	Tag and Interrogator	**By demonstration** Issue a *BlockPermalock* command to permalock a single block of any File_N, N>0. After successful tag response, attempt to write the selected block to verify that it has been locked. The Tag shall not execute the *Write* and instead treat the command's parameters as unsupported. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
606	6.3.2.12.3.10	A Tag shall only execute a *BlockPermalock* in the **secured** state.	O, CE	Tag	**By design**
607	6.3.2.12.3.10	Table 6-66 specifies how a Tag shall behave upon receiving a *BlockPermalock* targeting File_0 that follows a prior *Lock*, or vice versa (assuming Read/Lock=1_2).	O, CE	Tag	**By design**
608	6.3.2.12.3.10	*BlockPermalock* commands shall apply to a single memory bank.	O, CE	Tag and Interrogator	**By design**
609	6.3.2.12.3.10	A Tag shall only execute a *BlockPermalock* command if MemBank=11_2 (User memory); if a Tag receives a *BlockPermalock* with MemBank≠11_2 then it shall not execute the *BlockPermalock* and instead treat the command's parameters as unsupported (see Table C-34).	O, CE	Tag	**By design**
610	6.3.2.12.3.10	A Tag shall interpret the Read/Lock bit as follows: □ Read/Lock=0_2: A Tag shall backscatter the permalock status of blocks in the specified memory bank, starting from the memory block located at BlockPtr and ending at the memory block located at BlockPtr+(16×BlockRange)−1. A Tag shall backscatter a "0" if the memory block corresponding to that bit is not permalocked and a "1" if the block is permalocked. An Interrogator omits Mask from the *BlockPermalock* when Read/Lock=0_2. □ Read/Lock=1_2: A Tag shall permalock those blocks in the specified memory bank that are specified by Mask, starting at BlockPtr and ending at BlockPtr+(16×BlockRange)−1.	O, CE	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
611	6.3.2.12.3.10	If BlockRange=00_h then a Tag shall not execute the *BlockPermalock* and instead treat the command's parameters as unsupported (see Table C-34).	O, CE	Tag	**By design**
612	6.3.2.12.3.10	Read/Lock=0_2: The Interrogator shall omit Mask from the *BlockPermalock*.	O, CE	Interrogator	**By design**
613	6.3.2.12.3.10	Read/Lock=1_2: The Interrogator shall include a Mask of length 16×BlockRange bits in the *BlockPermalock*.	O, CE	Interrogator	**By design**
614	6.3.2.12.3.10	The Mask bits shall be ordered from lower-order block to higher (i.e. if BlockPtr=00_h then the leading Mask bit refers to block 0).	O, CE	Tag and Interrogator	**By design**
615	6.3.2.12.3.10	□ The Tag shall interpret each bit of Mask as follows: - Mask=0_2: Retain the current permalock setting for the corresponding memory block. - Mask=1_2: Permalock the corresponding memory block. If a block is already permalocked then a Tag shall retain the current permalock setting. A memory block, once permalocked, cannot be un-permalocked.	O, CE	Tag	**By demonstration** Tested in compliance with Item 605
616	6.3.2.12.3.10	A *BlockPermalock* contains 8 RFU bits. An Interrogator shall set these bits to 00_h.	O, CE	Interrogator	**By demonstration** Tested in compliance with Item 605
617	6.3.2.12.3.10	A Tag in the **secured** state that receives a *BlockPermalock* with nonzero RFU bits shall not execute the *BlockPermalock* and instead treat the command's parameters as unsupported (see Table C-34).	O, CE	Tag	**By design**
618	6.3.2.12.3.10	If a Tag receives a *BlockPermalock* that it cannot execute because User memory does not exist, or User memory is untraceably hidden and the Interrogator has a deasserted Untraceable privilege, or in which one of the asserted Mask bits references a non-existent memory block, or because the Interrogator has insufficient file privileges (see 6.3.2.11.3) then the Tag shall not execute the *BlockPermalock* and instead treat the command's parameters as unsupported (see Table C-34).	O, CE	Tag	**By design**
619	6.3.2.12.3.10	A Tag shall treat as invalid a *BlockPermalock* in which Read/Lock=0_2 but Mask is not omitted, or a *BlockPermalock* in which Read/Lock=1_2 but Mask has a length not equal to 16×BlockRange bits (see Table C-34).	O, CE	Tag	**By design**
620	6.3.2.12.3.10	Certain Tags, depending on the Tag manufacturer's implementation, may be unable to execute a *BlockPermalock* with certain BlockPtr and BlockRange values, in which case the Tag shall not execute the *BlockPermalock* and instead treat the command's parameters as unsupported (see Table C-34).	O, CE	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
621	6.3.2.12.3.10	If an Interrogator issues a *BlockPermalock* in which BlockPtr and BlockRange specify one or more nonexistent blocks, but Mask only asserts permalocking on existent blocks, then the Tag shall execute the *BlockPermalock*.	O, CE	Tag	**By design**
622	6.3.2.12.3.10	An Interrogator shall prepend a *BlockPermalock* with a frame-sync (see 6.3.1.2.8).	O, CE	Interrogator	**By design**
623	6.3.2.12.3.10	An unauthenticated Interrogator may, and an authenticated Interrogator shall, encapsulate a *BlockPermalock* in a *SecureComm* or *AuthComm* (see Table 6-29).	O, CE	Interrogator	**By design**
624	6.3.2.12.3.10	Upon receiving an executable *BlockPermalock* a Tag shall perform the requested operation, unless the Tag does not support block permalocking in which case it shall treat the command as invalid (see Table C-34).	O, CE	Tag	**By design**
625	6.3.2.12.3.10	If Read/Lock=0_2 then a Tag shall reply to a *BlockPermalock* using the *immediate* reply type specified in 6.3.1.6.1.	O, CE	Tag	**By design**
626	6.3.2.12.3.10	If the Tag is able to execute the *BlockPermalock* then its reply shall be as shown in Table 6-68 comprising a header (a 0-bit), the requested permalock bits, and the Tag's handle.	O, CE	Tag	**By design**
629	6.3.2.12.3.10	If the Tag is unable to execute the *BlockPermalock* then it shall backscatter an error code (see Table C-34, unsupported parameters) rather than the reply shown in Table 6-68.	O, CE	Tag	**By design**
630	6.3.2.12.3.10	The Tag's reply when Read/Lock=0_2 shall use the preamble specified by the TRext value in the *Query* or *QueryX* that initiated the inventory round.	O, CE	Tag	**By design**
631	6.3.2.12.3.10	If Read/Lock=1_2 then a Tag shall reply to a *BlockPermalock* using the *delayed* reply specified in 6.3.1.6.2.	O, CE	Tag	**By design**
632	6.3.2.12.3.11	Interrogators and Tags may implement the *Authenticate* command; if they do, they shall implement it as shown in Table 6-69.	O, TACA, TACF	Tag and Interrogator	**By demonstration** Issue an *Authenticate* command configured according to a supported cryptographic suite. Verify that the Tag backscatters a valid response. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
633	6.3.2.12.3.11	If SenRep=1_2 a Tag shall backscatter its response; if SenRep=0_2 a Tag shall store the response in the ResponseBuffer. Unless otherwise specified by the cryptographic suite, a Tag shall support SenRep=1_2 and may support SenRep=0_2.	O	Tag	**By demonstration** Tested in compliance with Item 632
634	6.3.2.12.3.11	An *Authenticate* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	O, TACA, TACF	Interrogatorr	**By design**
635	6.3.2.12.3.11	A Tag in the **open** or **secured** states that receives an *Authenticate* with nonzero RFU bits shall not execute the *Authenticate* and instead treat the command's parameters as unsupported (see Table C-34).	O, TACA, TACF	Tag	**By design**
636	6.3.2.12.3.11	An Interrogator shall prepend an *Authenticate* with a frame-sync (see 6.3.1.2.8).	O, TACA, TACF	Interrogator	**By design**
637	6.3.2.12.3.11	An Interrogator shall not encapsulate an *Authenticate* in a *SecureComm* or *AuthComm* (see Table 6-29).	O, TACA, TACF	Interrogator	**By design**
638	6.3.2.12.3.11	If a Tag supports the *Authenticate* command then it shall implement the security (**S**) indicator (see 6.3.2.1.3).	O, TACA, TACF	Tag	**By design**
639	6.3.2.12.3.11	An *Authenticate* command shall use the *in-process* reply specified in 6.3.1.6.3.	O, TACA	Tag	**By design**
640	6.3.2.12.3.11	If a Tag receives an *Authenticate* specifying an unsupported SenRep, an unsupported CSI, an improperly formatted or not-executable Message, or an improper cryptographic parameter then the Tag shall not execute the *Authenticate* and instead treat the command's parameters as unsupported (see Table C-34).	O, TACA, TACF	Tag	**By design**
641	6.3.2.12.3.11	If a Tag in the **secured** state receives an *Authenticate* that begins a new multi-step authentication sequence, then the Tag shall transition to the **open** state, discontinue using and reset the current cryptographic engine, and begin the new multi-step authentication sequence.	O, TACA, TACF	Tag	**By design**
642	6.3.2.12.3.11	If a Tag receives a properly formatted *Authenticate* but there is a cryptographic error and the cryptographic suite specifies that the error requires a security timeout, then the Tag shall set a security timeout as specified in 6.3.2.5.	O, TACA, TACF	Tag	**By design**
643	6.3.2.12.3.11	If a Tag that supports security timeouts for the *Authenticate* command receives an *Authenticate* during a timeout then it shall reject the command, backscatter an error code (see Annex I), and remain in its current state.	O TACA, TACF	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
644	6.3.2.12.3.12	Interrogators and Tags may implement the *AuthComm* command; if they do, they shall implement it as shown in Table 6-70.	O	Tag and Interrogator	**By demonstration** Issue an *AuthComm* command configured according a supported cryptographic suite. Verify that the Tag backscatters a valid response. Verify that the interrogator decodes the tag response according the specification. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
645	6.3.2.12.3.12	An *AuthComm* shall always be preceded by a Tag, Interrogator, or mutual authentication via an *Authenticate* or a *Challenge*.	O	Tag and Interrogator	**By design**
646	6.3.2.12.3.12	An Interrogator shall remove the command's preamble, handle, and CRC before encapsulating it in an *AuthComm*.	O	Interrogator	**By design**
647	6.3.2.12.3.12	The encapsulated command shall not be encrypted or obscured.	O	Tag and Interrogator	**By design**
648	6.3.2.12.3.12	An *AuthComm* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	O	Tag and Interrogator	**By design**
649	6.3.2.12.3.12	A Tag in the **open** or **secured** states that receives an *AuthComm* with nonzero RFU bits shall not execute the *AuthComm* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
650	6.3.2.12.3.12	A Tag in the **open** or **secured** states that receives an *AuthComm* encapsulating a disallowed command, an unsupported command, or a command that does not support encapsulation (see Table 6-29) shall not execute the *AuthComm* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
651	6.3.2.12.3.12	An Interrogator shall prepend an *AuthComm* with a frame-sync (see 6.3.1.2.8).	O	Interrogator	**By design**
652	6.3.2.12.3.12	A Tag shall only accept an *AuthComm* after a successful cryptographic authentication.	O	Tag	**By design**
653	6.3.2.12.3.12	Because an *Access*-command sequence is not a cryptographic authentication, a Tag that most recently entered the **secured** state via a successful *Access*-command sequence shall not execute an *AuthComm* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
654	6.3.2.12.3.12	When processing an *AuthComm* a Tag shall first perform the functions/analysis/state-change/error-handling for the *AuthComm* itself and then, if the *AuthComm* is successful, the functions/analysis/state-change/error-handling for the command encapsulated in the *AuthComm*'s Message field.	O	Tag	**By design**
655	6.3.2.12.3.12	A Tag shall reply to an *AuthComm* using the *in-process* reply specified in 6.3.1.6.3.	O	Tag	**By design**
656	6.3.2.12.3.12	The cryptographic suite shall specify the parameters that a Tag includes in its response, including at least the reply for the encapsulated command minus preamble, handle, and CRC.	O	Tag	**By design**
657	6.3.2.12.3.12	Unlike other commands that use an *in-process* reply, *AuthComm* does not include a SenRep field because a Tag shall always send (i.e. never store) its reply to an *AuthComm*.	O	Tag	**By design**
658	6.3.2.12.3.12	If a Tag receives a properly formatted *AuthComm* but there is a cryptographic error, and the cryptographic suite specifies that the error requires a security timeout, then the Tag shall set a security timeout as specified in 6.3.2.5.	O	Tag	**By design**
659	6.3.2.12.3.12	If a Tag that supports security timeouts for the *AuthComm* command receives an *AuthComm* during a timeout then it shall reject the command, backscatter an error code (see Annex I), and remain in its current state.	O	Tag	**By design**
660	6.3.2.12.3.13	Interrogators and Tags may implement the *SecureComm* command; if they do, they shall implement it as shown in Table 6-71.	O, TACF	Tag and Interrogator	**By demonstration** Issue a *SecureComm* command configured according a supported cryptographic suite. Verify that the Tag backscatters a valid response. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
661	6.3.2.12.3.13	A *SecureComm* shall always be preceded by a Tag, Interrogator, or mutual authentication via an *Authenticate* or a *Challenge*.	O, TACF	Interrogator	**By design**
662	6.3.2.12.3.13	Unless otherwise specified by the cryptographic suite, a Tag shall support SenRep=1_2 and may support SenRep=0_2.	O TACF	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
663	6.3.2.12.3.13	If a Tag receives a *SecureComm* specifying an unsupported value of SenRep then the Tag shall not execute the *SecureComm* and instead treat the command's parameters as unsupported (see Table C-34).	O TACF	Tag	**By design**
664	6.3.2.12.3.13	An Interrogator shall remove the command's preamble, handle, and CRC before encapsulating it in a *SecureComm*.	O, TACF	Interrogator	**By design**
665	6.3.2.12.3.13	The encapsulated command shall be encrypted.	O, TACF	Interrogator	**By design**
666	6.3.2.12.3.13	A *SecureComm* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	O, TACF	Interrogator	**By design**
667	6.3.2.12.3.13	A Tag in the **open** or **secured** states that receives a *SecureComm* with nonzero RFU bits shall not execute the *SecureComm* and instead treat the command's parameters as unsupported (see Table C-34).	O, TACF	Tag	**By design**
668	6.3.2.12.3.13	A Tag in the **open** or **secured** states that receives a *SecureComm* encapsulating a disallowed command, an unsupported command, or a command that does not support encapsulation (see Table 6-29) shall not execute the *SecureComm* and instead treat the command's parameters as unsupported (see Table C-34).	O, TACF	Tag	**By design**
669	6.3.2.12.3.13	An Interrogator shall prepend a *SecureComm* with a frame-sync (see 6.3.1.2.8).	O, TACF	Tag	**By design**
670	6.3.2.12.3.13	A Tag shall only accept a *SecureComm* after a successful cryptographic authentication.	O, TACF	Tag	**By design**
671	6.3.2.12.3.13	Because an *Access*-command sequence is not a cryptographic authentication, a Tag that most recently entered the **secured** state via a successful *Access*-command sequence shall not execute a *SecureComm* and instead treat the command's parameters as unsupported (see Table C-34).	O, TACF	Tag	**By design**
672	6.3.2.12.3.13	When processing a *SecureComm* a Tag shall first perform the functions/analysis/state-change/error-handling for the *SecureComm* itself and then, if the *SecureComm* is successful, the functions/analysis/state-change/error-handling for the command encapsulated in the *SecureComm*'s Message field.	O, TACF	Tag	**By design**
673	6.3.2.12.3.13	A Tag shall reply to a *SecureComm* using the *in-process* reply specified in 6.3.1.6.3.	O, TACF	Tag	**By design**
674	6.3.2.12.3.13	The cryptographic suite shall specify the parameters that a Tag includes in its response, including at least the reply for the encapsulated command minus preamble, handle, and CRC.	O, TACF	Tag	**By design**
675	6.3.2.12.3.13	If a Tag receives a properly formatted *SecureComm* but there is a cryptographic error, and the cryptographic suite specifies that the error requires a security timeout, then the Tag shall set a security timeout as specified in 6.3.2.5.	O, TACF	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
676	6.3.2.12.3.13	If a Tag that supports security timeouts for the *SecureComm* command receives a *SecureComm* during a timeout then it shall reject the command, backscatter an error code (see Annex I), and remain in its current state.	O, TACF	Tag	**By design**
677	6.3.2.12.3.14	Interrogators and Tags may implement the *KeyUpdate* command; if they do, they shall implement it as shown in Table 6-72.	O, TACF	Tag and Interrogator	**By demonstration** Issue a *KeyUpdate* command configured according a supported cryptographic suite. Verify that the Tag backscatters a valid response. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
678	6.3.2.12.3.14	A *KeyUpdate* shall always be preceded by an Interrogator or mutual authentication via an *Authenticate*.	O, TACF	Interrogator	**By design**
679	6.3.2.12.3.14	Unless otherwise specified by the cryptographic suite, a Tag shall support SenRep=1_2 and may support SenRep=0_2.	O, TACF	Tag	**By design**
680	6.3.2.12.3.14	If a Tag receives a *KeyUpdate* specifying an unsupported value of SenRep then the Tag shall not execute the *KeyUpdate* and instead treat the command's parameters as unsupported (see Table C-34).	O, TACF	Tag	**By design**
681	6.3.2.12.3.14	A *KeyUpdate* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	O, TACF	Interrogator	**By design**
682	6.3.2.12.3.14	A Tag in the **secured** state that receives a *KeyUpdate* with nonzero RFU bits shall not execute the *KeyUpdate* and instead treat the command's parameters as unsupported (see Table C-34).	O, TACF	Tag	**By design**
683	6.3.2.12.3.14	If a cryptographic suite allows sending a *KeyUpdate* in an *AuthComm* or without encapsulation then Message in the *KeyUpdate* shall be encrypted.	O, TACF	Interrogator	**By design**
684	6.3.2.12.3.14	A Tag in the **secured** state shall only write a key if (a) the Interrogator authenticated itself as a crypto superuser and KeyID is assigned to the same cryptographic suite as that specified by CSI in the *Authenticate* command that preceded the *KeyUpdate*, or (b) KeyID is the same as that used by the Interrogator to authenticate itself.	O, TACF	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
685	6.3.2.12.3.14	In all other instances the Tag shall not execute the *KeyUpdate* and instead treat the command's parameters as unsupported (see Table C-34). See 6.3.2.11.2 for a description of Tag privileges and the crypto superuser privilege.	O, TACF	Tag	**By design**
686	6.3.2.12.3.14	Upon receiving an executable *KeyUpdate* a Tag shall overwrite its old key with the new key.	O, TACF	Tag	**By design**
687	6.3.2.12.3.14	If the Tag does not write the new key successfully then it shall revert to the prior stored key.	O, TACF	Tag	**By design**
688	6.3.2.12.3.14	An Interrogator shall prepend an unencapsulated *KeyUpdate* with a frame-sync (see 6.3.1.2.8).	O, TACF	Interrogator	**By design**
689	6.3.2.12.3.14	A Tag shall only accept a *KeyUpdate* after a successful cryptographic authentication.	O, TACF	Tag	**By design**
690	6.3.2.12.3.14	Because an *Access*-command sequence is not a cryptographic authentication, a Tag that most recently entered the **secured** state via a successful *Access*-command sequence shall not execute a *KeyUpdate* and instead treat the command's parameters as unsupported (see Table C-34).	O, TACF	Tag	**By design**
691	6.3.2.12.3.14	A Tag shall reply to a *KeyUpdate* using the *in-process* reply specified in 6.3.1.6.3.	O, TACF	Tag	**By design**
692	6.3.2.12.3.14	The cryptographic suite shall specify the parameters that a Tag includes in its response.	O, TACF	Tag	**By design**
693	6.3.2.12.3.14	If a Tag receives a properly formatted *KeyUpdate* but there is a cryptographic error and the cryptographic suite specifies that the error requires a security timeout, then the Tag shall set a security timeout as specified in 6.3.2.5.	O, TACF	Tag	**By design**
694	6.3.2.12.3.14	If a Tag that supports security timeouts for the *KeyUpdate* command receives a *KeyUpdate* during a timeout then it shall reject the command, backscatter an error code (see Annex I), and remain in its current state.	O, TACF	Tag	**By design**
695	6.3.2.12.3.15	Interrogators and Tags may implement the *TagPrivilege* command; if they do, they shall implement it as shown in Table 6-74.	O	Tag and Interrogator	**By demonstration** Issue a *TagPrivilege* command configured according a supported cryptographic suite. Verify that the Tag backscatters a valid response. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
696	6.3.2.12.3.15	A *TagPrivilege* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	O	Interrogator	**By design**
697	6.3.2.12.3.15	A Tag in the **secured** state that receives a *TagPrivilege* containing nonzero RFU bits shall not execute the *TagPrivilege* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
698	6.3.2.12.3.15	An unauthenticated Interrogator may issue a *TagPrivilege*; if it does then it shall issue the *TagPrivilege* without encapsulation and with Target=0_2 (i.e. specifying the access password).	O	Interrogator	**By design**
699	6.3.2.12.3.15	An authenticated Interrogator shall encapsulate a *TagPrivilege* in a *SecureComm* or *AuthComm* (see Table 6-29).	O	Interrogator	**By design**
700	6.3.2.12.3.15	If a Tag in the **secured** state receives an unencapsulated *TagPrivilege* from an authenticated Interrogator then it shall not execute the *TagPrivilege* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
701	6.3.2.12.3.15	A Tag in the **secured** state shall only read or modify the access-password privileges if the Interrogator supplied the correct access password and is not attempting to assert a deasserted privilege.	O	Tag	**By design**
702	6.3.2.12.3.15	In all other instances the Tag shall not execute the *TagPrivilege* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
703	6.3.2.12.3.15	A Tag in the **secured** state shall only read or modify a key's privileges if (a) the Interrogator authenticated itself as a crypto superuser and KeyID is assigned to the same cryptographic suite as that specified by CSI in the *Authenticate* command that preceded the *TagPrivilege*, or (b) KeyID is the same as that used by the Interrogator to authenticate itself and the Interrogator is not attempting to assert a deasserted privilege.	O	Tag	**By design**
704	6.3.2.12.3.15	If an Interrogator specifies Action=0_2 in a *TagPrivilege* then it may use any value for privilege. A Tag shall ignore privilege when Action=0_2.	O	Tag and Interrogator	**By design**
705	6.3.2.12.3.15	If Tag receives a *TagPrivilege* with Target=0_2 then it shall ignore the value that the Interrogator supplies for KeyID.	O	Tag	**By design**
581/706	6.3.2.12.3.15	Upon receiving an executable *TagPrivilege* with Action=1_2 a Tag shall overwrite the old privileges with the new privileges.	O	Tag	**By design**
582/707	6.3.2.12.3.15	If the Tag does not write the new privileges successfully then it shall revert to the prior stored privileges.	O	Tag	**By design**
583/708	6.3.2.12.3.15	A Tag in the **secured** state that receives a *TagPrivilege* which attempts to assert one or more RFU privilege bits or to change an unchangeable privilege value shall not execute the *TagPrivilege* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
709	6.3.2.12.3.15	An Interrogator shall prepend an unencapsulated *TagPrivilege* with a frame-sync (see 6.3.1.2.8).	O	Interrogator	**By design**
710	6.3.2.12.3.15	A Tag shall reply to a *TagPrivilege* using the *in-process* reply specified in 6.3.1.6.3.	O	Tag	**By design**
711	6.3.2.12.3.15	The Tag's response shall be as shown in Table 6-73 for Action=0_2 or Action=1_2.	O	Tag	**By design**
712	6.3.2.12.3.16	Interrogators and Tags may implement the *ReadBuffer* command; if they do, they shall implement it as shown in Table 6-75.	O	Tag and Interrogator	**By demonstration** Tested in Compliance with 6.3.1.6.4
713	6.3.2.12.3.16	If a Tag implements the *ReadBuffer* command, then the Tag shall support WordPtr=000_h.	O	Tag	**By design**
714	6.3.2.12.3.16	If a cryptographic suite supported by the Tag specifies support of non-zero WordPtr values, then the Tag shall support these specified non-zero WordPtr values.	O	Tag	**By design**
715	6.3.2.12.3.16	If a Tag receives a *ReadBuffer* specifying an unsupported value of WordPtr then the Tag shall not execute the *ReadBuffer* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
716	6.3.2.12.3.16	BitCount specifies the number of bits to read. If BitCount=000_h then a Tag shall backscatter the contents of the ResponseBuffer starting at WordPtr and ending at the end of the allocated ResponseBuffer.	O	Tag	**By design**
717	6.3.2.12.3.16	If a Tag implements the *ReadBuffer* command, then the Tag shall support BitCount=000_h.	O	Tag	**By design**
718	6.3.2.12.3.16	If a cryptographic suite specifies support of non-zero BitCount values, then the Tag shall support these specified non-zero BitCount values.	O	Tag	**By design**
719	6.3.2.12.3.16	If a Tag receives a *ReadBuffer* specifying an unsupported value of BitCount then the Tag shall not execute the *ReadBuffer* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
720	6.3.2.12.3.16	A *ReadBuffer* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	O	Interrogator	**By design**
721	6.3.2.12.3.16	A Tag in the **open** or **secured** states that receives a *ReadBuffer* with nonzero RFU bits shall not execute the *ReadBuffer* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
722	6.3.2.12.3.16	An Interrogator may encapsulate a *ReadBuffer* in an *AuthComm* but shall not encapsulate it in a *SecureComm* (see Table 6-29).	O	Interrogator	**By design**
723	6.3.2.12.3.16	If the Tag supports the *Challenge* command with the value Immed=0_2, then the Tag shall implement the *ReadBuffer* command.	O	Tag	**By design** see Annex B.3
724	6.3.2.12.3.16	If the Tag supports the *Authenticate*, *SecureComm*, or *KeyUpdate* commands with SenRep=0_2, then the Tag shall implement the *ReadBuffer* command.	O	Tag	**By design** see Annex B.3

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
725	6.3.2.12.3.16	An Interrogator shall prepend an unencapsulated *ReadBuffer* with a frame-sync (see 6.3.1.2.8).	O	Interrogator	**By design**
726	6.3.2.12.3.16	A Tag shall reply to a *ReadBuffer* using the *immediate* reply specified in 6.3.1.6.1.	O	Tag	**By design**
727	6.3.2.12.3.16	If **C**=1_2 and the memory bits specified in the *ReadBuffer* exist then the Tag's reply shall be as shown in Table 6-76 including a header (a 0-bit), the data bits, and the Tag's handle.	O	Tag	**By design**
728	6.3.2.12.3.16	If one or more of the memory bits specified in the *ReadBuffer* do not exist, or if the **C** flag in XPC_W1 is zero-valued, then the Tag shall not execute the *ReadBuffer* and instead backscatter an error code (see Table C-34, unsupported parameters) within time T_1 in Table 6-16 rather than the reply shown in Table 6-76.	O	Tag	**By design**
729	6.3.2.12.3.17	Interrogators and Tags may implement the *Untraceable* command; if they do, they shall implement it as shown in Table 6-77.	O, EAS, TAC	Tag and Interrogator	**By demonstration** Issue an *Untraceable* command that is configured to hide the User memory. Verify that the *Read* command is only executed for an Interrogator that has an asserted Untraceable privilege. Issue another *Untraceable* command, which is configured to expose the User memory. Verify that the *Read* command is executed independent from the Untraceable privilege of the Interrogator. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860, 895, and 930 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: 8 TRext: 1_2
730	6.3.2.12.3.17	If the Tag does not support the **U** bit then the Tag shall ignore the provided U value but continue to process the remainder of the *Untraceable*.	O, EAS, TAC	Tag	**By design**
731	6.3.2.12.3.17	A Tag shall execute a range change prior to replying to the *Untraceable*.	O, EAS, TAC	Tag	**By design**
732	6.3.2.12.3.17	If a Tag does not support range reduction then it shall ignore Range but continue to process the remainder of the *Untraceable*.	O, EAS, TAC	Tag	**By design**
733	6.3.2.12.3.17	An *Untraceable* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	O, EAS, TAC	Interrogator	**By design**
734	6.3.2.12.3.17	A Tag in the **secured** state that receives an *Untraceable* with nonzero RFU bits, TID=11_2, or Range=11_2 shall not execute the *Untraceable* and instead treat the command's parameters as unsupported (see Table C-34).	O, EAS, TAC	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
735	6.3.2.12.3.17	If a Tag in the **secured** state receives an *Untraceable* from an Interrogator with an asserted Untraceable privilege then it shall execute the command.	O, EAS, TAC	Tag	**By design**
736	6.3.2.12.3.17	if the Interrogator has a deasserted Untraceable privilege then the Tag shall not execute the command and instead treat the command's parameters as unsupported (see Table C-34).	O, EAS, TAC	Tag	**By design**
737	6.3.2.12.3.17	An authenticated Interrogator shall encapsulate an *Untraceable* in a *SecureComm* or *AuthComm* (see Table 6-29).	O, EAS, TAC	Interrogator	**By design**
738	6.3.2.12.3.17	If a Tag in the **secured** state receives an unencapsulated *Untraceable* from an authenticated Interrogator then it shall not execute the *Untraceable* and instead treat the command's parameters as unsupported (see Table C-34).	O, EAS, TAC	Tag	**By design**
739	6.3.2.12.3.17	*Untraceable* commands shall be atomic, meaning that a Tag, upon receiving an executable *Untraceable*, shall discard its prior memory and range settings and implement the new ones.	O, EAS, TAC	Tag	**By design**
740	6.3.2.12.3.17	A Tag that supports **XI**=1_2 shall not execute an *Untraceable* that specifies Length bits greater than 11101_2 and shall instead treat the command's parameters as unsupported (see Table C-34).	O, EAS, TAC	Tag	**By design**
741	6.3.2.12.3.17	Regardless of these absolute bounds on Length, if an *Untraceable* specifies a Length value that a Tag does not support then the Tag shall not execute the *Untraceable* and instead treat the command's parameters as unsupported (see Table C-34).	O, EAS, TAC	Tag	**By design**
742	6.3.2.12.3.17	A Tag that is operating with reduced range shall do so for all commands regardless of whether an Interrogator has an asserted or a deasserted Untraceable privilege.	O, EAS, TAC	Tag	**By design**
743	6.3.2.12.3.17	A Tag shall execute supported access commands that operate on untraceably hidden memory if the commanding Interrogator has an asserted Untraceable privilege, but shall not execute these commands if the Interrogator has a deasserted Untraceable privilege.	O, EAS, TAC	Tag	**By design**
744	6.3.2.12.3.17	In the latter case a Tag shall behave as though untraceably hidden memory does not exist and treat the commands' parameters as unsupported (see Table C-34).	O, EAS, TAC	Tag	**By design**
745	6.3.2.12.3.17	A Tag that is untraceably hiding EPC memory shall not include any of the untraceably hidden EPC memory bits when replying to an *ACK*.	O, EAS, TAC	Tag	**By design**
746	6.3.2.12.3.17	An Interrogator shall prepend an unencapsulated *Untraceable* with a frame-sync (see 6.3.1.2.8).	O, EAS, TAC	Interrogator	**By design**
747	6.3.2.12.3.17	The details of this irreversible untraceability, including whether a Tag with irreversibly hidden memory will still alter its operating range, and vice versa, shall be Tag-manufacturer defined.	O, EAS, TAC	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
748	6.3.2.12.3.1	A Tag shall reply to an *Untraceable* using the *delayed* reply specified in 6.3.1.6.2. Upon receiving an executable *Untraceable* a Tag shall perform the specified actions.	O, EAS, TAC	Tag	**By design**
749	6.3.2.12.3.17	If a Tag receives an *Untraceable* (i) with field values it supports but nonetheless cannot execute, such as if the *Untraceable* instructs the Tag to expose an irreversibly hidden portion of Tag memory or the Interrogator has a deasserted Untraceable privilege, or (ii) with field values it does not support, unless the unsupported fields are U or Range, then the Tag shall not execute the *Untraceable* and instead treat the command's parameters as unsupported (see Table C-34).	O, EAS, TAC	Tag	**By design**
750	6.3.2.12.3.18	Interrogators and Tags may implement the *FileOpen* command; if they do, they shall implement it as shown in Table 6-78.	O, CE	Tag and Interrogator	**By demonstration** Issue a *FileOpen* command configured according a supported cryptographic suite. Verify that the Tag backscatters a valid response. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
751	6.3.2.12.3.18	A *FileOpen* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	O, CE	Interrogator	**By design**
752	6.3.2.12.3.18	A Tag in the **open** or **secured** states that receives a *FileOpen* with nonzero RFU bits or that specifies FileNum=1111111111_2 (RFU FileNum) shall not execute the *FileOpen* and instead treat the command's parameters as unsupported (see Table C-34).	O, CE	Tag	**By design**
753	6.3.2.12.3.18	An authenticated Interrogator shall encapsulate a *FileOpen* in a *SecureComm* or *AuthComm* (see Table 6-29).	O, CE	Interrogator	**By design**
754	6.3.2.12.3.18	If a Tag in the **secured** state receives an unencapsulated *FileOpen* from an authenticated Interrogator then it shall not execute the *FileOpen* and instead treat the command's parameters as unsupported (see Table C-34).	O, CE	Tag	**By design**
755	6.3.2.12.3.18	If an Interrogator or a Tag support File_N, N>0 then that Interrogator or Tag shall implement a *FileOpen*.	O, CE	Tag and Interrogator	**By design**
756	6.3.2.12.3.18	An Interrogator shall prepend an unencapsulated *FileOpen* with a frame-sync (see 6.3.1.2.8).	O, CE	Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
757	6.3.2.12.3.18	If a Tag supports the *FileOpen* command then it shall implement the file (**F**) indicator (see 6.3.2.1.3).	O, CE	Interrogator	**By design**
758	6.3.2.12.3.18	A Tag shall reply to a *FileOpen* using the *immediate* reply specified in 6.3.1.6.1.	O, CE	Tag	**By design**
759	6.3.2.12.3.18	If the Tag has an allocated file at FileNum then it shall close the currently open file, open the specified file, and reply as shown in Table 6-79.	O, CE	Tag	**By design**
760	6.3.2.12.3.18	LastFile indicates whether the just-opened file has the largest assigned FileNum; if a Tag has a FileNum larger than that of the just-opened file then it shall set LastFile to 0_2, otherwise it shall set LastFile to 1_2.	O, CE	Tag	**By design**
761	6.3.2.12.3.18	If a Tag receives a *FileOpen* specifying the currently open file then it shall leave the file open and reply as specified in Table 6-79.	O, CE	Tag	**By design**
762	6.3.2.12.3.18	If a Tag receives a *FileOpen* but does not have an allocated file at FileNum, or if User memory is untraceably hidden and the Interrogator has a deasserted Untraceable privilege, or if the Tag is otherwise unable to execute the *FileOpen*, then the Tag shall not execute the *FileOpen* and instead treat the command's parameters as unsupported (see Table C-34), reverting to the currently open file (or to no file if the Tag doesn't have any allocated files or if User memory is untraceably hidden and the Interrogator has a deasserted Untraceable privilege).	O, CE	Tag	**By design**
763	6.3.2.12.3.19	Interrogators and Tags may implement the *FileList* command; if they do, they shall implement it as shown in Table 6-80.	O	Tag and Interrogator	**By design**
764	6.3.2.12.3.19	For example, if FileNum=4 and AddlFiles=2 then the Tag shall provide information for File_4 and for the next two higher-numbered files (which may be File_5 and File_6 if the Tag manufacturer assigned file numbers sequentially or may be other files if the numbering is not sequential).	O	Tag	**By design**
765	6.3.2.12.3.19	A *FileList* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	O	Interrogator	**By design**
766	6.3.2.12.3.19	A Tag in the **open** or **secured** states that receives a *FileList* with nonzero RFU bits or that specifies FileNum=1111111111_2 (RFU FileNum) shall not execute the *FileList* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
637/ 767	6.3.2.12.3.19	An authenticated Interrogator shall encapsulate a *FileList* in a *SecureComm* or *AuthComm* (see Table 6-29).	O	Interrogator	**By design**
638/ 768	6.3.2.12.3.19	If a Tag in the **secured** state receives an unencapsulated *FileList* from an authenticated Interrogator then it shall not execute the *FileList* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
639/ 769	6.3.2.12.3.19	An Interrogator shall not specify AddlFiles=FF_h.	O	Interrogator	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
770	6.3.2.12.3.19	If a Tag receives a *FileList* with AddlFiles=FF_h then the Tag shall behave as though it had received a *FileList* with AddlFiles=FD_h.	O	Tag	**By design**
771	6.3.2.12.3.19	An Interrogator shall prepend an unencapsulated *FileList* with a frame-sync (see 6.3.1.2.8).	O	Interrogator	**By design**
772	6.3.2.12.3.19	A Tag shall reply to a *FileList* using the *in-process* reply specified in 6.3.1.6.3.	O	Tag	**By design**
773	6.3.2.12.3.19	A Tag's response shall be as shown in Table 6-81 and includes a Message for each file for which the Interrogator requested information.	O	Tag	**By design**
774	6.3.2.12.3.19	If a Tag is *static* then AvailFileSize shall be zero.	O	Tag	**By design**
775	6.3.2.12.3.19	If a Tag has more than 1022 blocks of free memory then AvailFileSize shall be 1111111111_2.	O	Tag	**By design**
776	6.3.2.12.3.19	If a Tag receives a *FileList* with an unsupported FileNum, or AddlFiles exceeds the number of files above FileNum, or User memory is untraceably hidden and the Interrogator has a deasserted Untraceable privilege, or the Tag is otherwise unable to execute the *FileList*, then the Tag shall not execute the *FileList* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
777	6.3.2.12.3.20	Interrogators and Tags may implement the *FilePrivilege* command; if they do, they shall implement it as shown in Table 6-83.	O	Tag and Interrogator	**By design**
778	6.3.2.12.3.20	A *FilePrivilege* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	O	Interrogator	**By design**
779	6.3.2.12.3.20	A Tag in the **secured** state that receives a *FilePrivilege* with nonzero RFU bits shall not execute the *FilePrivilege* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
780	6.3.2.12.3.20	An authenticated Interrogator shall encapsulate a *FilePrivilege* in a *SecureComm* or *AuthComm* (see Table 6-29).	O	Interrogator	**By design**
781	6.3.2.12.3.20	If a Tag in the **secured** state receives an unencapsulated *FilePrivilege* from an authenticated Interrogator then it shall not execute the *FilePrivilege* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
782	6.3.2.12.3.20	A Tag shall execute a *TagPrivilege* according to Table 6-82 which specifies, for each Action value, the privilege assignment that the Tag makes (if any), the fields in the *FilePrivilege* that the Tag ignores, the required Tag or file privilege to perform the requested operation, and the reply that the Tag backscatters.	O	Tag	**By design**
783	6.3.2.12.3.20	Upon receiving an executable *FilePrivilege* with Action=001_2, 011_2, 101_2, or 111_2 a Tag shall overwrite the current file privilege(s) with the new privilege.	O	Tag	**By design**
784	6.3.2.12.3.20	If the Tag does not write the new privilege successfully then it shall revert to the prior stored privilege.	O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
785	6.3.2.12.3.20	An Interrogator shall prepend an unencapsulated *FilePrivilege* with a frame-sync (see 6.3.1.2.8).	O	Interrogator	**By design**
786	6.3.2.12.3.20	A Tag's response to the *FilePrivilege*, for incorporation into the *in-process* reply specified in 6.3.1.6.3, shall be as shown in Table 6-84.	O	Tag	**By design**
787	6.3.2.12.3.20	If a Tag receives a *FilePrivilege* that it cannot execute because the access password or key the Interrogator supplied has insufficient privileges, or the *FilePrivilege* contains an unsupported KeyID, or privilege is an RFU value, or User memory is untraceably hidden and the Interrogator has a deasserted Untraceable privilege, or the Tag is otherwise unable to execute the *FilePrivilege*, then the Tag shall not execute the *FilePrivilege* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
788	6.3.2.12.3.21	Interrogators and Tags may implement the *FileSetup* command; if they do, they shall implement it as shown in Table 6-85.	O	Tag and Interrogator	**By design**
789	6.3.2.12.3.21	A *FileSetup* contains 2 RFU bits. An Interrogator shall set these bits to 00_2.	O	Interrogator	**By design**
790	6.3.2.12.3.21	A Tag in the **secured** state that receives a *FileSetup* with nonzero RFU bits shall not execute the *FileSetup* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
791	6.3.2.12.3.21	A Tag shall only execute a *FileSetup* issued by an Interrogator with a file superuser privilege (see 6.3.2.11.3).	O	Tag	**By design**
792	6.3.2.12.3.21	An authenticated Interrogator shall encapsulate a *FileSetup* in a *SecureComm* or *AuthComm* (see Table 6-29).	O	Interrogator	**By design**
793	6.3.2.12.3.21	If a Tag in the **secured** state receives an unencapsulated *FileSetup* from an authenticated Interrogator then it shall not execute the *FileSetup* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
794	6.3.2.12.3.21	A *static* Tag that supports the *FileSetup* command shall permit an Interrogator with the file superuser privilege to modify a file's type but never its size.	O	Tag	**By design**
795	6.3.2.12.3.21	A *static* Tag shall write the FileType in a *FileSetup* as the file's new type and shall ignore FileSize.	O	Tag	**By design**
796	6.3.2.12.3.21	A *dynamic* Tag shall permit an Interrogator with the file superuser privilege to modify a file's type and size.	O	Tag	**By design**
797	6.3.2.12.3.21	When increasing a file's size a *dynamic* Tag shall only allocate "free" memory (i.e. memory not currently allocated to another file) to the resized file.	O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
798	6.3.2.12.3.21	Regardless of whether a Tag is *static* or *dynamic*, after executing a *FileSetup* a Tag's response shall include both FileType and FileSize (even if the Tag made no changes to either one). See Table 6-86.	O	Tag	**By design**
799	6.3.2.12.3.21	An Interrogator shall prepend an unencapsulated *FileSetup* with a frame-sync (see 6.3.1.2.8).	O	Interrogator	**By design**
800	6.3.2.12.3.21	A Tag's response to the *FileSetup*, for incorporation into the *in-process* reply specified in 6.3.1.6.3, shall be as shown in Table 6-86.	O	Tag	**By design**
801	6.3.2.12.3.21	If a Tag receives a *FileSetup* that it cannot execute because the access password or key that the Interrogator most recently supplied does not have a file superuser privilege, or User memory is untraceably hidden and the Interrogator has a deasserted Untraceable privilege, or the Tag is otherwise unable to execute the *FileSetup*, then the Tag shall not execute the *FileSetup* and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
802	6.3.2.12.3.21	If a *dynamic* Tag is unable to execute the FileSize in the *FileSetup* command then it shall not execute any portion of the *FileSetup* (i.e. it shall not change the FileType) and instead treat the command's parameters as unsupported (see Table C-34).	O	Tag	**By design**
803	8.1	In case an Interrogator or Tag supports any command, response or feature of Clause 8 then this Interrogator or Tag shall support all mandatory commands, responses or features and it may support all optional commands, responses or features of Clause 8.	O	Tag and Interrogator	**By design**
804	8.2	A Tag with sensor support shall implement XPC_W1 (see 6.3.2.1.2.5) and shall utilize the Sensor Alarm indicator (**SA**) bit 214_h in XPC_W1 (see 6.3.2.1.2.5) for the sensor interface and/or be as specified by one or more of the three classes of sensor supported by this protocol and summarized in this subclause	O	Tag	**By demonstration** Issue a *Read* command to read XPC_W1 in EPC memory and verify there is no error code. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
805	8.2	A Tag having a Simple Sensor shall be implemented only in BAP Tags and shall have a Real Time Clock (RTC) to support sensor operations. Simple Sensors are defined in 8.5.	O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
806	8.2	A Tag having a Full Function Sensor shall only be implemented in BAP Tags and shall have a Real Time Clock (RTC) to support sensor operations.	O	Tag	**By design**
807	8.2	If a Tag has sensor support for any of the sensor classes then the **XI** bit of the EPC memory shall be asserted and XPC_W1 shall be supported, see also 6.3.2.1.2.	O	Tag	**By demonstration** Issue a *Read* command to read StoredPC in EPC memory. Verify that the Tag backscatters a response with **XI**=1_2. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2
808	8.2	If a violation of at least one alarm condition in at least one of the attached sensors occurs, then the Sensor Alarm indicator (**SA**) bit 214_h shall be set to 1_2 in XPC_W1 (see 6.3.2.1.2.5).	O	Tag	**By design**
809	8.2	Each sensor shall be fully compliant with the class of sensor.	O	Tag	**By design**
810	8.5	If a Tag implements a Simple Sensor then the Simple Sensor indicator (**SS**) bit 215_h shall be set to 1_2 in XPC_W1 (see 6.3.2.1.2.5).	O	Tag	**By demonstration** Issue an *ACK* command. Verify that the Tag backscatters a valid response including XPC_W1 with **SS**=1_2. *Test conditions:* Temp: +23 °C ± 3 °C Freq: 860, 895, and 930 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: 8 TRext: 1_2

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
811	8.6	If a Tag implements a Full Function Sensor then the Full Function Sensor indicator (**FS**) bit 216_h shall be set to 1_2 in XPC_W1 (see 6.3.2.1.2.5).	O	Tag	**By demonstration** Issue an *ACK* command. Verify that the Tag backscatters a valid response including XPC_W1 with **FS**=1_2. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860, 895, and 930 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: 8 TRext: 1_2
812	8.7.1	If a Tag implements a Snapshot Sensor then the Snapshot Sensor indicator (**SN**) bit 217_h shall be set to 1_2 in XPC_W1 (see 6.3.2.1.2.5).	O	Tag	**By demonstration** Issue an *ACK* command. Verify that the Tag backscatters a valid response including XPC_W1 with **SN**=1_2. *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: 860, 895, and 930 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: 8 TRext: 1_2
813	8.7.1	Any Snapshot Sensor implemented shall be in accordance to Table 8-1 and Table 8-2.	O	Tag	**By design**
814	8.7.2	A tag shall support at least one of the defined methods to initiate a Snapshot Sensor measurement and it may support more than one of the defined methods.	O	Tag	**By design**
815	8.7.2	Tag initiated during its power-up sequence and the sensor measurement typically occurs during T_{sp} (see Table 6-6) and the Snapshot Sensor information shall be available starting with the first inventory round which includes the Tag.	O	Tag	**By design**
816	8.7.2	The sensor measurement occurs during T_4 (see Table 6-16) and the Snapshot Sensor information shall be available starting with the next inventory round which includes the Tag if it remains energized.	O	Tag	**By design**
817	8.7.2	The sensor measurement occurs during T_5 (see Table 6-16) and the Snapshot Sensor information shall be available for a subsequent *Read* of XPC_W2 and/or starting with the next inventory round which includes the Tag.	O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
818	8.7.2 Table 8-4	Bit 220_h of XPC_W2: **When used by *Select* command:** 0: A Tag shall not initiate measurements for any Selected Sensors. 1: A Tag shall initiate a measurement for all Selected Sensors that are implemented by the Tag and if this method is supported by the selected Snapshot Sensor. **When used by *Write* command or *BlockWrite* command:** 0: Vendor defined command. 1: A Tag shall initiate a measurement for all Selected Sensors that are implemented by the Tag and only if this method is supported by the selected Snapshot Sensor.	O	Interrogator	**By design**
819	8.7.2 Table 8-4	Bits 221_h-$22F_h$ of XPC_W2: **When used by *Select* command:** A Tag shall be considered matching when any of the Selected Sensor types are implemented on the Tag. A Tag shall be considered non-matching if either there are no selected Sensor Types or none of the Selected Sensor types are implemented on the Tag. **When used by *Write* command or *BlockWrite* command:** If Sensor Command = 0 then it is a vendor defined command and the meaning of these bits are vendor defined. If Sensor Command = 1 then a Tag shall initiate a measurement for all Selected Sensors that are implemented by the Tag and only if this method is supported by the selected Snapshot Sensor.	O	Interrogator	**By design**
820	8.7.3	A Tag shall convert its sensor measurements accordingly to report its Snapshot Sensor information using the defined format based on the sensor type in Table 8-2.	O	Tag	**By design**
821	8.7.3	A Tag shall also report when a measurement error occurs using the defined value in Table 8-2 for the sensor type.	O	Tag	**By design**
822	8.7.3	A Tag shall report Snapshot Sensor information to an Interrogator via XPC_W2.	O	Tag	**By demonstration** Issue a *Read* command to read XPC_W2 in EPC memory and verify there is no error code. *Test conditions:* Temp: +23 °C ± 3 ºC Freq: 860, 895, and 930 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: 8 TRext: 1_2

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
823	8.7.3	Consequently, the Tag shall set **XEB** = 0_2 when Snapshot Sensor information is not available meaning that XPC_W2 = 0000_h, and the Tag shall set **XEB** = 1_2 when Snapshot Sensor information is available meaning that XPC_W2 ≠ 0000_h.	O	Tag	**By design**

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824	8.7.3	Snapshot Sensor information in XPC_W2 shall use the following formats: ■ XPC_W2 = (sensor type || sensor data) as defined in Table 8-1. This format is used for reporting a sensor measurement from only one Snapshot Sensor and the sensor type must be in the range 0000_2 to 1011_2. An example for this type of reporting is the following: □ XPC_W1 = 8100_h indicating a Snapshot Sensor Tag with sensor information available □ XPC_W2 = 1190_h indicating a temperature sensor with a measurement of 25°C ■ XPC_W2 = (11_2 || Memory Bank || Word Address). This format is used for reporting sensor measurements from a multi-dimension sensor, or a multi-sensor Tag, or when one or more sensors provides additional vendor defined supplemental data. An Interrogator may obtain the Snapshot Sensor information using a *Read* command with MemBank = Memory Bank, WordPtr = Word Address converted to EBV format, and WordCount = 00_h. The Snapshot Sensor information consists of a sequence of words, each having the format (sensor type || sensor data) as defined in Table 8-1. The sequence of words is terminated with a null value = 0000_h which does not correspond to any valid value for (sensor type || sensor data). Sensor type = 1111_2 is reserved for a Tag to include optional vendor defined supplemental data for a Snapshot Sensor. The supplemental data consists of a sequence of words and the number of data words is specified following the sensor type, i.e. (sensor type = 1111_2 || number of data words). An example for this type of reporting is the following: □ XPC_W1 = 8100_h indicating a Snapshot Sensor Tag with sensor information available. □ XPC_W2 = $E100_h$ indicating sensor data is in TID memory starting at word address 100_h. □ TID word 100_h = 1190_h indicates a temperature sensor with measurement of 25°C. □ TID word 101_h = $F002_h$ indicates 2 words follow of supplemental data for the temperature sensor. □ TID word 102_h = 1234_h is supplemental data word #1 for the temperature sensor. □ TID word 103_h = 5678_h is supplemental data word #2 for the temperature sensor. □ TID word 104_h = 2500_h indicates a relative humidity sensor with measurement of 80 %. □ TID word 105_h = 0000_h is the null value terminator indicating the end of sensor data.	O	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
825	Annex A	Although a general EBV may contain blocks of varying lengths, Tags and Interrogators manufactured according to this specification shall use blocks of length 8 bits (EBV-8).	M	Tag and Interrogator	**By design**
826	Annex A	Tags and Interrogators shall use the EBV-8 word format specified in Table A-1.	M	Tag and Interrogator	**By design**
827	Annex B	State-transition tables B.1 to B.7 shall define a Tag's response to Interrogator commands.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
828	Table B.1	"Invalid" shall mean a command not recognizable by the Tag such as (1) an erroneous command (example: a command with an incorrect Length field), (2) a command with a CRC error, or (3) an unsupported command.		--	Definition. Not verified.
829	Table B.2	"Invalid" shall mean a command not recognizable by the Tag such as (1) an erroneous command (example: a command with an incorrect Length field), (2) a command with a CRC error, or (3) an unsupported command.		--	Definition. Not verified.
830	Table B.3	"Invalid" shall mean a command not recognizable by the Tag such as (1) an erroneous command (example: a command with an incorrect Length field), (2) a command with a CRC error, or (3) an unsupported command.		--	Definition. Not verified.
831	Table B.4	"Invalid" shall mean a command not recognizable by the Tag such as (1) an erroneous command (example: a command with an incorrect Length field), (2) a command with a CRC error, or (3) an unsupported command.		--	Definition. Not verified.
832	Table B.5	"Unsupported parameters" shall mean an access command with a correct handle and CRC and that is recognizable by the Tag but contains or specifies (1) a nonzero or incorrect RFU value; (2) an unsupported WordPtr, BitCount, SenRep or CSI; (3) an encapsulated command that is unsupported or disallowed; (4) an unsupported or incorrect memory bank, memory location, address range, or FileNum; (5) a hidden or locked memory bank or location; (6) an unsupported file or files; (7) a command that requires encapsulation but is nonetheless unencapsulated (see Table 6-29); (8) a *delayed* or *in-process* reply and the specified operation causes the Tag to encounter an error; (9) an operation for which the Interrogator has insufficient privileges; (10) an unsupported cryptographic parameter; or (11) other parameters not supported by the Tag.		--	Definition. Not verified.

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
833	Table B.5	"Incorrect handle" shall mean (1) an *ACK* command with incorrect handle or (2) access command with a correct CRC and that is recognizable by the Tag but has an incorrect handle. The cryptographic suite indicated by CSI in the prior *Challenge* or *Authenticate* command may specify that a Tag reset its cryptographic engine upon receiving a security command with an incorrect handle.		--	Definition. Not verified.
834	Table B.5	"Improper" shall mean a command (except *Req_RN*, *Query*, or *QueryX*) that is recognizable by the Tag but is interspersed between successive *Kill* or *Access* commands in a password-based *Kill*- or *Access*-command sequence, respectively (see Figure 6-26 and Figure 6-28).		--	Definition. Not verified.
835	Table B.5	"Invalid" shall mean a command not recognizable by the Tag such as (1) an erroneous command (example: a command with an incorrect Length field or a *BlockWrite*/*BlockErase* with a zero-valued WordCount), (2) a command with a CRC error, (3) an unsupported command, or (4) a *Write* command for which the immediately preceding command was not a *Req_RN*. The cryptographic suite indicated by CSI in the prior *Challenge* or *Authenticate* command may specify that a Tag reset its cryptographic engine upon receiving an invalid command.		--	Definition. Not verified.
836	Table B.6	"Unsupported parameters" shall mean an access command with a correct handle and CRC and that is recognizable by the Tag but contains or specifies (1) a nonzero or incorrect RFU value; (2) an unsupported WordPtr, BitCount, SenRep or CSI; (3) an encapsulated command that is unsupported or disallowed; (4) an unsupported or incorrect memory bank, memory location, address range, lock payload, blockpermalock payload, KeyID, or FileNum; (5) a hidden or locked memory bank or location; (6) an unsupported file or files; (7) insufficient or unallocateable memory; (8) an unencrypted Message that requires encryption; (9) a command that requires encapsulation but is nonetheless unencapsulated (see Table 6-29); (10) a *delayed* or *in-process* reply and the specified operation causes the Tag to encounter an error; (11) an RFU privilege value; (12) an operation for which the Interrogator has insufficient privileges; (13) an unsupported cryptographic parameter; or (14) other parameters not supported by the Tag.		--	Definition. Not verified.
837	Table B.6	"Incorrect handle" shall mean an *ACK* or access command with a correct CRC and that is recognizable by the Tag but has an incorrect handle. The default next state is **secured**, but the cryptographic suite indicated by CSI in the prior *Challenge* or *Authenticate* command may specify that a Tag reset its crypto engine and transition to the **open** state upon receiving a security command with an incorrect handle.		--	Definition. Not verified.

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
838	Table B.6	"Improper" shall mean a command (except *Req_RN*, *Query*, or *QueryX*) that is recognizable by the Tag but is interspersed between successive *Kill* or *Access* commands in a password-based *Kill*- or *Access*-command sequence, respectively (see Figure 6-26 and Figure 6-28).		--	Definition. Not verified.
839	Table B.6	"Invalid" shall mean a command not recognizable by the Tag such as (1) an erroneous command (example: a command with an incorrect Length field or a *BlockWrite*/*BlockErase* with a zero-valued WordCount), (2) a command with a CRC error, (3) an unsupported command, or (4) a *Write* command for which the immediately preceding command was not a *Req_RN*. The default next state is **secured**, but the cryptographic suite indicated by CSI in the prior *Challenge* or *Authenticate* command may specify that a Tag reset its cryptographic engine and transition to the **open** state upon receiving an invalid command.		--	Definition. Not verified.
840	Annex C	Command-response tables C.1 to C.30 shall define a Tag's response to Interrogator commands.	M	Tag	**By design** Tested in compliance with 6.3.2.6, Figure 6-21
841	Table C.34	"Invalid" shall mean a command not recognizable by the Tag such as (1) an erroneous command (example: a command with an incorrect Length field), (2) a command with a CRC error, or (3) an unsupported command.		--	Definition. Not verified.
842	Table C.34	"Unsupported parameters" shall mean an access command with a correct handle and CRC and that is recognizable by the Tag but contains or specifies (1) a nonzero or incorrect value in RFU parameter or RFU value used in a parameter; (2) an unsupported WordPtr, BitCount, SenRep or CSI; (3) an encapsulated command that is unsupported or disallowed; (4) an unsupported or incorrect memory bank, memory location, address range, or FileNum; (5) a hidden or locked memory bank or location; (6) an unsupported file or files; (7) a command that requires encapsulation but is nonetheless unencapsulated (see Table 6-29); (8) a *delayed* or *in-process* reply and the specified operation causes the Tag to encounter an error; (9) an operation for which the Interrogator has insufficient privileges; (10) an unsupported cryptographic parameter; or (11) other parameters or parameter values not supported by the Tag.		--	Definition. Not verified.

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
843	Table C.34	"Unsupported parameters" shall mean an access command with a correct handle and CRC and that is recognizable by the Tag but contains or specifies (1) a nonzero or incorrect value in RFU parameter or RFU value used in a parameter; (2) an unsupported WordPtr, BitCount, SenRep or CSI; (3) an encapsulated command that is unsupported or disallowed; (4) an unsupported or incorrect memory bank, memory location, address range, lock payload, blockpermalock payload, KeyID, or FileNum; (5) a hidden or locked memory bank or location; (6) an unsupported file or files; (7) insufficient or unallocatable memory; (8) an unencrypted Message that requires encryption; (9) a command that requires encapsulation but is nonetheless unencapsulated (see Table 6-29); (10) a *delayed* or *in-process* reply and the specified operation causes the Tag to encounter an error; (11) an RFU privilege value; (12) an operation for which the Interrogator has insufficient privileges; (13) an unsupported cryptographic parameter; or (14) other parameters or parameter values not supported by the Tag.		--	Definition. Not verified.
844	Table C.34	"Incorrect handle" shall mean an access command with a correct CRC and that is recognizable by the Tag but has an incorrect handle. The cryptographic suite indicated by CSI in the prior *Challenge* or *Authenticate* command may specify that a Tag reset its cryptographic engine upon receiving a security command with an incorrect handle.		--	Definition. Not verified.
845	Table C.34	"Incorrect handle" shall mean an access command with a correct CRC and that is recognizable by the Tag but has an incorrect handle. The default next state is **secured**, but the cryptographic suite indicated by CSI in the prior *Challenge* or *Authenticate* command may specify that a Tag reset its cryptographic engine and transition to the **open** state upon receiving a security command with an incorrect handle.		--	Definition. Not verified.
846	Table C.34	"Improper" shall mean a command (except *Req_RN, Query*, or *QueryX*) that is recognizable by the Tag but is interspersed between successive *Kill* or *Access* commands in a password-based *Kill*- or *Access*-command sequence, respectively (see Figure 6-26 and Figure 6-28).		--	Definition. Not verified.
847	Table C.34	"Invalid" shall mean a command not recognizable by the Tag such as (1) an erroneous command (example: a command with an incorrect Length field or a *BlockWrite*/*BlockErase* with a zero-valued WordCount), (2) a command with a CRC error, (3) an unsupported command, or (4) a *Write* command for which the immediately preceding command was not a *Req_RN*. The cryptographic suite indicated by CSI in the prior *Challenge* or *Authenticate* command may specify that a Tag reset its cryptographic engine upon receiving an invalid command.		--	Definition. Not verified.

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
848	Table C.34	"Invalid" shall mean a command not recognizable by the Tag such as (1) an erroneous command (example: a command with an incorrect Length field or a *BlockWrite*/*BlockErase* with a zero-valued WordCount), (2) a command with a CRC error, (3) an unsupported command, or (4) a *Write* command for which the immediately preceding command was not a *Req_RN*. The default next state is **secured**, but the cryptographic suite indicated by CSI in the prior *Challenge* or *Authenticate* command may specify that a Tag reset its cryptographic engine and transition to the **open** state upon receiving an invalid command.		--	Definition. Not verified.
849	Annex G	When an Interrogator in a multiple- or dense-Interrogator environment instructs Tags to use subcarrier backscatter, the Interrogator shall adopt the channel plan for the regulatory region in which it is operating.	M	Interrogator	**By design**
850	Annex G	Interrogator signaling (both modulated and CW) shall be centered in a channel with the frequency accuracy specified in 6.3.1.2.1, unless local regulations specify tighter frequency accuracy, in which case the Interrogator shall meet the local regulations.	M	Interrogator	**By design** Tested in compliance with 6.3.1.2.1.
851	Annex G	Interrogator transmissions shall satisfy the multiple- or dense-Interrogator transmit mask in 6.3.1.2.11 (as appropriate), unless local regulations specify a tighter mask, in which case the Interrogator shall meet the local regulations.	O	Interrogator	**By design** Tested in compliance with 6.3.1.2.11.
852	Annex G	If an Interrogator uses SSB-ASK modulation, the transmit spectrum shall be centered in the channel during R=>T signaling, and the CW shall be centered in the channel during Tag backscatter.	O	Interrogator	**By demonstration** (only for Interrogators that implement SSB modulation in dense-Interrogator environments). *Test conditions:* Temp: +23 ºC ± 3 ºC Freq: At channel frequency closest to center of supported band. Power: Maximum Interrogator transmit power, as implemented. Modulation: SSB Tari: 25 µs Backscatter data rate: One or more of the dense-interrogator data rates specified in Annex G of the Protocol specification, as implemented. 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:* continuous repeated inventory sequence (no tags present)

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
853	Annex I.1	If a Tag is required to backscatter an error code then the Tag shall use one of the error codes shown in Table I-2.	M	Tag	**By design**
854	Annex I.1	If a Tag supports error-specific codes then it shall use the error-specific codes shown in Table I-2.	M	Tag	**By design**
855	Annex I.1	If a Tag does not support error-specific codes then it shall backscatter error code 00001111_2 (indicating a non-specific error) as shown in Table I-2, regardless of the error type, including cryptographic errors.	M	Tag	**By design**
856	Annex I.1	A Tag shall backscatter error codes only from the **open** or **secured** states.	M	Tag	**By design**
857	Annex I.1	A Tag shall not backscatter an error code if it receives an invalid or improper access command, or an access command with an incorrect handle.	M	Tag	**By design**
858	Annex I.1	If an error is described by more than one error code then the Tag shall backscatter only one of these error codes.	M	Tag	**By design**
859	Annex J.1	A Tag in the **arbitrate** state shall decrement its slot counter every time it receives a *QueryRep* command, transitioning to the **reply** state and backscattering an RN16 when its slot-counter value reaches 0000_h.	M	Tag	**By design**
860	Annex J.1	A Tag that returns to **arbitrate** with a slot-counter value of 0000_h shall decrement its slot-counter from 0000_h to $7FFF_h$ (i.e. the slot counter rolls over) at the next *QueryRep* with matching Session.	M	Tag	**By design**
861	Annex L.5	If **T**=0_2 then the **XI** bit may be either (i) the logical OR of bits 210_h–217_h of XPC_W1 or (ii) the logical OR of bits 210_h–218_h of XPC_W1; the Tag manufacturer shall choose whether the Tag implements (i) or (ii).	M	Tag	**By design** selected option shall be specified in the test submission
862	Annex N Table N-1	NOTE: All commands listed in Table N-1 are covered by the values in column MO in this table		Tag	**NA**
863	Annex N Table N-1	NOTE: All commands listed in Table N-1are covered by the values in column MO in this table		Interrogator	**NA**
864	Annex N Table N-1	6.3.2.1.3 an $E2_h$ class identifier and an XTID (see 4.1) are mandatory	EAS TAC TACC TACA TACF CE	Tag	**By demonstration** Tested in compliance with Item 147
865	Annex N Table N-1	6.3.2.1.3 a nonzero XTID serialization field is mandatory	EAS TAC TACC TACA TACF CE	Tag	**By demonstration** Tested in compliance with Item 147
866	Annex N Table N-1	6.3.2.1.2.5 **SLI** and **K** bits in XPC_W1 are mandatory	EAS TAC TACC TACA TACF CE	Tag	**By design**

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Item	Protocol Subclause	Requirement	MO	Applies To	How Verified
867	Annex N Table N-1	6.3.2.1.2.5 **NR** bit in XPC_W1 is mandatory	TAC TACC TACA TACF CE	Tag	**By design**
868	Annex N Table N-1	6.3.2.1.2.5 **H** bit in XPC_W1 is mandatory	CE	Tag	**By design**
869	Annex N Table N-1	6.3.2.11 a Tag shall implement the mechanisms in this protocol that prevent it from transitioning directly from the acknowledged to the secured state	EAS TAC TACC TACA TACF CE	Tag	**By design**
870	Annex N Table N-1	6.3.2.5 Security timeout for the *Access* command with a timeout range as specified in Table 6-21 is mandatory	EAS TAC TACC TACA TACF CE	Tag	**By demonstration** Apply access sequence with password $FAFA_h$. Begin access sequence after 19.9 ms and verify that tag does not accept it. Apply access sequence with password $FAFA_h$. Begin access sequence after 200.1 ms and verify that tag does accept it.
871	Annex N Table N-1	6.3.2.1.4.1 >32 bits User memory is mandatory	EAS	Tag	**By demonstration** Read at least 33 bits of user memory and verify that there is no error code
872	Annex N Table N-1	6.3.2.11.3 At least 2 files are mandatory	CE	Tag	**By demonstration** Open and read one byte of the first two files and verify that there is no error code

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Annex A
(informative)
Q&A

A.1 Scope

This annex provides additional explanation of conformance items, testing parameters, and equipment badging. Some of the questions answered here are referenced in the How Verified column of in the Protocol Requirements table in Section 7 while others relate generally to the conformance process.

The terms Reader and Interrogator are synonymous.

A.2 Q&A

Q1: How does a reader vendor specify R=>T and T=>R parameters to be tested?

A: The reader vendor specifies modulation type, PIE ratio, DR and mask type (dense, multi or single) for each Tari/Backscatter Data Rate (BDR)/encoding combination they wish to have tested in the Mode Table (Table A-1 is a sample completed table). BDR is defined as Backscatter Link Frequency (BLF) divided by M.

Field entry options are:

- Modulation types: DSB-ASK, SSB-ASK or PR-ASK
- PIE ratio: A value in the range 1.5:1 to 2:1, inclusive
- DR: 8 or 64/3
- Mask type: DI (Dense Interrogator), MI (Multi Interrogator), or SI (Single Interrogator)

The vendor enters up to six Tari's to be tested. If more than one Tari value is to be tested, the vendor must list their minimum and maximum Tari.

The same encoding/BDR values can appear more than once (note M=8, BDR=32 entries in the subcarrier and FDM DI categories in Table A-1). This is necessary if a different modulation type, PIE ratio, DR value, or mask type is to be tested for the same Tari/BDR/encoding values.

A "mode" is defined as a combination of Tari, modulation type, PIE, DR, BDR, mask type, and encoding (i.e. a particular entry in the Mode Table). For example, Table A-1 indicates six "modes" for testing.

Table A-1 Protocol Requirements

Backscatter Encoding	M	Backscatter Data Rate (kbps)	Tari (µs)					
			25	7.14	10			
FM0	1	160			PR/2:1/8			
	1	320		DS/1.5:1/8				
	1	640		DS/1.5:1/64				
Subcarrier	8	64	PR/2:1/64					
	8	32	PR/1.5:1/64					
FDM DI	8	32	PR/2:1/64					
TDM DI								

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Key:

	Dense interrogator mask met (necessary but not sufficient for DI certification)
	Multiple interrogator mask met
	Single interrogator mask met

DS	DSB-ASK
SS	SSB-ASK
PR	PR-ASK
X:1	PIE ratio
8	DR=8
64	DR=64/3

Table A-2 is a Mode Table template where VS indicates Vendor Selection, parameters to be chosen by the vendor. Limits such as >1, indicate parameter restrictions.

Table A-2 Reader Mode Table Template

Backscatter Encoding	M	Backscatter Data Rate (kbps)	Tari (µs)					
			VS max	VS min	VS	VS	VS	VS
FM0	1	VS						
	1	VS						
	1	VS						
	1	VS						
	1	VS						
	1	VS						
Subcarrier	VS >1	VS						
	VS >1	VS						
	VS >1	VS						
	VS >1	VS						
	VS >1	VS						
	VS >1	VS						
FDM DI	VS >2	VS						
	VS >2	VS						
TDM DI	VS	VS						
	VS	VS						

Parameters declared in the table are tested. The entries uniquely determine the expected RTcal and TRcal values. The test facility will derive test limits from these values.

Q2: The Mode Table is informative but contains an overwhelming amount of information. Is the HW certified or not?

A: GS1 will list a Conformance Badge for Readers and Tags. For Readers, the Conformance Badge will direct the viewer to the mode table for more detailed information. The following are examples of Reader and Tag badges.

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Figure A-1 Reader Conformance Badge Example

Reader Conformance Badge		**Options**
Reader or Module	Reader	*Reader, Module*
Intended Operating Region	US	*Intended region of operation*
Frequency Range	902 – 928 MHz	*Band of operation*
Modulation Types	PR-ASK and DSB-ASK	*PR-ASK, DSB-ASK, SSB-ASK*
Tari's	7.14 µs, 25 µs, 10 µs	*Tested Tari's*
Backscatter Encoding Support	FM0, Miller Subcarrier	*FM0, Miller Subcarrier*
Frequency Scheme	FHSS	*FHSS, Agility, Fixed*
Temperature Range	-40°C to 65°C	*Product temperature range*
Environment	Dense & Multi Interrogator	*Dense, Multi Interrogator*
Dense Operation*	FDM and TDM	*N/A, FDM, TDM*
Optional Command Support	Access, BlockWrite	*Access, BlockWrite, BlockErase*

* TDM only Dense Interrogator operators should not be used in a dense FDM deployment.

Figure A-2 Tag Conformance Badge Example

Tag Conformance Badge		**Options**
Frequency Range	860 – 930 MHz	*Band of operation*
Backscatter Modulation Type	ASK	*ASK, PSK*
Temperature Range	-40°C to 65°C	*Product temperature range*
Optional Command Support	Access, BlockWrite	*Access, BlockWrite, BlockErase*

Q3: What are the criteria for receiving a DI or MI certification? Does DI or MI certified mean the Reader meets the respective mask in all modes tested?

A: To receive DI certification the vendor shall declare himself an FDM (Frequency Division Multiplexed) and/or TDM (Time Division Multiplexed) operator. An FDM operator intends to participate in a cooperative frequency plan with other FDM operators such that Reader transmissions do not spectrally interfere with Tag backscatter signaling. A TDM operator intends to be on/off multiplexed such that two nearby Readers never transmit simultaneously. TDM DI only Readers should not be operated in an FDM DI deployment.

Criteria for getting DI certification are as follows:

1a) If FDM then test with Tari of 25 µs, PR-ASK or SSB-ASK, using a subcarrier with M=4 or 8, and declare other mode parameters

1b) If TDM then test in declared mode

2) Pass DI mask in tested mode

3) Pass channelization test (frequency accuracy)

MI certification is granted in the Conformance Badge if the MI mask is met for any one of the modes in the Mode Table; that is, at least one entry contains a yellow mark.

The vendor may choose to be tested against the DI mask in any mode. If the mask is met, this will be indicated in the Mode Table by a green mark. A mark, in itself, is not sufficient to achieve DI certification in the Conformance Badge. The other DI criteria must also be met, and if they are, a green mark will be indicated in the FDM DI or TDM DI portion of the Mode Table.

DI or MI certified does not mean the Reader meets the respective mask for all modes tested.

Q4: Can a Reader get a MI (yellow) and DI (green) mask mark at the same Tari, modulation type, PIE ratio, DR, BDR, and encoding values in the Mode Table?

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A: No, either a DI, MI, or SI mask mark is given for a particular set of these parameters. If a DI mask is met, it supercedes MI and SI, so DI credit is given (green mark). Likewise, MI supercedes SI. The vendor chooses DI, MI, or SI testing for a particular set of these parameters. The vendor has the option to move to a less stringent mask if they cannot meet the more stringent mask during test.

If at least one of the parameters listed above is unique this will appear as a separate entry in the Mode Table. Both DI and MI certification can be achieved if at least two modes are specified, and DI mask testing is performed for one and MI performed for the other. SI is not listed in the Conformance Badge unless neither the DI nor MI criteria are met.

Q5: If table entries are optional, what is the incentive for a vendor to attempt certification in multiple modes? The more modes elected, the greater possibility for failure. A vendor can get credit in the Conformance Badge by passing in just one mode. At the other extreme, test time can become excessive for vendors wishing testing at a large number of Tari's. What are the minimal and maximal test requirements?

A: Vendors are required to test at least one mode at their minimum and maximum Tari. If a Reader only supports one Tari, that Tari is tested, and it is shown in the Conformance Badge. If a Reader supports two or more Tari's, testing must occur at minimum and maximum Tari (at least two modes). The vendor can choose to get tested at up to six Tari's, at as many modulation types, PIE ratios, DR's, BDR's, and encoding values as they wish. The Conformance Badge will indicate the Tari's tested, not to exceed six values.

Q6: Numerous interrogators by demonstration items in the conformance document specify testing "At centre frequency closest to centre of supported band". What exactly does this mean?

A: The Gen2 protocol accommodates Readers from any region that regulates UHF RFID between 860 and 930 MHz Multiple operational frequency bands must therefore be supported in conformance testing. For tests in which "At centre frequency closest to centre of supported band" is specified as a test condition, the vendor declares this frequency to the testing facility according to the following criteria:

a. If the Reader is to be certified for operation in North America and supports subcarrier signalling, then the channelization must be supported, and the Reader is tested at 915.25 MHz which is the supported channel frequency closest to the centre of the band.

b. If the Reader is to be certified for operation in North America and does not support subcarrier signalling, the Reader is tested at the channel frequency closest to the band centre that the Reader supports. The vendor declares that frequency. The vendor may support a sub-band of the FCC band.

c. If the Reader is to be certified for operation in a region other than North America, the Reader is tested at the channel frequency closest to the band centre that the Reader supports. The vendor declares that frequency. The vendor may support a sub-band of the regional band.

If a Reader supports multiple regions, certification is achieved by separately testing each band according to the above guidelines.

The centre frequency definition has significance for Multi-Interrogator spectral mask testing (6.3.1.2.11, Figure 6.6). The following clarifies the procedures for Multi-Interrogator testing:

a. If the Reader is to be certified for operation in North America and supports subcarrier signalling, the spectral mask requirement (Figure 6.6) is centred at a valid channel frequency for purposes of compliance test. For the purposes of defining the testing mask, a channel is 500 kHz wide.

b. If the Reader is to be certified for operation in North America and does not support subcarrier signalling, the spectral mask is centred at the vendor declared frequency for purposes of compliance test. For the purposes of defining the test mask, a channel is a maximum of 500 kHz wide. The vendor declares the channel width.

c. If the Reader is to be certified for operation in a region other than North America, the spectral mask is centred at the vendor declared frequency for purposes of compliance test.

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For the purposes of defining the test mask, channel width is determined by local regulations and is 200 kHz for a CEPT-regulated region.

Q7: The Air Interface Standard (6.3.1.2.1) specifies that dense-interrogator testing can be limited to the minimum or maximum temperature at which the Reader supports (see Test Condition excerpt below). How does this statement affect me in conformance testing?

Test conditions:

Temp: max (–40 ºC, minimum supported temperature) and min (65 ºC, maximum supported temperature). If supported temperature range exceeds –25 ºC or 40 ºC then testing will also be performed at –25 ºC or 40 ºC respectively. All temperatures are in ºC (all ± 3 ºC)

A: The intent of this wording to provide a certification path for Readers rated for narrower or wider temperature ranges while preventing spectral pollution when they are operated outside their rated range.

The reader vendor declares their rated temperature range on the conformance application form and shows evidence in their by-design documentation that the rated temperature is specified in their product specification. The test facility tests over the declared range. If the vendor passes, the tested range is listed in the vendors Conformance Badge. It is the end users responsibility to deploy the Reader in an environment that does not exceed the tested limits.

For Readers with rated ranges beyond the –40 ºC or 65 ºC limits, testing shall also be performed at –40 ºC or 65 ºC, respectively. For Readers with rated ranges between –25 ºC and –40 ºC or between 40 ºC and 65 ºC, testing shall also be performed at –25 ºC or 40 ºC, respectively.

Q8: For purposes of testing Reader power-up settling time, what defines the end of the settling time interval? The T_{sp} settling time interval is shown in Figure 6-3a in the Gen2 protocol specification.

A: The T_{sp} interval ends when the envelope settles to within 5% of its 100% electric field strength level.

Q9: The Air Interface Standard (6.3.1.2.6 and 6.3.1.2.7) specifies that the Reader RF envelope shall rise and fall monotonically between the specified power limits. Measurement parameters are not specified, so it is feasible that a Reader can fail the monotonicity test due to measurement uncertainty. What is the test procedure that accounts for measurement uncertainty?

A: The test set recovers a time-sampled profile of the rising and falling ramp of the RF envelope. Within the regions that the monotonicity requirements apply, samples are compared to all previous samples. In the case of a falling ramp, the current sample must be less than the previous sample within the measurement tolerance of the test set. For example, if the test set power measurement error is ±2%, than the current sample cannot exceed any of the previous samples by more than 2%. The test facility shall establish the measurement accuracy of the test set.

Q10: Testing of Reader modulated RF envelope characteristics and symbol durations are specified in 6.3.1.2.3 and 6.3.1.2.5 of the Air Interface Standard. These parameters are determined based on A and B measurements as shown in Figure 6-2a and Figure 6-2b of the Air Interface Standard. In test, how is A determined?

A: In 6.3.1.2.5 of the Air Interface Standard, A is referred to as the nominal field strength of the RF envelope, measured in units of V/m or A/m. In Figure 6-2a and Figure 6-2b, A is shown as the midpoint between the maximum and minimum ripple excursions. The ripple represents inter-symbol interference associated with the band-limiting of the transmit symbols. Inter-symbol interference can case the RF envelope to exceed the maximum amplitude of an un-modulated signal with the same power. For consistency with the Air Interface Standard, the value of A in 6.3.1.2.3 and 6.3.1.2.5 shall be determined by measuring the un-modulated envelope immediately preceding modulation from the first Reader command issued after the end of the settling interval following a power-up. The test facility shall determine the optimal measurement time to establish an accurate estimate of A.

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Q11: Testing of T=>R data rates are specified in 6.3.1.3.3 for inventory rounds beginning with either a *Query* or *QueryX* command. These parameters are determined based symbol duration. For Miller 2, 4 and 8, how is the symbol duration determined?

A: For Miller 2, 4 or 8, the determination of the subcarrier period is as follow:

- Measure the time between a defined number of pulses:
  - Miller 2: 4 short pulses or 1 long and 2 short pulses (see the picture below as example)
  - Miller 4: 8 short pulses or 1 long and 6 short pulses
  - Miller 8: 16 short pulses or 1 long and 14 short pulses
- Divide the measured time by the number of subcarrier cycles (two, four or eight) to get the average subcarrier period per symbol.

The measurement must be repeated for all symbols of the tag response. From all measurements, calculate the average as well as the minimum and the maximum values.

Figure A-3 Determination of Miller subcarrier period (M=2)

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Annex B
(informative)
DUT technical information required for test submission

B.1 Introduction

This document describes the required input parameters for Gen2v3 Conformance tests, which shall be supplied for each DUT (Tag or Interrogator) additional to the following documentation:

The product vendor shall supply datasheets and other information useful for communication with the tags and operation of the tags.

The documentation shall unambiguously define the brand name, model number, firmware version, and hardware version of the DUT.

The product vendor shall mark each DUT with a clearly visible number. Furthermore, it shall provide a list containing DUT number linked to EPC memory content and TID content for each tag.

B.2 Application Conformance

This section applies for both Tag and Interrogator.

The supplied DUT supports the following applications according Annex N of the Gen 2 V3.0.0:

☒ M mandatory functionality

☐ EAS EAS functionality

☐ TAC Tag Alteration (Core) functionality

☐ TACC Tag Alteration (Core + Challenge) functionality

☐ TACA Tag Alteration (Core + Authenticate) functionality

☐ TACF Tag Alteration (Core + Full) functionality

☐ CE Consumer Electronics functionality

B.3 Command support

This section applies for both Tag and Interrogator.

The supplied DUT supports the following optional commands:

☐ *Challenge*

Does *Challenge* support Immed=0_2? ☐ Y / ☐ N

☐ *Access*

☐ *BlockWrite*

☐ *BlockErase*

☐ *BlockPermalock*

☐ *Authenticate*

Does *Authenticate* support SenRep=0_2? ☐ Y / ☐ N

☐ *AuthComm*

☐ *SecureComm*

Does *SecureComm* support SenRep=0_2? ☐ Y / ☐ N

☐ *KeyUpdate*

Does *KeyUpdate* support SenRep=0_2? ☐ Y / ☐ N

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☐ *TagPrivilege*

Does *TagPrivilege* support SenRep=0_2? ☐ Y / ☐ N

☐ *ReadBuffer*

☐ *Untraceable*

☐ *FileOpen*

☐ *FileList*

Does *FileList* support SenRep=0_2? ☐ Y / ☐ N

☐ *FilePrivilege*

Does *FilePrivilege* support SenRep=0_2? ☐ Y / ☐ N

☐ *FileSetup*

Does *FileSetup* support SenRep=0_2? ☐ Y / ☐ N

B.4 Configuration of tags

This section applies for tags only:

The product vendor shall complete the form below and/or provide a documentation containing the requested information.

- Is the Tag capable of receiving and acting on Interrogator commands within a period not exceeding the maximum settling-time interval specified in Gen2v2 (i.e. within T_s or T_{hs})? ☐ Y / ☐ N (NOTE: answer to this question will not impact Gen2v3 Tag conformance)
- Is the Kill password implemented? ☐ Y / ☐ N
- Is the Access password implemented? ☐ Y / ☐ N
- Please provide the size of each memory bank:
  - Reserved Memory: _____ bit
  - EPC Memory: _____ bit
  - TID Memory: _____ bit
  - User Memory: _____ bit
- If User Word Count (UWC) can be modified, how do you modify the UWC value? _____
- How many files are contained in the User Memory? _____
- What is the Block size for each file? _____
- If more than one file is implemented, how is the numbering (FileNum) of the files implemented? _____
- Are there any assignments of irreversible untraceability of memory regions (6.3.2.12.3.17)
- If applicable, default Tag privilege associated with access password (Gen2v3 Table 6-23) _____
- If applicable, default Tag privilege associated with each cryptographic suite's Key (Gen2v3 Table 6-24) _____
- If applicable, default File privileges (Gen2v3 Table 6-25 and Table 6-26) _____

The following information is only required if at least one Security access command is supported:

- Which Authentication is supported by the device?
  - ☐ Tag Authentication
  - ☐ Interrogator Authentication

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- ☐ Mutual Authentication

- Which ISO/IEC 29167 Cryptographic Suite is supported?
  - ☐ Part ___
  - ☐ Part ___
  - ☐ More than 2 parts: _____
- How many keys are available? _____
- Keys shall be set as follows, whereas the leading part shall be used according the key length:
  - Key 0: 0x003A 0123 4567 8901 23…
  - Key 1: 0x015C 0123 4567 8901 23…
  - Key 2: 0x023A 0123 4567 8901 23…
  - Key 3: 0x035C 0123 4567 8901 23…
  - Key nn (for even nn): 0xnn3A 0123 4567 8901 23…
  - Key nn (for odd nn): 0xnn5C 0123 4567 8901 23…
- Please specify the implementation of the key management in case necessary for testing
- If multiple Cryptographic Suites are supported, please provide information on the assignment of the available Keys to the different Cryptographic Suites.
  _____
- What is the maximum size of the ResponseBuffer? _____
- What is maximal number of backscatter transmission in case of an In-process Tag reply?
  _____

The following information is only required if one or more sensor is supported:

- Which sensor types are supported by the device?
  - ☐ Sensor Alarm only
  - ☐ Simple Sensor
  - ☐ Full-function Sensor
  - ☐ Snapshot Sensor

B.5 Configuration of Interrogators

This section applies for interrogators only:

- What is the maximal number of words the Interrogator can handle as a response to an *ACK*, *Read* or *ReadVar* command? _____

The following information is only required if at least one Security access command is supported:

- Which Authentication is supported by the device?
  - ☐ Tag Authentication
  - ☐ Interrogator Authentication
  - ☐ Mutual Authentication
- Which ISO/IEC 29167 Cryptographic Suite is supported?
  - ☐ Part ___
  - ☐ Part ___
  - ☐ More than 2 parts: _____

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