Anti-Collision Mode for Multi-Tag

For RED4S_v2.2.0 or later
For RED Utility_v4.0.0 or later

PHYCHIPS

Revision History

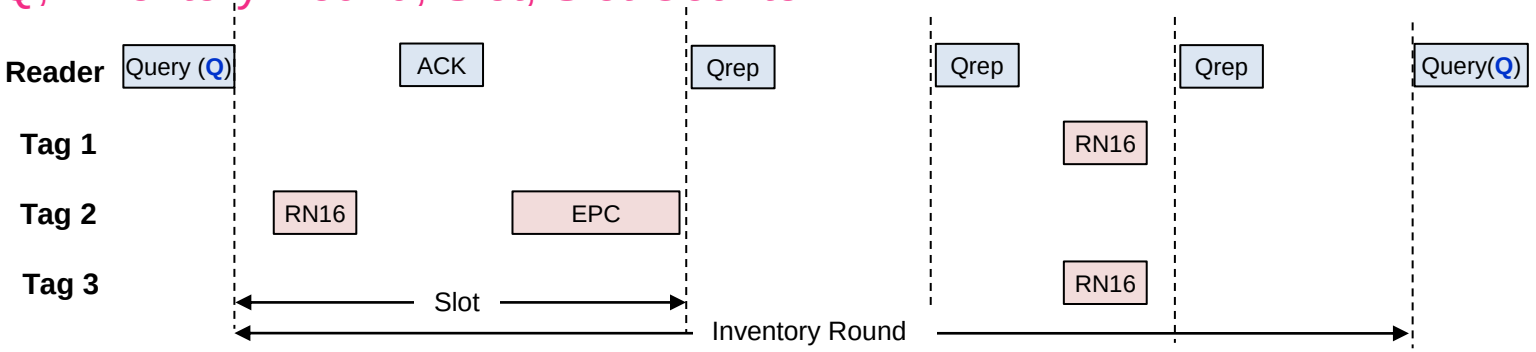
Version	Date	Description
01	2015-02-05	Initial release
02	2015-05-28	Update anti-collision
03	2015-06-11	Add anti-collision : mode2
04	2016-07-26	Update anti-collision mode
05	2016-07-28	Fix a typo
06	2018-01-08	RED4S : update anti-collision mode
07	2018-03-29	RED4S : update anti-collision mode 3
08	2019-03-27	Update anti-collision mode
09	2021-11-03	Update contents
10	2022-03-10	Fix a typo

Document Summary

- This document contains anti-collision mode for multi-tag
  - Basic theory to understand anti-collision
  - Some anti-collision modes provided by Phychips
  - The way to configure the anti-collision mode

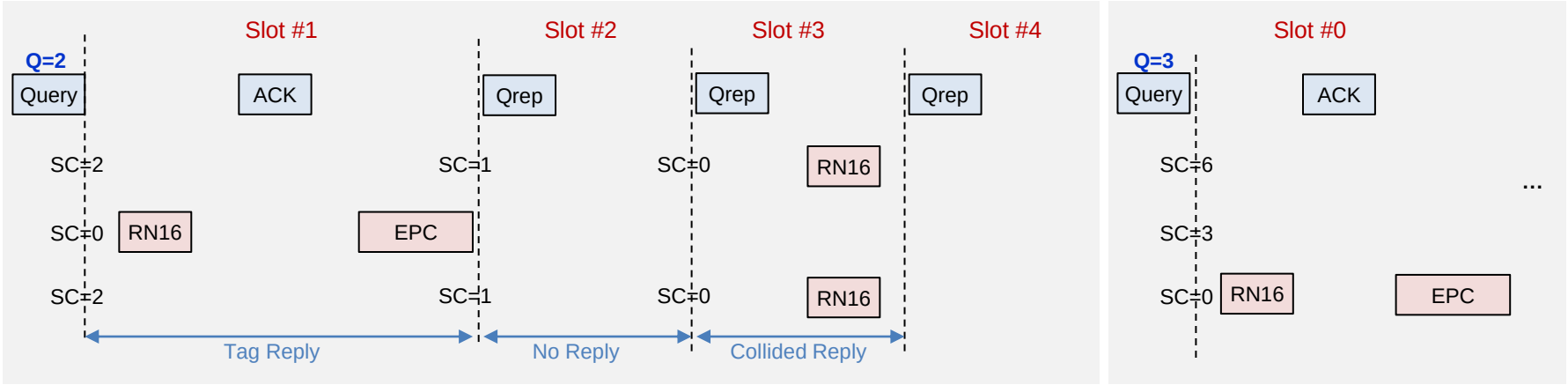
Basic – Q (1/2)

- Q, Inventory Round, Slot, Slot Counter



  - **Q** (in *Query* command)
    - To regulate the probability of Tag response
    - Range(0, 15)
  - Inventory Round
    - The period between successive *Query* commands
  - Slot
    - The point in an inventory round at which a Tag may respond
    - The number of slot depends on Q value
  - Slot Counter
    - Upon receiving a *Query* command a Tag preloads a value between 0 and 2^{Q}-1, drawn from the Tag' random number generator, into its slot counter
    - Upon receiving a *QueryRep* command a Tag shall decrement its slot counter.

Basic – Q (2/2)



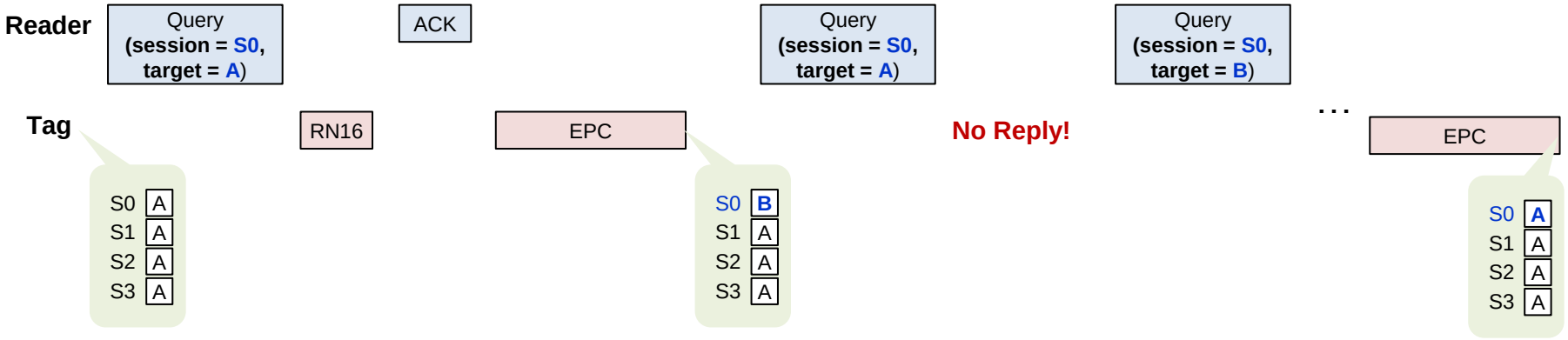
1. Reader sends *Query* command to Tag
   - ex) Q = 2

2. Tags generate random number between 0 and (2^Q-1) and preload into its slot counter
   - ex) Random number is generated between 0 and 3 (Tag1=2, Tag2=0, Tag3=2)

3. Tags decrements its slot counter whenever it receives *QueryRep* command from Reader. Tags reply *RN16* when slot counter is zero
   - ex) Tag 2 response immediately to Reader due to zero slot counter.
   - ex) The collision is occurred between Tag 1 and Tag 3 response because two Tags have same slot counter number

4. Tags generate new random number when it receive next *Query* command

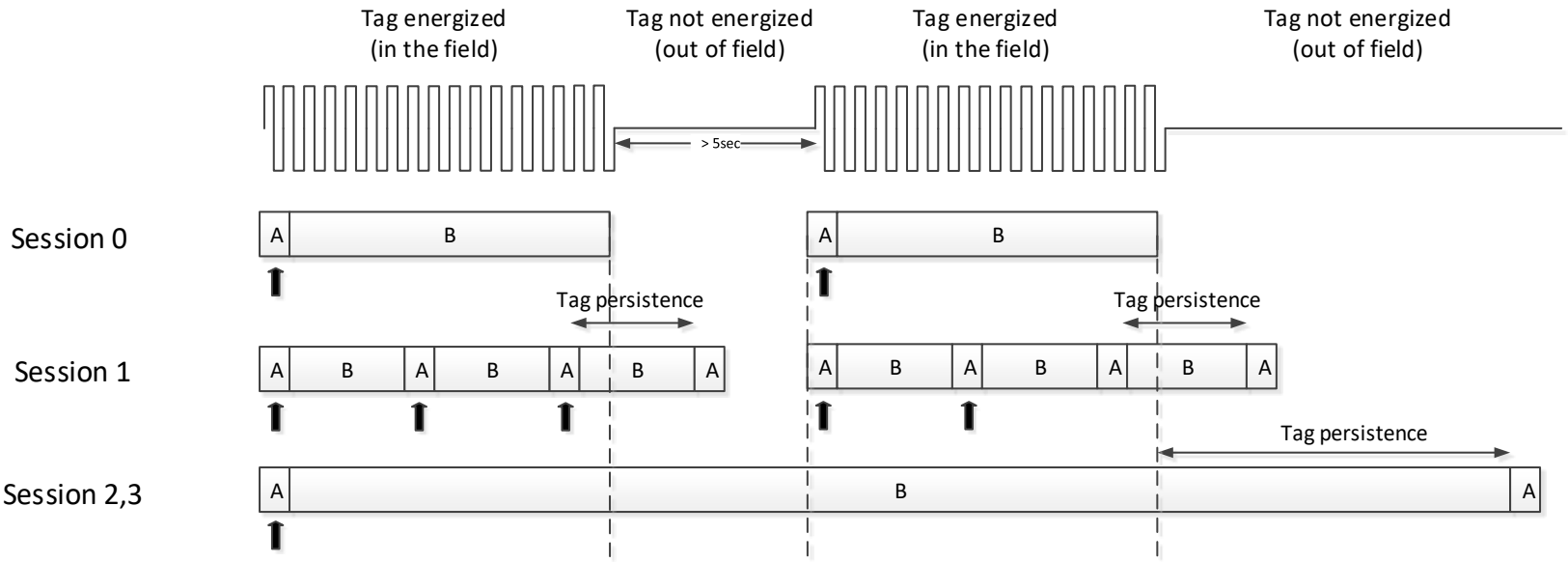
Basic – Session (1/2)



- Session
  - Tag has four session S0, S1, S2 and S3
  - Reader chooses one of four session and inventories Tags within session
  - For each session, Tags maintain a corresponding inventoried flag.

- Inventoried Flag
  - Indicates whether a Tag may respond to a Reader
  - Maintain A or B values for each of four session
  - Reader typically inventories Tags from A to B followed by a re-inventory of Tags from B back to A (or vice verse)

Basic – Session (2/2)



- Persistence Time
  - Each session has persistence time to maintain inventoried flag
  - Suppose the Reader always inventories the tag by targeting A, Tag participated in inventory round changes inventoried flag to B
  - Reader can't re-read Tag before persistence time is expired.

※ Refer to application note "[AN035-XX] Configuration of session for multi-tag" for more detail session

Anti-Collision Algorithm

- Q and session are important parameter for multi-tag!

- In case there are many tags in the field
  - The larger Q value, the collision can be reduced because the Tags less likely to generate random number
  - By using session S1, S2 or S3, the Tags that participated in inventory round is excluded next inventory round
  - Because the number of Tag that will participate next inventory round is reduced, the collision can be reduced

- In case there are small tags in the field
  - The smaller Q value, the read time can be reduced because empty slots are reduced

- Anti-Collision algorithm
  - Typically, anti-collision algorithm can be made with combination of Q and session
  - Must be applied proper algorithm for multi-tag environments

Anti-Collision Mode

RED4S only

- Phychips provides 2 anti-collision modes
  - Use Q and session parameters

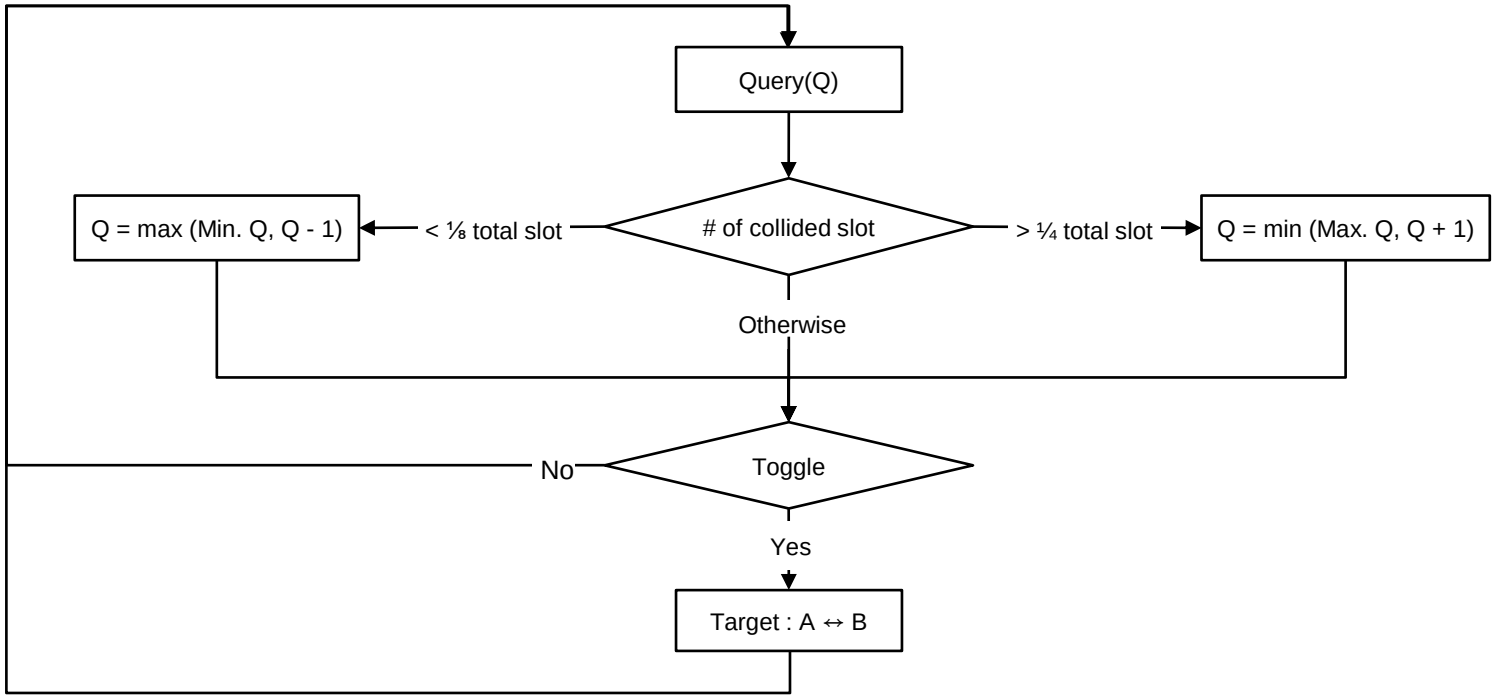
- Manual Mode
  - Fixed or Dynamic Q
  - Select Session (0 ~ 3) or SL flag
  - Select Target flag A, B or Toggle

- Multi-tag Mode
  - Dynamic Q (0 ~ 15, Start Q is 4)
  - Used the Session 1 (fixed)
  - Used target change (A→B or B →A) and QueryAdjust together according to specified algorithm

Manual Mode

RED4S only

- Manual Mode
  - Fixed or Dynamic Q : Start Q, Min. Q, Max. Q // When AutoRead operation starts, Q = Start Q
  - Select Session (0 ~ 3) or SL flag, Target flag A, B or Toggle



Configuration : Anti-Collision Mode

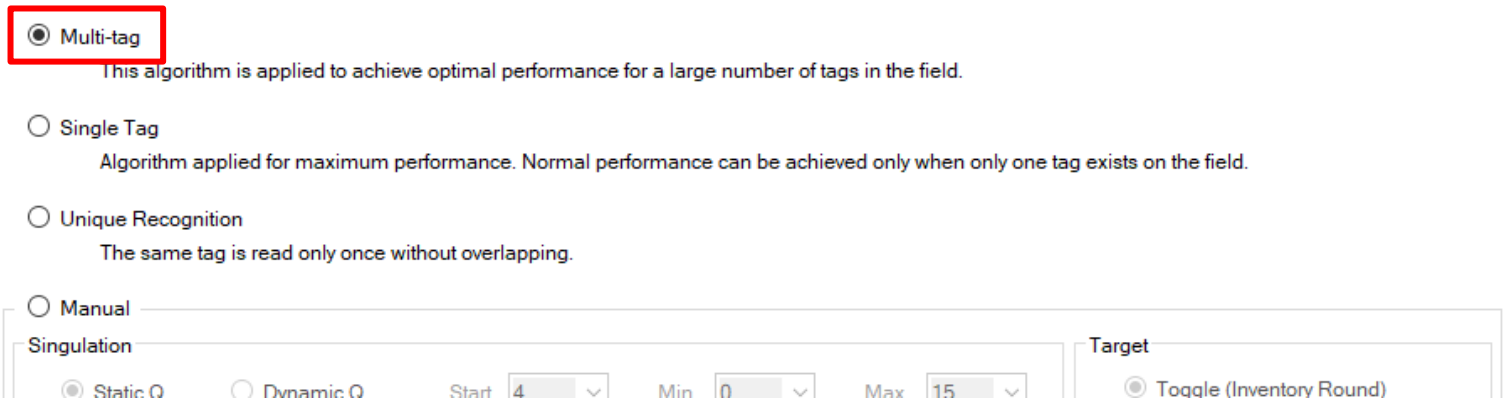
- Set Anti-Collision Mode
  - Message Type: Command (0x00)
  - Code: Set Anti-Collision Mode (0x35)
  - Arguments
    - Mode (8-bit): Manual Mode (0x00), Multi-tag Mode (0x03)

- Example) Multi-tag Mode (0x03)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Mode	End Mark	CRC-16
0xBB	0x00	0x35	0x00	0x01	0x03	0x7E	0xNNNN

* Multi-tag Mode is default (RED4S_v2.2.0 or later)

- RED Utility : on the “Inventory Settings” tab



Configuration : Query parameters (1/2)

- Set Query parameter (Session, Sel , Target, Q)
  - Message Type: Command (0x00)
  - Code: Set Type C A/I Query Parameters (0x0E)
  - Arguments
    - DR (1-bit): DR=8 (0), DR=64/3 (1)
    - M (2-bit): M=1 (00), M=2 (01), M=4 (10), M=8 (11)
    - TRext (1-bit): No pilot tone (0), Use pilot tone (1)
    - Sel (2-bit): All (00 or 01), ~SL (10), SL (11)
    - Session (2-bit): S0 (00), S1 (01), S2 (10), S3 (11)
    - Target (1-bit): A (0), B (1)
    - Q (4-bit): 0-15; the number of slots in the round.
    - Toggle (1-bit): Disable (000), Every Inventory Round (001), Every Dwell Time (010)

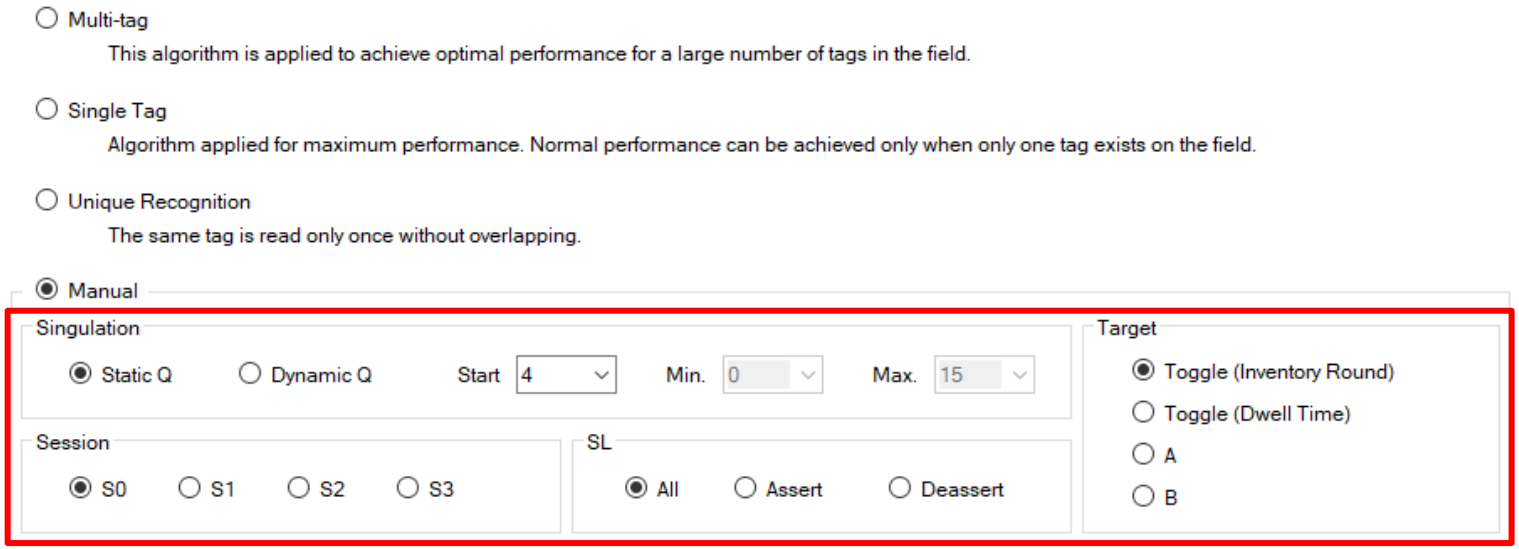
- Example) DR=8, M=1, TRext=Use pilot tone, Sel=All, Session=S0, Target=A, Q=4, No change to Q

Preamble			Msg Type	Code	PL (MSB)	PL (LSB)	DR	M	TR	Sel	S
0xBB			0x00	0x0E	0x00	0x02	0	00	1	00	00
Target	Q	Toggle	End Mark	CRC-16							
0	0100	000	0x7E	0xNNNN							

Configuration : Query parameters (2/2)

- Set Query parameter (Session, Sel , Target, Q)

  - RED Utility : on the “Inventory Settings” tab



Address information

PHYCHIPS Inc.
#104, 187 Techno 2-ro, Yuseong-gu, Daejeon, Korea (Yongsan-dong, Migun Technoworld 2), 34025
Web site : http://www.phychips.com
E-mail : sales@phychips.com
TEL : +82-42-864-2402
FAX : +82-42-864-2403