PHYCHIPS

RED RCP
2023-03-03

Reader Control Protocol
User Manual

For RED4S_v2.2.0 or later

Rev. 1.0.25 2023-03-03

Contents

1 Revision History

Version	Date	Description
1.0.0	2015.03.05	Initial Release
1.0.1	2015.05.19	Add some functions
1.0.2	2015.05.28	Modified in section 4.28 Get Anti-Collision Mode Modified in section 4.29 Set Anti-Collision Mode
1.0.3	2015.06.10	Modified in section 3.2.2 Message code field Removed in section 4.18 Start Auto Read Removed in section 4.19 Stop Auto Read Added in section 4.18 Read Type C UII TID Modified in section 4.20 Read Type C Read Long Data Modified in section 4.27 Get Anti-Collision Mode Modified in section 4.28 Set Anti-Collision Mode Added in section 5 Use Case
1.0.4	2015.07.30	Modified in section 4.3 Get Region Modified in section 4.4 Set Region
1.0.5	2015.08.03	Added in section.4.43 Get DTC Result
1.0.6	2015.11.05	Modified in section 4.18 Read Type C UII TID
1.0.7	2015.12.07	Corrected in section 2.2.1 IRQ Pin Number
1.0.8	2016.01.27	Added in section 4.52 Start Read with Fast Leakage Cal. Removed contents about Generic Transport Modified in section 4.46 Set Optimum Frequency Hopping Table Corrected in section 4.4.2 External Interrupt Pin Number
1.0.9	2016.05.13	Modified in section 3.4.1 CRC General Fixed typo error Added in section 4.39 Antenna Check
1.0.10	2016.06.15	Added error codes in section 4.52 Command failure
1.0.11	2016.09.12	Removed in section 4.32 Stop Auto Read RSSI Fixed typo error
1.0.12	2016.11.03	Fixed missing error: 4.32 Write Type C Tag Data, 4.33 BlockWrite Type C Tag Data
1.0.13	2016.12.23	Modified in section 4.30 Start Auto Read RSSI
1.0.14	2017.09.04	Modified in section 4.42 Get DTC Result
1.0.15	2018.01.03	Added in section 4.51 Get PA Gain Control (Used only in RED4S) Added in section 4.52 Set PA Gain Control (Used only in RED4S)
1.0.16	2018.02.22	Modified in section 4.53 Command Failure
1.0.17	2018.03.23	Modified in section 4.3 Get Region Modified in section 4.4 Set Region Modified in section 4.13 Set FH and LBT Parameters
1.0.18	2019.02.12	Modified in section 4.17 Read Type C UII Modified in section 4.52 Set PA Gain Mode (Used only in RED4S) Fixed typo error in 4.22 Set Session
1.0.19	2019.02.18	Removed in section 4.39 Get Temperature Modified in section 4.1 Set Reader Power Mode Fixed typo error in 4.14 Get Tx Power Level
1.0.20	2019.10.10	Modified in section 4.43 Get Registry Item Modified in section 4.52 Command Failure Fixed typo error: 4.35 BlockPermalock Type C Tag, 4.36 Kill Type C Tag, 4.41 Get DTC Result, 4.44 Set Optimum Frequency Hopping Table
1.0.21	2019.12.06	Modified in section 4.52 Command Failure
1.0.22	2019.12.06	Modified in section 4.52 Command Failure
1.0.23	2020.11.01	Modified in section 4.6 Get Type C A/I Query Parameters Modified in section 4.7 Set Type C A/I Query Parameters

		Modified in section 4.10 Get FH and LBT Parameters Modified in section 4.11 Set FH and LBT Parameters Modified in section 4.20 Get Modulation Mode Modified in section 4.21 Set Modulation Mode Modified in section 4.22 Get Anti-Collision Mode Modified in section 4.23 Set Anti-Collision Mode Modified in section 4.31 Write Type C Tag Data Added in section 4.27 Start Auto Read2 Ex Added in section 4.29 Get Frequency Information Added in section 4.39 Set Frequency Information Added in section 4.37 Get Selection Enable Added in section 4.38 Set Selection Enable Added in section 4.39 Get Multi-Antenna Sequence Added in section 4.40 Set Multi-Antenna Sequence Added in section 4.42 Get Selection Added in section 4.43 Set Selection Added Use Case to Select the Multiple Tags
1.0.24	2022.05.23	Fixed typo error
1.0.25	2023.03.03	Modified in section 4.30 Write Type C Tag Data

2 Hardware Interface

It is possible to control PR9200 through UART, SPI or I2C. The interface type could be decided in PR9200 firmware. In order to use UART interface, the user should build firmware with UART RCP option. The UART format is described in the following section 2.1. SPI format is described in the following section 2.2 and the firmware should be built with SPI RCP option. Section 2.3 describes I2C format and the firmware should be built with I2C RCP option.

2.1 UART

The UART interface assigned to one channel; Pin P00 (RXD) and Pin P01 (TXD). The data is sent least significant bit (LSB) first. Signal format of data flow is shown in the figure below. Parameters for UART communication are 8 data bit, 1 stop bit, and no parity.

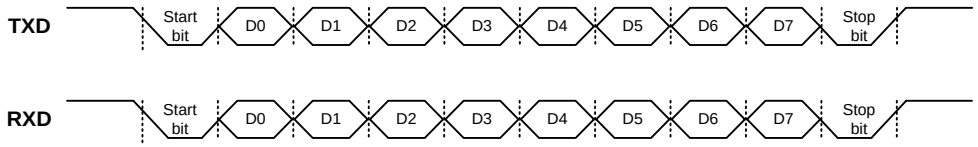


Figure 1 Serial Interface Format

2.2 SPI

PR9200 is operated as SPI slave and pins are assigned to P07 (SEL), P04 (SPI_TXD), P05 (SPI_RXD), P06 (SCK). The data is sent least significant bit (LSB) first. Signal format of data flow is shown in the figure below.

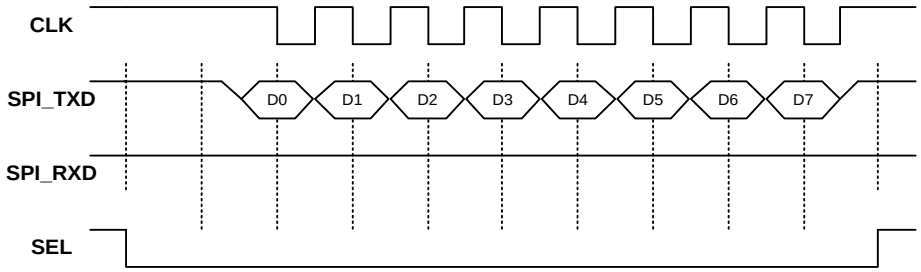


Figure 2 Master Write Mode

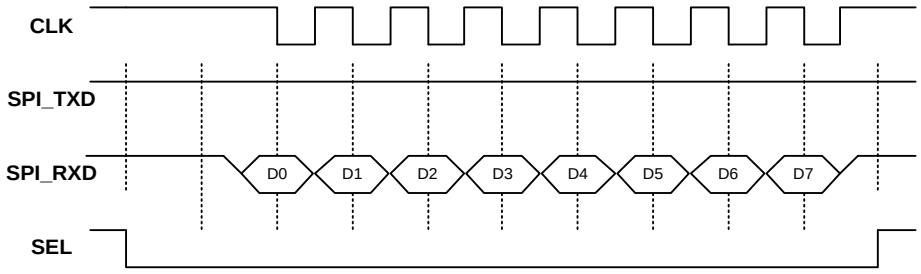


Figure 3 Master Read Mode

2.2.1 SPI Mode Switching

To switch between Master Write Mode and Master Read Mode in SPI interface, additional two bytes should be sent to PR9200. To retrieve a response and notification after the RCP command, the mode change bytes 0xBB and 0x0A are used. IRQ (P16) helps master determine time to send to mode change byte. Slave change IRQ to low when there is packet that slave response to master after command processing. When IRQ become low, Master send mode change bytes (0xBB, 0x0A) to slave. After retrieving the response, SPI interface shall be reverted to previous Master Writer Mode and IRQ return to high.

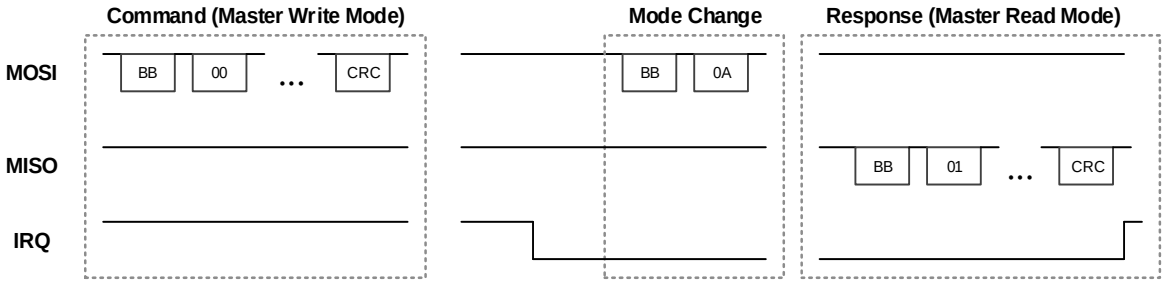


Figure 4 SPI command and response

Tag reading command should be sent to PR9200 before internal tag reading process. Finishing slave's tag reading, slave change IRQ to low. Then tag IDs could be retrieved using mode change bytes(0xBB, 0x0A). After retrieving tag IDs, SPI interface shall be reverted to previous Master Writer Mode. Also IRQ return to high.

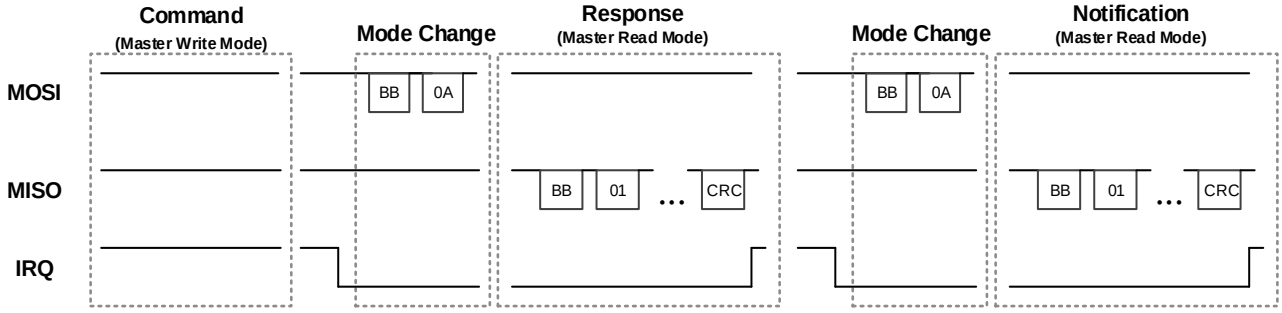


Figure 5 Reading tag IDs through SPI

2.3 I2C

PR9200 is operated as I2C slave and pins are assigned to P11 (SDA), P12 (SCK). The data is sent least significant bit (MSB) first. Signal format of data flow is shown in the figure below.

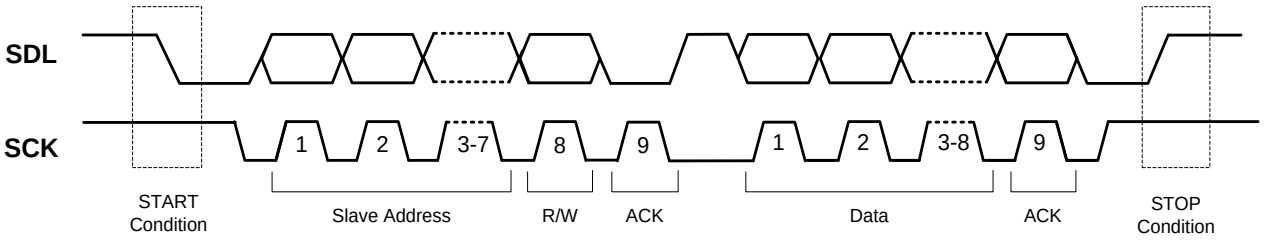


Figure 6 I2C Interface Format

2.3.1 I2C Mode Switching

I2C mode is determined according to mode bit of first byte. I2C mater sends to command and waits until IRQ become low. Slave change IRQ to low when there is packet that slave response to master after command processing.

When IRQ become low, Master receives response after switching mode bit to ‘read’. After retrieving the response, SPI interface shall be reverted to previous Master Writer Mode and IRQ return to high.

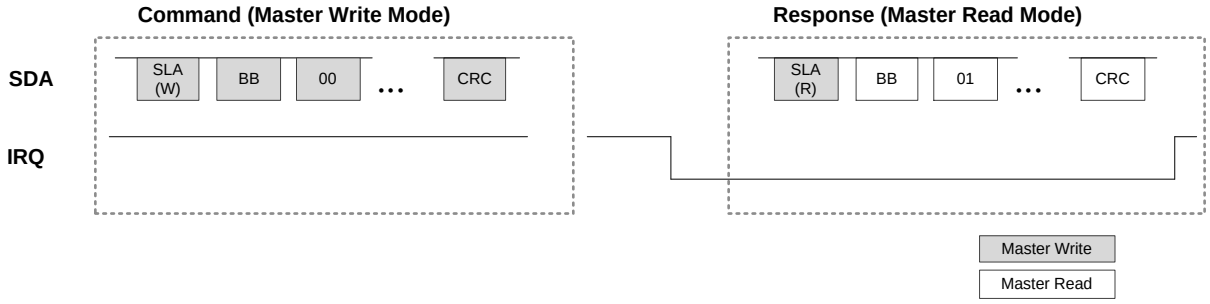


Figure 7 I2C command and response

3 RFID Reader Control Protocol overview

PR9200 UHF RFID reader is controlled through RCP(Reader Control Protocol) which is using the UART serial interface. The RCP packet format is shown in the Figure 8 below. Preamble and end mark have constant values. 0xBB is used for preamble and 0x7E is used for end mark. Header consists of 3 fields: Message Type, Code, and Payload Length. Message Type field indicates packet types; command (0x00), response (0x01), notification (0x02). Code field is used to indicate control command type or response type. Payload Length field is used to inform PR9200 about payload length. Payload contains either data or control information.

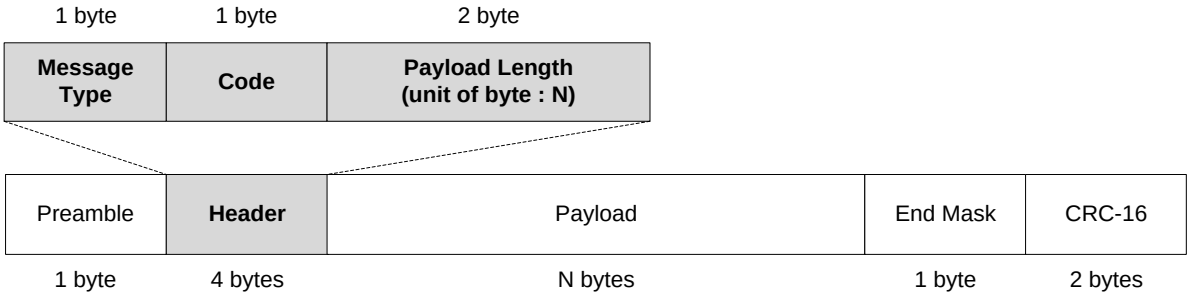


Figure 8 RCP packet format

RCP packet uses the big-endian convention. This means that high-order byte is filled first and low-order byte is filled last. In some cases, additional dummy bit 0s shall be added to pad out size of high-order byte.

3.1 Preamble and End Mark field

Preamble indicates the start of a RCP packet. Preamble has always the value 0xBB. End mark indicates the end of a RCP packet. End mark has always the value 0x7E. It is possible that a payload filed contains 0xBB or 0x7E (or both.) To tell these fields from other payload data, the header field has a payload length field.

3.2 Header Field

The header field is composed of 3 fields; message type, message codes, and payload length.

3.2.1 Message type field

The message type is used for indicating RCP packet type. Below table shows RCP packet types. Command packets are user-to-reader RCP packets. Response and notification RCP packets are reader-to-user RCP packets.

Type	Code value (HEX)
Command	0x00
Response	0x01
Notification	0x02
Reserved	0x03 to 0xFF

Table 1 Message Type

- Command and response

Command packets are used to control reader. After user sends a command packet to reader, a response packet is sent to user. All command packets have corresponding response packets.

- Notification

Unlike response packets, the notification packets are independently sent to user. In ‘Read Type C Tag ID Multiple’ mode, the notification packets have tag information and these packets are sent to user during reading round.

3.2.2 Message code field

Except for some commands, all packets may have two possible types; command and response packet. More details of using message code field follow next chapter.

Message code	Message Type	Code	UART	SPI	I²C
Set Reader Power Control	0x00 / 0x01	0x01	Yes	Yes	Yes
Get Reader Information	0x00 / 0x01	0x03	Yes	Yes	Yes
Get Region	0x00 / 0x01	0x06	Yes	Yes	Yes
Set Region	0x00 / 0x01	0x07	Yes	Yes	Yes
Set System Reset	0x00 / 0x01	0x08	Yes	Yes	Yes
Get Type C A/I Query Related Parameters	0x00 / 0x01	0x0D	Yes	Yes	Yes
Set Type C A/I Query Related Parameters	0x00 / 0x01	0x0E	Yes	Yes	Yes
Get current RF Channel	0x00 / 0x01	0x11	Yes	Yes	Yes
Set current RF Channel	0x00 / 0x01	0x12	Yes	Yes	Yes
Get FH and LBT Parameters	0x00 / 0x01	0x13	Yes	Yes	Yes
Set FH and LBT Parameters	0x00 / 0x01	0x14	Yes	Yes	Yes
Get Tx Power Level	0x00 / 0x01	0x15	Yes	Yes	Yes
Set Tx Power Level	0x00 / 0x01	0x16	Yes	Yes	Yes
RF CW signal control	0x00 / 0x01	0x17	Yes	Yes	Yes
Read Type C UII	0x00 / 0x01	0x22	Yes	Yes	Yes
Read Type C UII RSSI	0x02	0x23	Yes	Yes	Yes
Read Type C UII TID	0x00 / 0x01 / 0x02	0x25	Yes	Yes	Yes
Read Type C Tag Data	0x00 / 0x01	0x29	Yes	Yes	Yes
Get Frequency Hopping Table	0x00 / 0x01	0x30	Yes	Yes	Yes
Set Frequency Hopping Table	0x00 / 0x01	0x31	Yes	Yes	Yes
Get Modulation	0x00 / 0x01	0x32	Yes	Yes	Yes
Set Modulation	0x00 / 0x01	0x33	Yes	Yes	Yes
Get Anti-Collision Mode	0x00 / 0x01	0x34	Yes	Yes	Yes
Set Anti-Collision Mode	0x00 / 0x01	0x35	Yes	Yes	Yes
Start Auto Read2	0x00 / 0x01 / 0x02	0x36	Yes	Yes	Yes
Stop Auto Read2	0x00 / 0x01	0x37	Yes	Yes	Yes
Start Auto Read RSSI	0x00 / 0x01 / 0x02	0x38	Yes	Yes	Yes
Stop Auto Read RSSI	0x00 / 0x01	0x39	Yes	Yes	Yes
Start AutoRead2 Ex	0x00 / 0x01 / 0x02	0x3A	Yes	Yes	Yes
Get Frequency Information	0x00 / 0x01	0x44	Yes	Yes	Yes
Set Frequency Information	0x00 / 0x01	0x45	Yes	Yes	Yes
Write Type C Tag Data	0x00 / 0x01	0x46	Yes	Yes	Yes
BlockWrite Type C Tag Data	0x00 / 0x01	0x47	Yes	Yes	Yes
BlockErase Type C Tag Data	0x00 / 0x01	0x48	Yes	Yes	Yes
BlockPermalock Type C Tag	0x00 / 0x01	0x83	Yes	Yes	Yes
Kill/Recom Type C Tag	0x00 / 0x01	0x65	Yes	Yes	Yes
Set PA Gain Mode	0x00 / 0x01	0x66	Yes	Yes	Yes
Get PA Gain Mode	0x00 / 0x01	0x67	Yes	Yes	Yes
Lock Type C Tag	0x00 / 0x01	0x82	Yes	Yes	Yes
Get Selection Enable	0x00 / 0x01	0x8E	Yes	Yes	Yes
Set Selection Enable	0x00 / 0x01	0x8F	Yes	Yes	Yes
Get Multi-Antenna Sequence	0x00 / 0x01	0x99	Yes	Yes	Yes
Set Multi-Antenna Sequence	0x00 / 0x01	0x9A	Yes	Yes	Yes
Antenna Check	0x00 / 0x01	0xAC	Yes	Yes	Yes

Get Selection	0x00 / 0x01	0xAE	Yes	Yes	Yes
Set Selection	0x00 / 0x01	0xAF	Yes	Yes	Yes
Get RSSI	0x00 / 0x01	0xC5	Yes	Yes	Yes
Scan RSSI	0x00 / 0x01	0xC6	Yes	Yes	Yes
Get DTC Result	0x00 / 0x01	0xCA	Yes	Yes	Yes
Update Registry	0x00 / 0x01	0xD2	Yes	Yes	Yes
Get Registry Item	0x00 / 0x01	0xD4	Yes	Yes	Yes
Command Failure	0x01	0xFF	Yes	Yes	Yes
Set Optimum Frequency Hopping Table	0x00 / 0x01	0xE4	Yes	Yes	Yes
Get Frequency Hopping Mode	0x00 / 0x01	0xE5	Yes	Yes	Yes
Set Frequency Hopping Mode	0x00 / 0x01	0xE6	Yes	Yes	Yes
Get Tx Leakage RSSI Level	0x00 / 0x01	0xE7	Yes	Yes	Yes
Set Tx Leakage RSSI Level	0x00 / 0x01	0xE8	Yes	Yes	Yes
Start Read with Fast Leakage Cal.	0x00 / 0x01	0xEC	Yes	Yes	Yes
Request Fast Leakage Cal.	0x01	0xED	Yes	Yes	Yes

Table 2 Message codes

3.2.3 Payload length

The header is used to indicate the length of payload that is succeeding to payload length field. Payload length is expressed in 2 bytes.

3.3 Payload Field

Payload field contains either data or control information, depending on the packet type. For command packets, the control information is placed here. For response and notification packets, data information is placed here instead.

3.4 Cyclic Redundancy Check(CRC) Field

3.4.1 CRC General

The Command and Response use the same CRC-16 for verify a purity of message bits. The 16-bit CRC shall be calculated on all the message bits from the message type field to the end mark field. CRC doesn't include a preamble. The Polynomial used to calculate the CRC is $X^{16}+X^{12}+X^5+1$ (initial value is 0xFFFF). The resulting CRC value shall be attached to the end of the packet (after End Mark filed) and transmitted. The most significant byte shall be transmitted first. The most significant bit of each byte shall be transmitted first.

An exemplary schematic diagram for a CRC-16 circuit is shown in below figure. The polynomial used to calculate the CRC-16, $X^{16}+X^{12}+X^5+1$, is the CRC-CCITT international standard, ITU recommendation X.25.

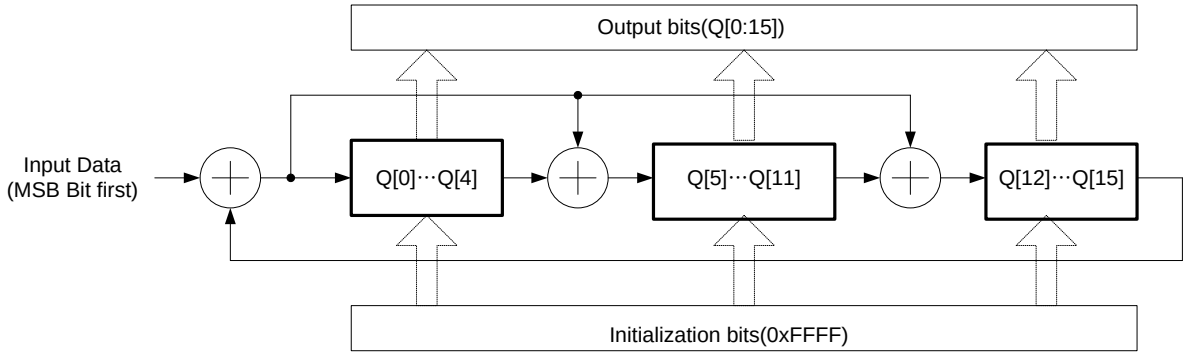


Figure 9 CRC-16 circuit

To calculate a CRC-16, first preload the entire CRC register(i.e. Q[15:0], Q15 is the MSB and Q0 is the LSB) with the value 0xFFFF. Second, clock the data bits to be encoded into the Input Data, MSB first. After clocking in all the data bits, Q[15:0] holds the CRC-16.

There are two methods to check a CRC-16

3.4.2 Inversion of incoming CRC bits by the receiving part.

First preload the entire CRC register(Q[15:0]) with the value 0xFFFF. Second, clock the received data bits into the Input Data, MSB first. Third, invert all bits of the received CRC-16, and clock the inverted CRC-16 bits into the Input Data, MSB first. The CRC-16 check passed if the value in Q[15:0]=0x1D0F

3.4.3 Non-inversion of incoming CRC bits by the receiving part.

First preload the entire CRC register(Q[15:0]) with the value 0xFFFF, then clock the received data and CRC-16 bits into the Input Data, MSB first. The CRC-16 check passed if the value in Q[15:0]=0x0000.

4 Details of Command, Response and Notification

4.1 Set Reader Power Mode

Set power mode.

4.1.1 Command

Message Type: Command (0x00)
Code: Set Reader Power Control (0x01)
Arguments
- Parameter (8-bit): SLEEP Mode (0x00)

Example) Sleep mode

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

4.1.2 Response

Message Type: Response (0x01)
Code: Set Reader Power Control (0x01)
Arguments
- Success (0x00)

Example) Success

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

*In order to change Sleep mode to Normal mode, user must use external interrupt signal, P17. While module is Sleep mode, go down pin P17 to GND(Logic low) and you can exit Sleep mode.

4.2 Get Reader Information

Get basic information from the reader.

4.2.1 Command

Message Type: Command (0x00)
Code: Get Reader Information (0x03)
Arguments
- Model (0x00)
- S/N (0x01)
- Manufacturer (0x02)
- Frequency (0x03)
- Tag Type (0x04)

Example1) Reads reader manufacturer

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x00	0x03	0x00	0x01	0x02	0x7E	0xNNNN

Example2) Reads tag type

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x00	0x03	0x00	0x01	0x04	0x7E	0xNNNN

4.2.2 Response

Message Type: Response (0x01)
Code: Get Reader Information (0x03)
Arguments
- String (variable length)

Example1) Manufacturer = PHYCHIPS

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Argument		
0xBB	0x01	0x03	0x00	0x08	0x50 (P)	0x48 (H)	0x59 (Y)
Argument					End Mark	CRC-16	
0x43 (C)	0x48 (H)	0x49 (I)	0x50 (P)	0x53 (S)	0x7E	0xNNNN	

Example2) Tag Type = ISO 18000-6 Type B(0x01), ISO 18000-6 Type C(0x02)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Argument	End Mark	CRC-16
0xBB	0x01	0x03	0x00	0x01	0x02	0x7E	0xNNNN

4.3 Get Region

Get the current region. PR9200 uses individual channel table that depends on region. List of region code follows below.

4.3.1 Command

Message Type: Command (0x00)
Code: Get Region (0x06)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x06	0x00	0x00	0x7E	0xNNNN

4.3.2 Response

Message Type: Response (0x01)
Code: Get Region (0x06)
- Korea (0x11)
- US Wide (0x21)
- US Narrow (0x22)
- Europe (0x31)
- Japan (0x41)
- China (0x52)
- Brazil (0x61)

Example) Europe

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x06	0x00	0x01	0x31	0x7E	0xNNNN

4.4 Set Region

Set the current region. PR9200 uses individual channel table that depends on region. List of region code follows below.

4.4.1 Command

Message Type: Command (0x00)
Code: Set Region (0x07)
Arguments
- Korea (0x11)
- US Wide (0x21)
- US Narrow (0x22)
- Europe (0x31)
- Japan (0x41)
- China (0x52)
- Brazil (0x61)

Example) Europe

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x00	0x07	0x00	0x01	0x31	0x7E	0xNNNN

4.4.2 Response

Message Type: Response (0x01)
Code: Set Region (0x07)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x07	0x00	0x01	0x00	0x7E	0xNNNN

4.5 Set System Reset

Set the system level reset.

4.5.1 Command

Message Type: Command (0x00)
Code: Set System Reset (0x08)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x08	0x00	0x00	0x7E	0xNNNN

4.5.2 Response

Message Type: Response (0x01)
Code: Set System Reset (0x08)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x08	0x00	0x01	0x00	0x7E	0xNNNN

4.6 Get Type C A/I Query Parameters

Get 18000-6C air interface protocol command 'Query' parameters.

4.6.1 Command

Message Type: Command (0x00)
Code: Get Type C A/I Query Parameters (0x0D)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x0D	0x00	0x00	0x7E	0xNNNN

4.6.2 Response

Message Type: Response (0x01)
Code: Get Type C A/I Query Parameters (0x0D)
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 (3-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, Toggle = Disable

Preamble			Msg Type	Code	PL (MSB)	PL (LSB)	DR	M	TR	Sel	S
0xBB			0x01	0x0D	0x00	0x02	0	00	1	00	00
T	Q	TG	End Mark	CRC-16							
0	0100	000	0x7E	0xNNNN							

4.7 Set Type C A/I Query Parameters

Set 18000-6C air interface protocol command 'Query' parameters.

4.7.1 Command

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 (3-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, Toggle=Disable

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	DR	M	TR	Sel	S
0xBB	0x00	0x0E	0x00	0x02	0	00	1	00	00

T	Q	TG	End Mark	CRC-16
0	0100	000	0x7E	0xNNNN

4.7.2 Response

Message Type: Response (0x01)
Code: Set Type C A/I Query Parameters (0x0E)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x0E	0x00	0x01	0x00	0x7E	0xNNNN

4.8 Get RF Channel

Get RF channel. This command is valid only for non-FH mode.

4.8.1 Command

Message Type: Command (0x00)
Code: Get current RF Channel (0x11)
Arguments
- None

Example) Get current RF channel

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x11	0x00	0x00	0x7E	0xNNNN

4.8.2 Response

Message Type: Response (0x01)
Code: Get current RF Channel (0x11)
Arguments
- CN (8-bit): Channel Number. The range of channel number depends on regional settings
- CNO (8-bit): Channel number offset for miller subcarrier.

Example) Channel Number = 10

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	CN	CNO	End Mark
0xBB	0x01	0x11	0x00	0x02	0x0A	0x00	0x7E

CRC-16
0xNNNN

4.9 Set RF Channel

Set RF channel. This command is valid only for non-FHSS mode.

4.9.1 Command

Message Type: Command (0x00)
Code: Set current RF Channel (0x12)
Arguments
- CN (8-bit): Channel number. The range of channel number depends on regional settings
- CNO (8-bit): Channel number offset for miller subcarrier.

Example) Channel Number = 10, Channel Number Offset = 0

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	CN	CNO	End Mark
0xBB	0x00	0x12	0x00	0x02	0x0A	0x00	0x7E

CRC-16
0xNNNN

4.9.2 Response

Message Type: Response (0x01)
Code: Set current RF Channel (0x12)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x12	0x00	0x01	0x00	0x7E	0xNNNN

4.10 Get FH and LBT Parameters

Get FH and LBT control

4.10.1 Command

Message Type: Command (0x00)
Code: Get FH and LBT Parameters (0x13)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x13	0x00	0x00	0x7E	0xNNNN

4.10.2 Response

Message Type: Response (0x01)
Code: Get FH and LBT Parameters (0x13)
Arguments
- DT (16-bit): Dwell Time (1 = 1ms)
- IT (16-bit): Idle Time (1 = 1ms)
- CST (16-bit): Carrier Sense Time (1 = 1ms)
- RFL (16-bit): Target RF power level (-dBm x 10)
- FH (8-bit): enable (0x01 or over) / disable (0x00)
- LBT (8-bit): enable (0x01 or over) / disable (0x00)
- CW (8-bit): enable (0x01) / disable (0x00)

Example) Success, FH disable, LBT enable, DT 400ms, IT 100ms, CST 10ms, RFL -630 (-63.0 dBm)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	DT (MSB)	DT (LSB)	IT (MSB)
0xBB	0x01	0x13	0x00	0x0B	0x01	0x90	0x00
IT (LSB)	CST (MSB)	CST (LSB)	RFL (MSB)	RFL (LSB)	FH	LBT	CW
0x64	0x00	0x0A	0xFD	0x8A	0x00	0x01	0x00
End Mark	CRC-16						
0x7E	0xNNNN						

4.11 Set FH and LBT Parameters

Set FH and LBT Parameters

4.11.1 Command

Message Type: Command (0x00)
Code: Set FH and LBT Parameters (0x14)
Arguments
- DT (16-bit): Dwell Time (10 ~ 40000, 1 = 1ms)
- IT (16-bit): Idle Time (0 ~ 40000, 1 = 1ms)
- CST (16-bit): Carrier Sense Time (1 ~ 1000, 1 = 1ms)
- RFL (16-bit): Target RF power level (-dBm x 10)
- FH (8-bit): enable (0x01 or over) / disable (0x00)
- LBT (8-bit): enable (0x01 or over) / disable (0x00)
- CW (8-bit): enable (0x01) / disable (0x00)

Example1) FH enable (with LBT feature), DT 400ms, IT 100ms, CST 10ms, RFL -740 (-74.0 dBm)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	DT (MSB)	DT (LSB)	IT (MSB)
0xBB	0x00	0x14	0x00	0x0B	0x01	0x90	0x00
IT (LSB)	CST (MSB)	CST (LSB)	RFL (MSB)	RFL (LSB)	FH	LBT	CW
0x64	0x00	0x0A	0xFD	0x1C	0x01	0x01	0x00
End Mark	CRC-16						
0x7E	0xNNNN						

Example2) LBT enable (with FH feature), DT 400ms, IT 100ms, CST 10ms, RFL -740 (-74.0 dBm)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	DT (MSB)	DT (LSB)	IT (MSB)
0xBB	0x00	0x14	0x00	0x0B	0x01	0x90	0x00
IT (LSB)	CST (MSB)	CST (LSB)	RFL (MSB)	RFL (LSB)	FH	LBT	CW
0x64	0x00	0x0A	0xFD	0x1C	0x01	0x02	0x00
End Mark	CRC-16						
0x7E	0xNNNN						

4.11.2 Response

Message Type: Response (0x01)
Code: Set FH and LBT Parameters (0x14)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x14	0x00	0x01	0x00	0x7E	0xNNNN

4.12 Get Tx Power Level

Get current, minimum, maximum Tx power level

4.12.1 Command

Message Type: Command (0x00)
Code: Get Tx Power Level (0x15)
Arguments
- None

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x15	0x00	0x00	0x7E	0xNNNN

4.12.2 Response

Message Type: Response (0x01)
Code: Get Tx Power Level (0x15)
Arguments
- PWR (16-bit): Current Tx Power
- Min PWR (16-bit): Min Tx Power
- Max PWR (16-bit): Max Tx Power

Example) PWR = 200 (20.0 dBm), Min PWR = 180 (18.0 dBm), Max PWR = 250 (25.0 dBm)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PWR (MSB)	PWR (LSB)	Min PWR (MSB)
0xBB	0x01	0x15	0x00	0x06	0x00	0xC8	0x00

Min PWR (LSB)	Max PWR (MSB)	Max PWR (LSB)	End Mark	CRC-16
0xB4	0x00	0xFA	0x7E	0xNNNN

4.13 Set Tx Power Level

Set current Tx power level.

4.13.1 Command

Message Type: Command (0x00)
Code: Set Tx Power Level (0x16)
Arguments
- PWR (16-bit): Tx Power

Example) PWR = 200 (20.0 dBm)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PWR (MSB)	PWR (LSB)	End Mark
0xBB	0x00	0x16	0x00	0x02	0x00	0xC8	0x7E

CRC-16
0xNNNN

4.13.2 Response

Message Type: Response (0x01)
Code: Set Tx Power Level (0x16)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x16	0x00	0x01	0x00	0x7E	0xNNNN

4.14 RF CW signal control

Turn the Continuous Wave (CW) signal on/off. This command packet is only valid for idle mode.

4.14.1 Command

Message Type: Command (0x00)
Code: RF CW signal control (0x17)
Arguments
- On (0xFF)
- Off (0x00)

Example) Turn RF CW signal on.

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x00	0x17	0x00	0x01	0xFF	0x7E	0xNNNN

4.14.2 Response

Message Type: Response (0x01)
Code: RF CW signal control (0x17)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x17	0x00	0x01	0x00	0x7E	0xNNNN

4.15 Read Type C UII

Read a EPC Block (PC + EPC).

[NOTE] Later version of RED4S_v1.x.x has two kinds of message types. it depends on the status of the R/W. When it performs the tag report and inventory simultaneously, it would be 0x02(Notification). Otherwise, when it reports after the inventory, the message type has 0x01(Response).

4.15.1 Command

Message Type: Command (0x00)
Code: Read Type C UII (0x22)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x22	0x00	0x00	0x7E	0xNNNN

4.15.2 Response

Message Type: Response (0x01)
Code: Read Type C UII (0x22)
Arguments
- EPC Block (PC + EPC)

Example) PC = 0x3000, EPC = 0xE2003411B802011383258566

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PC (MSB)	PC (LSB)	EPC (MSB)
0xBB	0x01	0x22	0x00	0x0E	0x30	0x00	0xE2
0x00	0x34	0x11	0xB8	0x02	0x01	0x13	0x83
		EPC (LSB)	End Mark	CRC-16			
0x25	0x85	0x66	0x7E	0xNNNN			

4.15.3 Notification

Message Type: Notification (0x02)
Code: Read Type C UII (0x22)
Arguments
- EPC Block (PC + EPC)

Example) PC = 0x3000, EPC = 0xE2003411B802011383258566

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PC (MSB)	PC (LSB)	EPC (MSB)
0xBB	0x02	0x22	0x00	0x0E	0x30	0x00	0xE2
0x00	0x34	0x11	0xB8	0x02	0x01	0x13	0x83
		EPC (LSB)	End Mark	CRC-16			
0x25	0x85	0x66	0x7E	0xNNNN			

4.16 Read Type C UII TID

Start an automatic tag read operation, tag IDs with TID are sent back to user though notification packet.

4.16.1 Command

Message Type: Command (0x00)
Code: Read Type C UII TID (0x25)
Arguments
- MTNU: maximum number of tags to read
- MTIME: maximum elapsed time to tagging (sec)
- RC (16-bit): Repeat cycle (how many times reader perform inventory round).

Example) MTNU = 0, MTIME = 0, Repeat Cycle = 100

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	MTNU	MTIME	RC(MSB)
0xBB	0x00	0x25	0x00	0x04	0x00	0x00	0x00
RC(LSB)	End Mark	CRC-16					
0x64	0x7E	0xNNNN					

4.16.2 Response

Message Type: Response (0x01)
Code: Read Type C UII TID (0x25)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x25	0x00	0x01	0x00	0x7E	0xNNNN

4.16.3 Notification

Message Type: Notification (0x02)
Code: Read Type C UII TID (0x25)
Arguments
- EPC Block (PC + EPC)
- TID Block (Variable)

Example) PC = 0x3000, EPC = 0xE2003411B802011383258566, TID = 0xE2003411B8020113

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PC(MSB)	PC(LSB)	EPC (MSB)
0xBB	0x02	0x25	0x00	0x16	0x30	0x00	0xE2
0x00	0x34	0x11	0xB8	0x02	0x01	0x13	0x83
		EPC (LSB)	TID (MSB)				
0x25	0x85	0x66	0xE2	0x00	0x34	0x11	0xB8
		TID (LSB)	End Mark	CRC-16			
0x02	0x01	0x13	0x7E	0xNNNN			

Message Type: Notification (0x02)
Code: Read Type C UII TID (0x25)
Arguments
- Read complete (0x1F)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x02	0x25	0x00	0x01	0x1F	0x7E	0xNNNN

4.17 Read Type C Tag Data

Read Type C tag data from specified memory bank.

4.17.1 Command

Message Type: Command (0x00)
Code: Read Type C Tag Memory (0x29)
Arguments
- AP (32-bit): Access Password if target memory bank was password protected. Otherwise, set AP filled to 0x00000000.
- UL (16-bit): Target tag's EPC length
- EPC (variable): Target tag's EPC
- MB (8-bit): Target memory bank; RFU (0x00), EPC (0x01), TID (0x02), User (0x03)
- SA (16-bit): Starting Address word pointer
- DL (16-bit): Data Length (Word Count)

Note: The Read Type C Tag Data command supports maximum 128 word.

Example)
Access Password = 0x00000000, UL = 12 (0x0C) byte,
EPC = 0xE2003411B802011526370494, Target memory bank = RFU, Start Address = 0x0000, Length = 4 word

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	AP (MSB)		
0xBB	0x00	0x29	0x00	0x17	0x00	0x00	0x00
AP (LSB)	UL (MSB)	UL (LSB)	EPC (MSB)				
0x00	0x00	0x0C	0xE2	0x00	0x34	0x11	0xB8
						EPC (LSB)	MB
0x02	0x01	0x15	0x26	0x37	0x04	0x94	0x00
SA (MSB)	SA (LSB)	DL (MSB)	DL (LSB)	End Mark	CRC-16		
0x00	0x00	0x00	0x04	0x7E	0xNNNN		

4.17.2 Response

Message Type: Response (0x01)
Code: Read Type C Tag Memory (0x29)
Arguments
- Tag memory contents (variable)

Example) RFU memory bank = 0x0000000000000000

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Tag Mem (MSB)		
0xBB	0x01	0x29	0x00	0x08	0x00	0x00	0x00
				Tag Mem (LSB)	End Mark	CRC-16	
0x00	0x00	0x00	0x00	0x00	0x7E	0xNNNN	

4.18 Get Frequency Hopping Table

Get current frequency hopping table.

4.18.1 Command

Message Type: Command (0x00)
Code: Get Frequency Hopping Table (0x30)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x30	0x00	0x00	0x7E	0xNNNN

4.18.2 Response

Message Type: Response (0x01)
Code: Get Frequency Hopping Table (0x30)
Arguments
- Table Size (8-bit): Number of channels
- Channel Number (variable)

Example) Table Size = 6, channel numbers = 47, 19, 20, 23, 46, 16

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Table Size	CH Num (MSB)	
0xBB	0x01	0x30	0x00	0x07	0x06	0x2F	0x13
			CH Num (LSB)	End Mark	CRC-16		
0x14	0x17	0x2E	0x10	0x7E	0xNNNN		

4.19 Set Frequency Hopping Table

Set current frequency hopping table.

4.19.1 Command

Message Type: Command (0x00)
Code: Set Frequency Hopping Table (0x31)
Arguments
- Table Size (8-bit): Number of channels
- Channel Numbers (variable)

Example)
Table Size = 6, channel numbers 47, 19, 20, 23, 46, 16

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Table Size	CH Num (MSB)	
0xBB	0x00	0x31	0x00	0x07	0x06	0x2F	0x13
			CH Num (LSB)	End Mark	CRC-16		
0x14	0x17	0x2E	0x10	0x7E	0xNNNN		

4.19.2 Response

Message Type: Response (0x01)
Code: Set Frequency Hopping Table (0x31)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x31	0x00	0x01	0x00	0x7E	0xNNNN

4.20 Get Modulation Mode

Get current modulation mode. The modulation mode is combination Rx modulation type and BLF

4.20.1 Command

Message Type: Command (0x00)
Code: Get Modulation Mode (0x32)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x32	0x00	0x00	0x7E	0xNNNN

4.20.2 Response

Message Type: Response (0x01)
Code: Get Modulation Mode (0x32)
Arguments
- BLF (16-bit): backscatter link frequency
- RxMod (8-bit): data rate and modulation format
- DR (8-bit): divide ratio

	BLF	RxMod	DR
250KHz, M4, DR=64/3	0x00FA	0x02	0x01
250KHz, M8, DR=64/3	0x00FA	0x03	0x01
300KHz, FM0, DR=64/3	0x012C	0x00	0x01

Example) BLF = 250KHz, RxMod = M8, DR = 64/3

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	BLF (MSB)	BLF (LSB)	RxMod
0xBB	0x01	0x32	0x00	0x04	0x00	0xFA	0x03

DR	End Mark	CRC-16
0x01	0x7E	0xNNNN

4.21 Set Modulation Mode

Set current modulation mode. The modulation mode is combination Rx modulation type and BLF

4.21.1 Command

Message Type: Command (0x00)
Code: Set Modulation Mode (0x33)
Arguments
- BLF (16-bit), RxMod (8-bit), DR (8-bit):

	BLF	RxMod	DR
250KHz, M4, DR=64/3	0x00FA	0x02	0x01
250KHz, M8, DR=64/3	0x00FA	0x03	0x01
300KHz, FM0, DR=64/3	0x012C	0x00	0x01

Example) Manual, BLF = 250KHz, RxMod = M8, DR = 64/3

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Mod Mode	BLF (MSB)	BLF (LSB)
0xBB	0x00	0x33	0x00	0x05	0xFF	0x00	0xFA

RxMod	DR	End Mark	CRC-16
0x03	0x01	0x7E	0xNNNN

4.21.2 Response

Message Type: Response (0x01)
Code: Set Modulation Mode (0x33)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x33	0x00	0x01	0x00	0x7E	0xNNNN

4.22 Get Anti-Collision Mode

Get Anti-collision algorithm.

4.22.1 Command

Message Type: Command (0x00)
Code: Get Anti-Collision Mode (0x34)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x34	0x00	0x00	0x7E	0xNNNN

4.22.2 Response

Message Type: Response (0x01)
Code: Get Anti-Collision Mode (0x34)
Arguments
- Anti-collision Mode (8-bit): Manual (0x01), Auto (0x03)
- Q Start (8-bit)
- Q Max (8-bit)
- Q Min (8-bit)

Example) Anti-collision Mode: Auto, Q Start: 4, Q Max:7, Q Min: 2

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Mode	Q Start	Q Max
0xBB	0x01	0x34	0x00	0x04	0x03	0x04	0x07
Q Min	End Mark	CRC-16					
0x02	0x7E	0xNNNN					

[Notice] Refer to application note “Anti-Collision Mode for multi-tag” for more detail

4.23 Set Anti-Collision Mode

Set Anti-collision algorithm.

4.23.1 Command

Message Type: Command (0x00)
Code: Set Anti-Collision Mode (0x35)
Arguments
- Anti-collision Mode (8-bit): Manual (0x01), Auto (0x03)
- Q Start (8-bit)
- Q Max (8-bit)
- Q Min (8-bit)

Example) Anti-collision Mode: Auto, Start: 4, Q Max:7, Q Min: 2

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Mode	Q Start	Q Max
0xBB	0x00	0x35	0x00	0x04	0x03	0x04	0x07

Q Min	End Mark	CRC-16
0x02	0x7E	0xNNNN

4.23.2 Response

Message Type: Response (0x01)
Code: Set Anti-Collision Mode (0x35)
Arguments
- Success (0x00)

Example) Success

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

[Notice] Refer to application note “Anti-Collision Mode for multi-tag” for more detail

4.24 Start Auto Read2

Start an automatic tag read operation, tag IDs are sent back to user though notification packet.

4.24.1 Command

Message Type: Command (0x00)
Code: Start Auto Read2 (0x36)
Arguments
- Reserve: type B tag (0x01), type C Tag (0x02)
- MTNU: maximum number of tag to read
- MTIME: maximum elapsed time to tagging (sec)
- RC (16-bit): Repeat cycle (how many times reader perform inventory round).

Example) MTNU = 0, MTIME = 0, Repeat Cycle = 100

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Reserve	MTNU	MTIME
0xBB	0x00	0x36	0x00	0x05	0x02	0x00	0x00
RC(MSB)	RC(LSB)	End Mark	CRC-16				
0x00	0x64	0x7E	0xNNNN				

4.24.2 Response

Message Type: Response (0x01)
Code: Start Auto Read2 (0x36)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x36	0x00	0x01	0x00	0x7E	0xNNNN

4.24.3 Notification

Message Type: Notification (0x02)
Code: Read Type C UII (0x22)
Arguments
- EPC Block (PC + EPC)

Example) PC = 0x3000, EPC = 0xE2003411B802011383258566

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PC(MSB)	PC(LSB)	EPC (MSB)
0xBB	0x02	0x22	0x00	0x0E	0x30	0x00	0xE2
0x00	0x34	0x11	0xB8	0x02	0x01	0x13	0x83
		EPC (LSB)	End Mark	CRC-16			
0x25	0x85	0x66	0x7E	0xNNNN			

Message Type: Notification (0x02)
Code: Start Auto Read2 (0x36)
Arguments
- Read complete (0x1F)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x02	0x36	0x00	0x01	0x1F	0x7E	0xNNNN

4.25 Start Auto Read RSSI

Start an automatic tag read operation, tag IDs with RSSI are sent back to user though notification packet.

4.25.1 Command

Message Type: Command (0x00)
Code: Start Auto Read RSSI (0x38)
Arguments
- Reserve: type B tag (0x01), type C Tag (0x02)
- MTNU: maximum number of tag to read
- MTIME: maximum elapsed time to tagging (sec)
- RC (16-bit): Repeat cycle (how many times reader perform inventory round).

Example) MTNU = 0, MTIME = 0, Repeat Cycle = 100

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Reserve	MTNU	MTIME
0xBB	0x00	0x38	0x00	0x05	0x02	0x00	0x00
RC(MSB)	RC(LSB)	End Mark	CRC-16				
0x00	0x64	0x7E	0xNNNN				

4.25.2 Response

Message Type: Response (0x01)
Code: Start Auto Read RSSI (0x38)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x38	0x00	0x01	0x00	0x7E	0xNNNN

4.25.3 Notification

Message Type: Notification (0x02)
Code: Read Type C UII RSSI (0x23)
Arguments
- EPC Block (PC + EPC)
- Tag RSSI (32-bit): RSS_I (8-bit), RSSI_Q (8-bit), GAIN_I (8-bit), GAIN_Q (8-bit)

Example) PC = 0x3000, EPC = 0xE2003411B802011383258566, TAG RSSI = -38.6

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PC(MSB)	PC(LSB)	EPC (MSB)
0xBB	0x02	0x23	0x00	0x12	0x30	0x00	0xE2
0x00	0x34	0x11	0xB8	0x02	0x01	0x13	0x83
		EPC (LSB)	RSSI_I	RSSI_Q	GAIN_I	GAIN_Q	End Mark
0x25	0x85	0x66	0x8E	0x84	0xFB	0x12	0x7E
CRC-16							
0xNNNN							

Note: Tag RSSI calculation

$$\text{RFIN\_I}' = 20\log_{10}(RSSI\_I) - GAIN\_I - 63$$
$$\text{RFIN\_Q}' = 20\log_{10}(RSSI\_Q) - GAIN\_Q - 63$$
$$\text{RFIN\_I}'' = 10^{(\frac{RFIN\_I'}{20})}$$
$$\text{RFIN\_Q}'' = 10^{(\frac{RFIN\_Q'}{20})}$$

$$\text{RFIN} = \sqrt{(RFIN\_I'')^2 + (RFIN\_Q'')^2}$$
$$\text{TAG\_RSSI} = 20\log_{10}(RFIN)$$

Message Type: Notification (0x02)
Code: Start Auto Read RSSI (0x38)
Arguments
- Read complete (0x1F)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x02	0x38	0x00	0x01	0x1F	0x7E	0xNNNN

4.26 Stop Auto Read2

Stop an automatic read2 operation.

4.26.1 Command

Message Type: Command (0x00)
Code: Stop Auto Read2 (0x37)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x37	0x00	0x00	0x7E	0xNNNN

4.26.2 Response

Message Type: Response (0x01)
Code: Stop Auto Read2 (0x37)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x37	0x00	0x01	0x00	0x7E	0xNNNN

4.27 Start Auto Read2 Ex

Start an automatic tag read operation during the inventory round. Tag IDs is reported with memory data, Tag RSSI(if enabled) and used antenna port number.

4.27.1 Command

Message Type: Command (0x00)
Code: Start AutoRead2 Ex (0x3A)
Arguments
- Mode (8-bit): Operation mode; EPC only (0xC0)
- Tag RSSI (8-bit): disable(0), enable(1)
- AntPort (8-bit): antenna port bit
- MTNU (8-bit): maximum number of tag to read
- MTIME (8-bit): maximum elapsed time to tagging (sec)
- RC (16-bit): repeat cycle (how many times reader perform inventory round)

Example 1) Mode= 0xC0, Tag RSSI = 0, AntPort = 0x0F, MTNU = 0, MTIME = 0, RC = 100

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Mode	Tag RSSI	AntPort
0xBB	0x00	0x3A	0x00	0x07	0xC0	0x00	0x0F
MTNU	MTIME	RC (MSB)	RC (LSB)	End Mark	CRC-16		
0x00	0x00	0x00	0x64	0x7E	0xNNNN		

4.27.2 Response

Message Type: Response (0x01)
Code: Start AutoRead2 Ex (0x3A)
Arguments
- Success (0x00)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x3A	0x00	0x01	0x00	0x7E	0xNNNN

4.27.3 Notification

Message Type: Notification (0x02)
Code: Read Type C UII Ex2 (0x26)
Arguments
- Mode (8-bit) : Operation mode; EPC only (0xC0)
- Tag RSSI (8-bit): disable(0), enable(1)
- AntPort (8-bit): antenna port bit
- EPC Block (PC + EPC)
- Data Block (variable)
- RSSI Block (32-bit): RSSI_I (8-bit), RSSI_Q (8-bit), GAIN_I (8-bit), GAIN_Q (8-bit)

Example 1) Mode = 0xC0, Tag RSSI = Disable, AntPort = 0x02, PC = 0x3000, EPC = 0xE2003411B802011383258566

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Mode	Tag RSSI	AntPort
0xBB	0x02	0x26	0x00	0x11	0xC0	0x00	0x02
PC(MSB)	PC(LSB)	EPC (MSB)					
0x30	0x00	0xE2	0x00	0x34	0x11	0xB8	0x02
					EPC (LSB)	End Mark	CRC-16

0x01	0x13	0x83	0x25	0x85	0x66	0x7E	0xNNNN

Note: Tag RSSI calculation

$$\text{RFIN\_I}' = 20\log_{10}(RSSI\_I) - GAIN\_I - 63$$
$$\text{RFIN\_Q}' = 20\log_{10}(RSSI\_Q) - GAIN\_Q - 63$$
$$\text{RFIN\_I}'' = 10^{(\frac{RFIN\_I'}{20})}$$
$$\text{RFIN\_Q}'' = 10^{(\frac{RFIN\_Q'}{20})}$$
$$\text{RFIN} = \sqrt{(RFIN\_I'')^2 + (RFIN\_Q'')^2}$$
$$\text{TAG\_RSSI} = 20\log_{10}(RFIN)$$

Message Type: Notification (0x02)
Code: Start AutoRead2 Ex (0x3A)
Arguments
- Read complete (0x1F)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x02	0x3A	0x00	0x01	0x1F	0x7E	0xNNNN

4.28 Get Frequency Information

Get user-defined frequency information.

4.28.1 Command

Message Type: Command (0x00)
Code: Get Frequency Information (0x44)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x44	0x00	0x00	0x7E	0xNNNN

4.28.2 Response

Message Type: Response (0x01)
Code: Get Frequency Information (0x44)
Arguments
- Spacing (16-bit): kHz
- Start Frequency (32-bit): kHz
- Channel (8-bit): Number of channels
- RF Preset (8-bit): 900M_Narrow (0xF0), 900M_Wide (0xF1), 800M (0xF2) or Pre-defined Region code

Example) Spacing: 250kHz, Start Frequency: 915,250kHz, Channel: 50 EA, RF Preset: 900M_Wide

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Spacing (MSB)	Spacing (LSB)	Start Freq (MSB)
0xBB	0x01	0x44	0x00	0x08	0x00	0xFA	0x00
		Start Freq (LSB)	Channel	RF Preset	End Mark	CRC-16	
0x0D	0xF7	0x32	0x32	0xF1	0x7E	0xNNNN	

4.29 Set Frequency Information

Set user-defined frequency information

4.29.1 Command

Message Type: Command (0x00)
Code: Set Frequency Information (0x45)
Arguments
- Spacing (16-bit): kHz
- Start Frequency (32-bit): kHz
- Channel (8-bit): Number of channels
- RF Preset (8-bit): 900M_Narrow (0xF0), 900M_Wide (0xF1), 800M (0xF2) or Pre-defined Region code

Example) Spacing: 250kHz, Start Frequency: 915,250kHz, Channel: 50 EA, RF Preset: 900M_Wide

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Spacing (MSB)	Spacing (LSB)	Start Freq (MSB)
0xBB	0x00	0x45	0x00	0x08	0x00	0xFA	0x00
		Start Freq (LSB)	Channel	RF Preset	End Mark	CRC-16	
0x0D	0xF7	0x32	0x32	0xF1	0x7E	0xNNNN	

4.29.2 Response

Message Type: Response (0x01)
Code: Set Frequency Information (0x45)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Argument	End Mark	CRC-16
0xBB	0x01	0x45	0x00	0x01	0x00	0x7E	0xNNNN

4.30 Write Type C Tag Data

Write type C tag data.

4.30.1 Command

Message Type: Command (0x00)
Code: Write Type C User Data (0x46)
Arguments
- AP (32-bit): Access Password if target memory bank was password protected. Otherwise, set AP filled to 0x00000000.
- UL (16-bit): Target tag's EPC length (if TM is not EPC, Target tag's memory length)
- EPC (variable): Target tag's EPC (if TM is not EPC, Target tag's memory value)
- MB (8-bit): memory bank; 0x00 Reserved, 0x01 EPC, 0x02 TID, 0x03 User
- SA (16-bit): Starting Address word pointer
- DL (16-bit): Data Length to write (Word Count)
- DT (variable): Data to write
- TMB (8-bit): Target tag's Memory bank (memory bank; 0x00 Reserved, 0x01 EPC, 0x02 TID, 0x03 User)

Example)
Access Password = 0x00000000, UL = 12 (0x0C), EPC = 0xE2003411B802011526370494,
memory bank = RFU, Start Address = 0x0000, Data Length = 4 word, Data to write = 0x1234567800000000, Target Tag Target memory bank = EPC

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	AP (MSB)		
0xBB	0x00	0x46	0x00	0x1F	0x00	0x00	0x00
AP (LSB)	UL (MSB)	UL (LSB)	EPC (MSB)				
0x00	0x00	0x0C	0xE2	0x00	0x34	0x11	0xB8
						EPC (LSB)	MB
0x02	0x01	0x15	0x26	0x37	0x04	0x94	0x00
SA (MSB)	SA (LSB)	DL (MSB)	DL (LSB)	DT (MSB)			
0x00	0x00	0x00	0x04	0x12	0x34	0x56	0x78
			DT (LSB)	TMB	End Mark	CRC-16	
0x00	0x00	0x00	0x00	0x02	0x7E	0xNNNN	

4.30.2 Response

Message Type: Response (0x01)
Code: Write Type C User Data (0x46)
Arguments
- Result: Success (0x00)
- EPC (variable): Target tag's EPC

Example) Success, EPC: 0xE2003411B802011526370494

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Result	EPC (MSB)	
0xBB	0x01	0x46	0x00	0x0C	0x00	0xE2	0x00
0x34	0x11	0xB8	0x02	0x01	0x15	0x26	0x37
	EPC (LSB)	End Mark	CRC-16				
0x04	0x94	0x7E	0xNNNN				

4.31 BlockWrite Type C Tag Data

Blockwrite type C tag data.

4.31.1 Command

Message Type: Command (0x00)
Code: BlockWrite Type C User Data (0x47)
Arguments
- AP (32-bit): Access Password if target memory bank was password protected. Otherwise, set AP filled to 0x00000000.
- UL (16-bit): Target tag's EPC length
- EPC (variable): Target tag's EPC
- MB (8-bit): Target memory bank; 0x00 Reserved, 0x01 EPC, 0x02 TID, 0x03 User
- SA (16-bit): Starting Address word pointer
- DL (16-bit): Data Length to write (Word Count)
- DT (variable): Data to write

Example)
Access Password = 0x00000000, UL = 12 (0x0C), EPC = 0xE2003411B802011526370494,
Target memory bank = RFU, Start Address = 0x0000, Data Length = 4 word, Data to write = 0x1234567800000000

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	AP (MSB)		
0xBB	0x00	0x47	0x00	0x1F	0x00	0x00	0x00
AP (LSB)	UL (MSB)	UL (LSB)	EPC (MSB)				
0x00	0x00	0x0C	0xE2	0x00	0x34	0x11	0xB8
						EPC (LSB)	MB
0x02	0x01	0x15	0x26	0x37	0x04	0x94	0x00
SA (MSB)	SA (LSB)	DL (MSB)	DL (LSB)	DT (MSB)			
0x00	0x00	0x00	0x04	0x12	0x34	0x56	0x78
			DT (LSB)	End Mark	CRC-16		
0x00	0x00	0x00	0x00	0x7E	0xNNNN		

4.31.2 Response

Message Type: Response (0x01)
Code: BlockWrite Type C User Data (0x47)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x47	0x00	0x01	0x00	0x7E	0xNNNN

4.32 BlockErase Type C Tag Data

Block erases type C tag data.

4.32.1 Command

Message Type: Command (0x00)
Code: BlockErase Type C Tag Data (0x48)
Arguments
- AP (32-bit): Access Password if target memory bank was password protected. Otherwise, set AP filled to 0x00000000.
- UL (16-bit): Target tag's EPC length
- EPC (variable): Target tag's EPC
- MB (8-bit): Target memory bank; 0x00 RFU, 0x01 EPC, 0x02 TID, 0x03 User
- SA (16-bit): Starting Address word pointer
- DL (16-bit): Data Length (Word Count)

Example)
Access Password = 0x00000000, UL = 12 (0x0C) byte, EPC = 0xE2003411B802011526370494,
Target memory bank = RFU, Start Address = 0x0000, Length = 4 word

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	AP (MSB)		
0xBB	0x00	0x48	0x00	0x17	0x00	0x00	0x00
AP (LSB)	UL (MSB)	UL (LSB)	EPC (MSB)				
0x00	0x00	0x0C	0xE2	0x00	0x34	0x11	0xB8
						EPC (LSB)	MB
0x02	0x01	0x15	0x26	0x37	0x04	0x94	0x00
SA (MSB)	SA (LSB)	DL (MSB)	DL (LSB)	End Mark	CRC-16		
0x00	0x00	0x00	0x04	0x7E	0xNNNN		

4.32.2 Response

Message Type: Response (0x01)
Code: BlockErase Type C Tag Data (0x48)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x48	0x00	0x01	0x00	0x7E	0xNNNN

4.33 BlockPermalock Type C Tag

BlockPermalock type C tag.

4.33.1 Command

Message Type: Command (0x00)
Code: BlockPermalock Type C Tag (0x83)
Arguments
- AP (32-bit): Access Password if target memory bank was password protected. Otherwise, set AP filled to 0x00000000.
- UL (16-bit): Target tag's EPC length
- EPC (variable): Target tag's EPC
- RFU (8-bit): 0x00
- R/L (8-bit): Read/Lock bit; 0x00 Read, 0x01 Permalock
- MB (8-bit): Target memory bank; 0x00 Reserved, 0x01 EPC, 0x02 TID, 0x03 User
- BP (16-bit): Mask starting address, specified in units of 16 blocks
- BR (8-bit): Mask range, specified in units of 16 blocks
- Mask (variable): Mask value

Example)
Access Password = 0x11111111, UL = 12 (0x0C), EPC = 0xE2003411B802011526370494, RFU = 0x00, Read/Lock bit = Lock (0x01), Target memory bank = User memory (0x03), Block Pointer = 0x0000, Block Range = 1, Mask value = 0xFFFF

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	AP (MSB)		
0xBB	0x00	0x83	0x00	0x1A	0x11	0x11	0x11
AP (LSB)	UL (MSB)	UL (LSB)	EPC (MSB)				
0x11	0x00	0x0C	0xE2	0x00	0x34	0x11	0xB8
						EPC (LSB)	RFU
0x02	0x01	0x15	0x26	0x37	0x04	0x94	0x00
R/L	MB	BP (MSB)	BP (LSB)	BR	Mask (MSB)	Mask (LSB)	End Mark
0x01	0x03	0x00	0x00	0x01	0xFF	0xFF	0x7E
CRC-16							
0xNNNN							

4.33.2 Response

Message Type: Response (0x01)
Code: BlockPermalock Type C Tag (0x83)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x83	0x00	0x01	0x00	0x7E	0xNNNN

4.34 Kill Type C Tag

Kill a Tag.

4.34.1 Command

Message Type: Command (0x00)
Code: Kill Type C Tag (0x65)
Arguments
- KP (32-bit): Kill Password. If KP filed set to 0x00000000, 'Kill Type C Tag' command do not work. The target tag ignores it.
- UL (16-bit): Target tag's EPC length
- EPC (variable): Target tag's EPC

Example)
Kill Password =0x87654321, UL = 12 (0x0C) byte, EPC = 0xE2003411B802011526370494

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	KP (MSB)		
0xBB	0x00	0x65	0x00	0x12	0x87	0x65	0x43
KP (LSB)	UL (MSB)	UL (LSB)	EPC (MSB)				
0x21	0x00	0x0C	0xE2	0x00	0x34	0x11	0xB8
						EPC (LSB)	End Mark
0x02	0x01	0x15	0x26	0x37	0x04	0x94	0x7E
CRC-16							
0xNNNN							

4.34.2 Response

Message Type: Response (0x01)
Code: Kill Type C Tag (0x65)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x65	0x00	0x01	0x00	0x7E	0xNNNN

4.35 Lock Type C Tag

Lock an indicated memory bank in the tag.

4.35.1 Command

Message Type: Command (0x00)
Code: Lock Type C Tag (0x82)
Arguments
- AP (32-bit): Access Password if memory bank was password protected. Otherwise, set AP filled to 0x00000000.
- UL (16-bit): Target tag's EPC length
- EPC (variable): Target tag's EPC
- LD (24-bit): Lock mask and action flags. Pad 4-bit zeros (dummy) to the left of 20-bit lock mask and associated action flags.

Example)
Access Password = 0x00000000, UL = 12(0x0C) byte, EPC = 0xE2003411B802011526370494, Lock mask and action flags = 0x080200 {Binary: 0000 (dummy) + 1000000000 (mask) + 1000000000 (lock data)}

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	AP (MSB)		
0xBB	0x00	0x82	0x00	0x15	0x00	0x00	0x00
AP (LSB)	UL (MSB)	UL (LSB)	EPC (MSB)				
0x00	0x00	0x0C	0xE2	0x00	0x34	0x11	0xB8
						EPC (LSB)	LD (MSB)
0x02	0x01	0x15	0x26	0x37	0x04	0x94	0x08
	LD (LSB)	End Mark	CRC-16				
0x02	0x00	0x7E	0xNNNN				

4.35.2 Response

Message Type: Response (0x01)
Code: Lock Type C Tag (0x82)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x82	0x00	0x01	0x00	0x7E	0xNNNN

4.36 Get Selection Enable

Get selection enable status.
Up to 8 Selects can be individually enabled and configured. This command reads the current enable status of each select.

4.36.1 Command

Message Type: Command (0x00)
Code: Get Selection Enable (0x8E)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x8E	0x00	0x00	0x7E	0xNNNN

4.36.2 Response

Message Type: Response (0x01)
Code: Get Selection Enable (0x8E)
Arguments
- Enable Status (8-bit): Bit Masking, 1(Enable), 0(Disable)

Sel 8	Sel 7	Sel 6	Sel 5	Sel 4	Sel 3	Sel 2	Sel 1
0x80	0x40	0x20	0x10	0x08	0x04	0x02	0x01

Example) Select #1, #2= ENABLE

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x8E	0x00	0x01	0x03	0x7E	0xNNNN

4.37 Set Selection Enable

Set selection enable status.
Up to 8 Selects can be individually enabled and configured. This command configures the current enable status of each select.

4.37.1 Command

Message Type: Command (0x00)
Code: Set Selection Enable (0x8F)
Arguments
- Enable Status (8-bit): Bit Masking, 1(Enable), 0(Disable)

Sel 8	Sel 7	Sel 6	Sel 5	Sel 4	Sel 3	Sel 2	Sel 1
0x80	0x40	0x20	0x10	0x08	0x04	0x02	0x01

Example) Select #1, #2= ENABLE

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Enable	End Mark	CRC-16
0xBB	0x00	0x8F	0x00	0x01	0x03	0x7E	0xNNNN

4.37.2 Response

Message Type: Response (0x01)
Code: Set Selection Enable (0x8F)
Arguments
- Success (0x00)

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x8F	0x00	0x01	0x00	0x7E	0xNNNN

4.38 Get Multi-Antenna Sequence

Get current multiple antenna sequence.

4.38.1 Command

Message Type: Command (0x00)
Code: Get Multi-Antenna Sequence(0x99)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0x99	0x00	0x00	0x7E	0xNNNN

4.38.2 Response

Message Type: Response (0x01)
Code: Get Multi-Antenna Sequence(0x99)
Arguments
- Size (8-bit): Number of sequences
- Sequence (variable): The maximum size is 8 or less. #1 (0x01), #2 (0x02), #3 (0x04), #4 (0x08), #5 (0x10), #6 (0x20), #7 (0x40), #8 (0x80)

Example) Size=8, Sequence = #1(0x01), #5(0x10), #2(0x02), #6(0x20), #3(0x04), #7(0x40), #4(0x08), #8(0x80)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Size	Seq. (MSB)	
0xBB	0x01	0x99	0x00	0x09	0x08	0x01	0x10
					Seq. (LSB)	End Mark	CRC-16
0x02	0x20	0x04	0x40	0x08	0x80	0x7E	0xNNNN

4.39 Set Multi-Antenna Sequence

Set current multiple antenna sequence.

4.39.1 Command

Message Type: Command (0x00)
Code: Set Multi-Antenna Sequence(0x9A)
Arguments
- Size (8-bit): Number of sequences
- Sequence (variable): The maximum size is 8 or less. #1 (0x01), #2 (0x02), #3 (0x04), #4 (0x08), #5 (0x10), #6 (0x20), #7 (0x40), #8 (0x80)

Example) Size=8, Sequence = #1(0x01), #5(0x10), #2(0x02), #6(0x20), #3(0x04), #7(0x40), #4(0x08), #8(0x80)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Size	Seq. (MSB)	
0xBB	0x00	0x9A	0x00	0x09	0x08	0x01	0x10
					Seq. (LSB)	End Mark	CRC-16
0x02	0x20	0x04	0x40	0x08	0x80	0x7E	0xNNNN

4.39.2 Response

Message Type: Response (0x01)
Code: Set Multi-Antenna Sequence(0x9A)
Arguments
- Success (0x00)

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x9A	0x00	0x01	0x00	0x7E	0xNNNN

4.40 Antenna Check

Check the antenna condition

4.40.1 Command

Message Type: Command (0x00)
Code: Antenna Check (0xAC)
Arguments
- Ref. Level (8-bit): reference level. A recommended value is 100 (=0x64)

Example) RL = 100 (0x64)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Ref. Level	End Mark	CRC-16
0xBB	0x00	0xAC	0x00	0x01	0x64	0x7E	0xNNNN

4.40.2 Response

Message Type: Response (0x01)
Code Antenna Check (0xAC)
Arguments
- Success (0x00)

Example 1) Success (=Normal)

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

Example 2) Failure (=Abnormal)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Error Code	Cmd. Code	Sub Error Code
0xBB	0x01	0xFF	0x00	0x03	0xFF	0xAC	0xFC

End Mark	CRC-16
0x7E	0xNNNN

4.41 Get Selection

Get 18000-6C air interface protocol command ‘Select’ parameters.
Up to 8 'Select' commands can be set, and parameters of the 'Select' command can be read individually.

4.41.1 Command

Message Type: Command (0x00)
Code: Get Selection (0xAE)
Arguments
- Index (8-bit): Selection index to read (1~8)

Example) Index=1

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

4.41.2 Response

Message Type: Response (0x01)
Code: Get Selection (0xAE)
Arguments
- Index (8-bit): Selection index (1~8)
- Target (8-bit): S0 (0x00), S1 (0x01), S2 (0x2), S3 (0x03), SL (0x04)
- Action (8-bit): Refer to ISO18000-6C.
- Memory Bank (8-bit): RFU (0x00), EPC (0x01), TID (0x02), User (0x03)
- Pointer (16-bit): Starting mask address
- Length (8-bit): mask length bits
- Mask (0~255 bits): Mask value

Example) Index = 1, Target=S0, Action=assert SL or inventoried - > A, MB=User, Pointer = 0x000000FF, Length =0x20, T=0, Mask = 11111111111111110000000000000000

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Index	Target	Action
0xBB	0x01	0xAE	0x00	0x0B	0x01	0x00	0x00
MB	Pointer (MSB)	Pointer (LSB)	Length	Mask (MSB)			Mask (LSB)
0x03	0x00	0x00	0x20	0xFF	0xFF	0x00	0x00
End Mark	CRC-16						
0x7E	0xNNNN						

4.42 Set Selection

Set 18000-6C air interface protocol command ‘Select’ parameters.
User can set up to 8 ‘Select’ commands.
This selection is valid only when it is enabled with the "4.38 Set Selection Enable" command.

4.42.1 Command

Message Type: Command (0x00)
Code: Set Selection (0xAF)
Arguments
- Index (8-bit): Selection index to set (1~8)
- Target (8-bit): S0 (0x00), S1 (0x01), S2 (0x2), S3 (0x03), SL (0x04)
- Action (8-bit): Refer to ISO18000-6C.
- Memory Bank (8-bit): RFU (0x00), EPC (0x01), TID (0x02), User (0x03)
- Pointer (16-bit): Starting mask address
- Length (8-bit): mask length bits
- Mask (0~255 bits): Mask value

Example) Index = 1, Target=S0, Action=assert SL or inventoried - > A, MB=User, Pointer = 0x000000FF, Length =0x20, T=0, Mask = 11111111111111110000000000000000

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Index	Target	Action
0xBB	0x00	0xAF	0x00	0x0B	0x01	0x00	0x00
MB	Pointer (MSB)	Pointer (LSB)	Length	Mask (MSB)			Mask (LSB)
0x03	0x00	0x00	0x20	0xFF	0xFF	0x00	0x00
End Mark	CRC-16						
0x7E	0xNNNN						

4.42.2 Response

Message Type: Response (0x01)
Code: Set Selection (0xAF)
Arguments
- Success (0x00)

Example) Success

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

4.43 Get RSSI

Get RSSI level

4.43.1 Command

Message Type: Command (0x00)
Code: Get RSSI level (0xC5)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0xC5	0x00	0x00	0x7E	0xNNNN

4.43.2 Response

Message Type: Response (0x01)
Code: Get RSSI level (0xC5)
Arguments
- RSSI (16-bit): RSSI level (-dBm x 10, decimal value)

Example) RSSI = 900 (-90.0 dBm)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	RSSI (MSB)	RSSI (LSB)	End Mark
0xBB	0x01	0xC5	0x00	0x02	0x03	0x84	0x7E

CRC-16
0xNNNN

4.44 Scan RSSI

Scan RSSI level on all channels

4.44.1 Command

Message Type: Command (0x00)
Code: Scan RSSI (0xC6)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0xC6	0x00	0x00	0x7E	0xNNNN

4.44.2 Response

Message Type: Response (0x01)
Code: Scan RSSI (0xC6)
Arguments
- CHS (8-bit): Start channel number
- CHE (8-bit): Stop channel number
- CHB (8-bit): Best channel (lowest RSSI channel)
- RSSI1 (8-bit): RSSI level on CHS (-dBm)
- RSSI2 (8-bit): RSSI level on CHS + 1 (-dBm)
 ….
- RSSI[N] (8-bit): RSSI level on CHE (-dBm)

Example) CHS = 7, CHE = 20, CHB = 7, RSSI1 = 90 (-90dBm), RSSI2 = 87 (-87), RSSI3 = 87 (-87), RSSI4 = 87 (-87), RSSI5 = 87 (-87), RSSI6 = 87 (-87), RSSI7 = 92 (-92), RSSI8 = 87 (-87), RSSI9 = 90 (-90), RSSI10 = 87 (-87), RSSI11 = 87 (-87), RSSI12 = 87 (-87), RSSI13 = 90 (-90), RSSI14 = 90 (-90)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	CHS	CHE	CHB
0xBB	0x01	0xC6	0x00	0x11	0x07	0x14	0x07
RSSI1	RSSI2	RSSI3	RSSI4	RSSI5	RSSI6	RSSI7	RSSI8
0x5A	0x57	0x57	0x57	0x57	0x57	0x5C	0x57
RSSI9	RSSI10	RSSI11	RSSI12	RSSI13	RSSI14	End Mark	CRC-16
0x5A	0x57	0x57	0x57	0x5A	0x5A	0x7E	0xNNNN

4.45 Get DTC Result

Scan RSSI level on all channels

4.45.1 Command

Message Type: Command (0x00)
Code: Get DTC Result (0xCA)
Arguments
- None

Example)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0xCA	0x00	0x00	0x7E	0xNNNN

4.45.2 Response

Message Type: Response (0x01)
Code: Get DTC Result (0xCA)
Arguments
- IDT(8-bit): inductor number for digital tune
- DTC1(8-bit): digital tunable capacitor 1
- DTC2(8-bit): digital tunable capacitor 2
- RSSI(8-bit): leakage RSSI value to check leakage cancellation results
- State(8-bit): state number of leakage cancellation algorithm

Example) Example) IDT = 2, DTC1 = 23, DTC2 = 1, RSSI = 38, State = 1

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	IDT	DTC1	DTC2
0xBB	0x01	0xCA	0x00	0x05	0x02	0x17	0x01
RSSI	State	End Mark	CRC-16				
0x26	0x01	0x7E	0xNNNN				

4.45.3 Notification

Message Type: Notification (0x02)
Code: Get DTC Result (0xCA)
Arguments
- IDT(8-bit): inductor number for digital tune
- DTC1(8-bit): digital tunable capacitor 1
- DTC2(8-bit): digital tunable capacitor 2
- RSSI(8-bit): leakage RSSI value to check leakage cancellation results
- State(8-bit): state number of leakage cancellation algorithm
- CC(8-bit): current channel
- OT(8-bit) : Operation time of leakage cancellation(ms)

Example) IDT = 2, DTC1 = 23, DTC2 = 1, RSSI = 38, State = 1, Current Channel = 10, OT = 48ms

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	IDT	DTC1	DTC2
0xBB	0x02	0xCA	0x00	0x07	0x02	0x17	0x01
RSSI	State	CC	OT	End Mark	CRC-16		
0x26	0x01	0x0A	0x30	0x7E	0xNNNN		

4.46 Update Registry

Sets Registry Update function

4.46.1 Command

Message Type: Command (0x00)
Code: Update Registry (0xD2)
Arguments
- Arg (8-bit): Store (0x01)

Example) Store data into Registry

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x00	0xD2	0x00	0x01	0x01	0x7E	0xNNNN

4.46.2 Response

Message Type: Response (0x01)
Code Update Registry (0xD2)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0xD2	0x00	0x01	0x00	0x7E	0xNNNN

4.47 Get Registry Item

Gets Registry items

4.47.1 Command

Message Type: Command (0x00)
Code: Get Registry Item (0xD4)
Arguments
- Registry Version (0x0000)
- Firmware Date (0x0001)
- Band (0x0002)
- Anti-Collision Mode (0x0003)
- Modulation Mode (0x0004)
- (Query) Q Value (0x0005)
- Part Number (0x0006)
- Device Type (0x0007)
- Firmware Version (0x0008)
- Leakage Cal. Mode (0x0009)
- Session (0x000A)
- Serial Number (0x000B)
- Reserved (0x000C~)

Example) Get Registry version

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	ADD (MSB)	ADD (LSB)	End Mark
0xBB	0x00	0xD4	0x00	0x02	0x00	0x00	0x7E
CRC-16							
0xNNNN							

4.47.2 Response

Message Type: Response (0x01)
Code: Get Registry Item (0xD4)
Arguments
- Active (8-bit): Registry items status; Inactive (0x00), Read-Only (0xBC), Active (0xA5)
- Data (Variable)

Example) Registry Version = 1

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Active	Data	End Mark
0xBB	0x01	0xD4	0x00	0x02	0x00	0x01	0x7E
CRC-16							
0xNNNN							

4.48 Set Optimum Frequency Hopping Table

Set Optimum Frequency Hopping Table.
When the reader's antenna size is not large enough, you cannot use all channel of your band.
If you read tag's information at the channel outside antenna bandwidth, the read range will be quite decreased
This command help you search good channels within your band and set optimized frequency hopping table.
When you execute this command, reader find optimized channel automatically.

4.48.1 Command

Message Type: Command (0x00)
Code: Set Optimum Frequency Hopping Table (0xE4)
Arguments
- None

Example) Set Optimum Frequency Hopping Table

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0xE4	0x00	0x00	0x7E	0xNNNN

4.48.2 Response

Message Type: Response (0x01)
Code: Set Optimum Frequency Hopping Table (0xE4)
Arguments
- Start (0x00), Finish (0x01)

Example) Start

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0xE4	0x00	0x01	0x00	0x7E	0xNNNN

Example) Finish

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0xE4	0x00	0x01	0x01	0x7E	0xNNNN

4.48.3 Notification

When the mode of the Leakage Cal. is 'Fast Leakage Cal.', the RED4 or RED5 Report some information of Leakage Cal.

Message Type: Notification (0x02)
Code: Get DTC Result (0xCA)
Arguments
- IDT(8-bit): inductor number for digital tune
- DTC1(8-bit): digital tunable capacitor 1
- DTC2(8-bit): digital tunable capacitor 2
- RSSI(8-bit): leakage RSSI value to check leakage cancellation results
- State(8-bit): state number of leakage cancellation algorithm
- CC(8-bit): Current Channel
- OT(8-bit) : Operation time of leakage cancellation(ms)

Example) IDT = 2, DTC1 = 23, DTC2 = 1, RSSI = 38, State = 1, Current Channel = 10, OT = 48ms

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	IDT	DTC1	DTC2
0xBB	0x02	0xCA	0x00	0x07	0x02	0x17	0x01
RSSI	State	CC	OT	End Mark	CRC-16		
0x26	0x01	0x0A	0x30	0x7E	0xNNNN		

4.49 Get Frequency Hopping Mode

Get Frequency Hopping Mode
Reader can set two types of Frequency hopping table: normal mode and SH (Smart hopping) mode.

Reader use all frequency channel of your operation band in normal mode.
In SH (Smart Hopping) mode, you use the specified frequency hopping table selected by “Set Optimum Frequency Hopping Table” command.

4.49.1 Command

Message Type: Command (0x00)
Code: Get Frequency Hopping Mode (0xE5)
Arguments
- None

Example) Get Frequency Hopping Mode

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0xE5	0x00	0x00	0x7E	0xNNNN

4.49.2 Response

Message Type: Response (0x01)
Code: Get Frequency Hopping Mode (0xE5)
Arguments
- Frequency Hopping Mode (0x00: Normal Mode, 0x01: Smart Hopping Mode)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Mode	End Mark	CRC-16
0xBB	0x01	0xE5	0x00	0x01	0x00	0x7E	0xNNNN

4.50 Set Frequency Hopping Mode

Set Frequency hopping mode
Normal mode uses all the frequency channel of your band for frequency hopping
Smart hopping mode use the hopping table selected by “Set Optimum Frequency Hopping Table”.

4.50.1 Command

Message Type: Command (0x00)
Code: Set Frequency Hopping Mode (0xE6)
Arguments

- Frequency Hopping Mode (0x00: Normal Mode, 0x01: Smart Hopping Mode)

Example) Set Normal Mode

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Mode	End Mark	CRC-16
0xBB	0x00	0xE6	0x00	0x01	0x00	0x7E	0xNNNN

4.50.2 Response

Message Type: Response (0x01)
Code: Set Frequency Hopping Mode (0xE6)
Arguments
- Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0xE6	0x00	0x01	0x00	0x7E	0xNNNN

4.51 Get Tx Leakage RSSI Level for Smart hopping Mode

For Smart hopping mode, reference value of Tx Leakage RSSI is needed to select the good channel according to antenna while “Set Optimum Frequency Hopping Table”.

4.51.1 Command

Message Type: Command (0x00)
Code: Get Tx Leakage RSSI level for smart hopping mode (0xE7)
Arguments
-None

Example) Get tx leakage RSSI level for Smart hopping mode

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0xE7	0x00	0x00	0x7E	0xNNNN

4.51.2 Response

Message Type: Response (0x01)
Code: Get Tx Leakage RSSI level for Smart hopping Mode (0xE7)
Arguments
-Reference Tx Leakage RSSI Level (1~255)

Example) Reference Tx leakage RSSI Level = 50

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0xE7	0x00	0x01	0x32	0x7E	0xNNNN

4.52 Set Tx Leakage RSSI Level for Smart hopping Mode

Set Tx Leakage RSSI Level for Smart hopping mode.
This value is reference level to select channel for Smart hopping mode.
If this value is too small, the number of channels can be used may be reduced. If you want to use more channels with Smart hopping mode, increase this value. Default value is 50.

4.52.1 Command

Message Type: Command (0x00)
Code: Set Tx Leakage RSSI level for smart hopping mode (0xE8)
Arguments
-Reference Tx Leakage RSSI Level (1~255)

Example) Set Reference Tx leakage RSSI Level to 50

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x00	0xE8	0x00	0x01	0x32	0x7E	0xNNNN

4.52.2 Response

Message Type: Response (0x01)
Code: Set Tx Leakage RSSI level for smart hopping mode (0xE8)
Arguments
-Success (0x00)

Example) Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0xE8	0x00	0x01	0x00	0x7E	0xNNNN

4.53 Start Read with Fast Leakage Cal.

Start Read with Fast Leakage Cal.
When the mode of the Leakage Cal. is 'Fast Leakage Cal.', RED4 or RED5 supports this command. It need s some parameter that obtained by 4.46 Set Optimum Frequency Hopping Table.

4.53.1 Command

Message Type: Command (0x00)
Code: Start Read with Fast Leakage Cal. (0xEC)
Arguments
- Channel, IDT(Inductor), DTC1, DTC2

Example) Start Read with Fast Leakage Cal. IDT = 0x02, DTC1 = 0x17, DTC2 = 0x18, Channel 0x0A

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	IDT	DTC1	DTC2
0xBB	0x00	0xEC	0x00	0x08	0x02	0x17	0x01
Channel	Reserved	Reserved	Reserved	Reserved	End Mark	CRC-16	
0x0A	0x00	0x00	0x00	0x00	0x7E	0xNNNN	

4.53.2 Response

Message Type: Response (0x01)
Code: Start Read with Fast Leakage Cal. (0xEC)
Arguments
-Success (0x00)

Example) Success

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

Message Type: Response (0x01)
Code: Request Fast Leakage Cal. (0xED)
Arguments
- Channel

Example) Request Fast Leakage Cal. at Channel 0x0A

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Channel	End Mark	CRC-16
0xBB	0x01	0xED	0x00	0x01	0x0A	0x7E	0xNNNN

4.53.3 Notification

Message Type: Notification (0x02)
Code: Read Type C UII (0x22)
Arguments
- EPC Block (PC + EPC)

Example) PC = 0x3000, EPC = 0xE2003411B802011383258566

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PC(MSB)	PC(LSB)	EPC (MSB)
0xBB	0x02	0x22	0x00	0x0E	0x30	0x00	0xE2
0x00	0x34	0x11	0xB8	0x02	0x01	0x13	0x83
		EPC (LSB)	End Mark	CRC-16			
0x25	0x85	0x66	0x7E	0xNNNN			

4.54 Command failure

Response to invalid command

Message Type: Response (0x01)
Code: Command failure (0xFF)
Arguments
- Reserved (8-bit)
- Command code (8-bit)
- Error Code (8-bit)

Category	Error Code	Description
0x00 – 0x0F: EPC G2v2 Error Message	0x00	Other error
	0x01	Not supported
	0x02	Insufficient privileges
	0x03	Memory overrun
	0x04	Memory locked
	0x05	Crypto suite error
	0x06	Command not encapsulated
	0x07	ResponseBuffer overflow
	0x08	Security timeout
	0x0B	Insufficient power
	0x0F	Non-specific error
0x10 – 0x7F: Vendor Specific Error	0x11	Sensor Scheduling configuration
	0x12	Tag Busy
	0x13	Measurement type not supported
0x80 – 0x8F: Protocol Error	0x80	No tag detected
	0x81	Handle acquisition failure
	0x82	Access password failure
	0x83	Kill password failure
0x90 – 0x9F: Modem Error	0x90	CRC error
	0x91	Rx Timeout
0xA0 – 0xAF: Registry	0xA0	Registry update failure
	0xA1	Registry erase failure
	0xA2	Registry write failure
	0xA3	Registry not exist
0xB0 – 0xBF: Peripheral	0xB0	UART failure
	0xB1	SPI failure
	0xB2	I2C failure
	0xB3	GPIO failure
0xC0 – 0xDF: Reserved		
0xE0 – 0xFF: Custom Error	0xE0	Not supported command
	0xE1	Undefined command
	0xE2	Invalid parameter
	0xE3	Too high parameter
	0xE4	Too low parameter
	0xE5	Failure automatic read operation
	0xE6	Not automatic read mode
	0xE7	Failure to get last response
	0xE8	Failure to control test
	0xE9	Failure to reset Reader
	0xEA	Rfidblock control failure
	0xEB	Automatic read in operation
	0xF0	Undefined other error
	0xF1	Failure to verify write operation
	0xFC	Abnormal antenna
	0xFF	None error

[NOTE] ‘EPC G2V2 Error Message (0x00 ~ 0x0F)’ means the error code defined in air protocol standard and is directly received from tag. Other error codes are generated by the reader.

Example) Invalid parameter

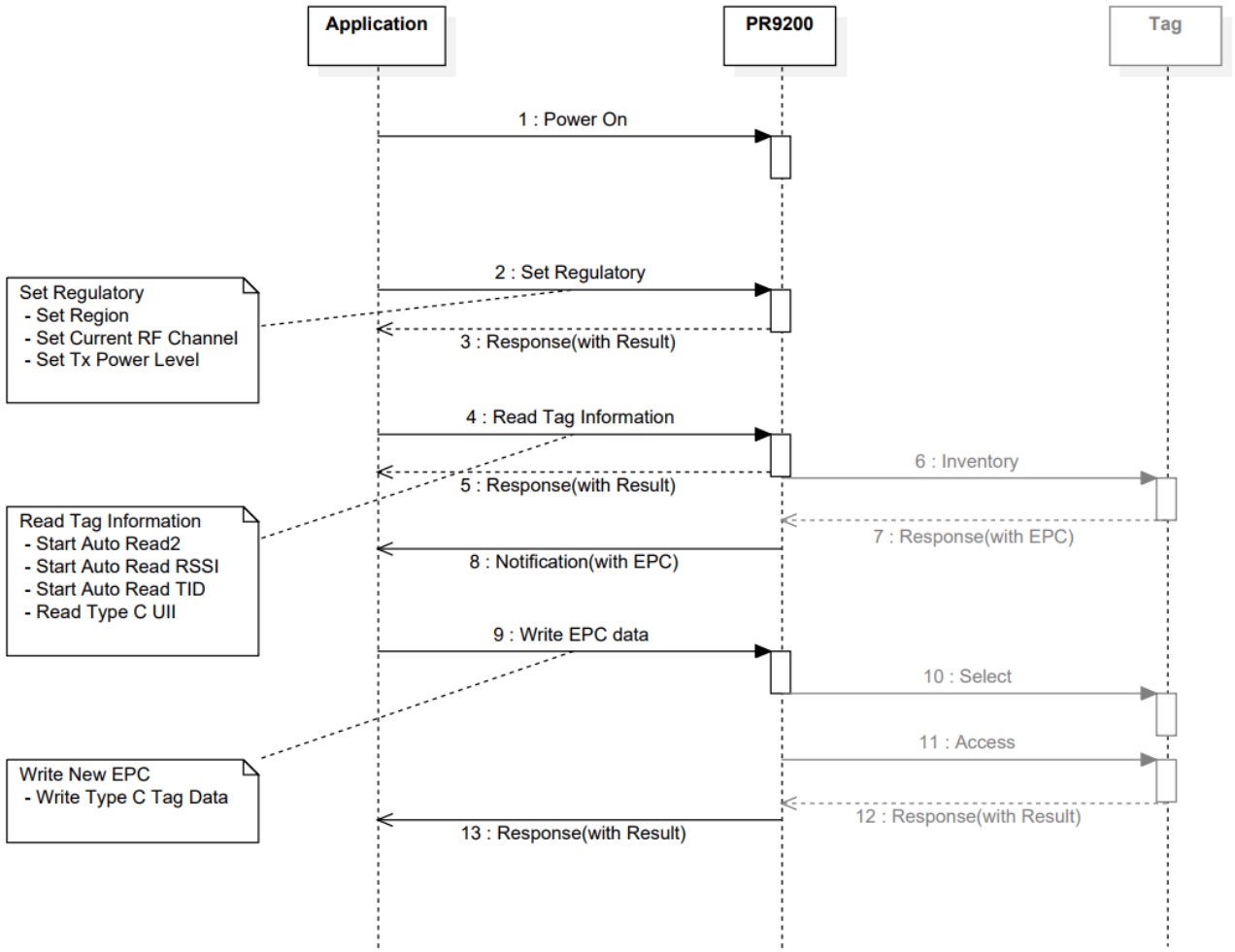
Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Reserved	Cmd. Code	Error Code
0xBB	0x01	0xFF	0x00	0x03	0xNN	0x07	0xE2
End Mark	CRC-16						
0x7E	0xNNNN						

5 Use Case

5.1 Change to the new EPC

Replace it with a new EPC.

5.1.1 Command Sequence



5.1.2 Command Example

[Command] Set Region
Region = US Wide

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x00	0x07	0x00	0x01	0x21	0x7E	0xNNNN

[Response] Set Region
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x07	0x00	0x01	0x00	0x7E	0xNNNN

[Command] Set Current RF Channel
Channel Number = 10, Channel Number Offset = 0

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	CN	CNO	End Mark
0xBB	0x00	0x12	0x00	0x02	0x0A	0x00	0x7E

CRC-16
0xNNNN

[Response] Set Current RF Channel
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x12	0x00	0x01	0x00	0x7E	0xNNNN

[Command] Set Tx Power Level
PWR = 200 (20.0 dBm)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PWR (MSB)	PWR (LSB)	End Mark
0xBB	0x00	0x16	0x00	0x02	0x00	0xC8	0x7E

CRC-16
0xNNNN

[Response] Set Tx Power Level
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x16	0x00	0x01	0x00	0x7E	0xNNNN

[Command] Start Auto Read 2
MTNU = 0, MTIME = 0, Repeat Cycle = 100

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Reserve	MTNU	MTIME
0xBB	0x00	0x36	0x00	0x05	0x02	0x00	0x00

RC(MSB)	RC(LSB)	End Mark	CRC-16
0x00	0x64	0x7E	0xNNNN

[Response] Start Auto Read 2
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x36	0x00	0x01	0x00	0x7E	0xNNNN

[Notification] Start Auto Read 2
PC = 0x3000, EPC = 0xE2003411B802011383258566

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PC(MSB)	PC(LSB)	EPC (MSB)
0xBB	0x02	0x22	0x00	0x0E	0x30	0x00	0xE2
0x00	0x34	0x11	0xB8	0x02	0x01	0x13	0x83
		EPC (LSB)	End Mark	CRC-16			
0x25	0x85	0x66	0x7E	0xNNNN			

[Command] Write Type C Tag Data
Access Password = 0x00000000, UL = 12 (0x0C), EPC = 0xE2003411B802011383258566,
Target memory bank = EPC, Start Address = 0x0002, Data Length = 6 word,
Data to write = 0xE2003411B802011383258566

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	AP (MSB)		
0xBB	0x00	0x46	0x00	0x23	0x00	0x00	0x00
AP (LSB)	UL (MSB)	UL (LSB)	EPC (MSB)				
0x00	0x00	0x0C	0xE2	0x00	0x34	0x11	0xB8
						EPC (LSB)	MB
0x02	0x01	0x13	0x83	0x25	0x85	0x66	0x01
SA (MSB)	SA (LSB)	DL (MSB)	DL (LSB)	DT (MSB)			
0x00	0x02	0x00	0x06	0xE2	0x00	0x34	0x11
							DT (LSB)
0xB8	0x02	0x01	0x13	0x83	0x25	0x85	0x77
End Mark	CRC-16						
0x7E	0xNNNN						

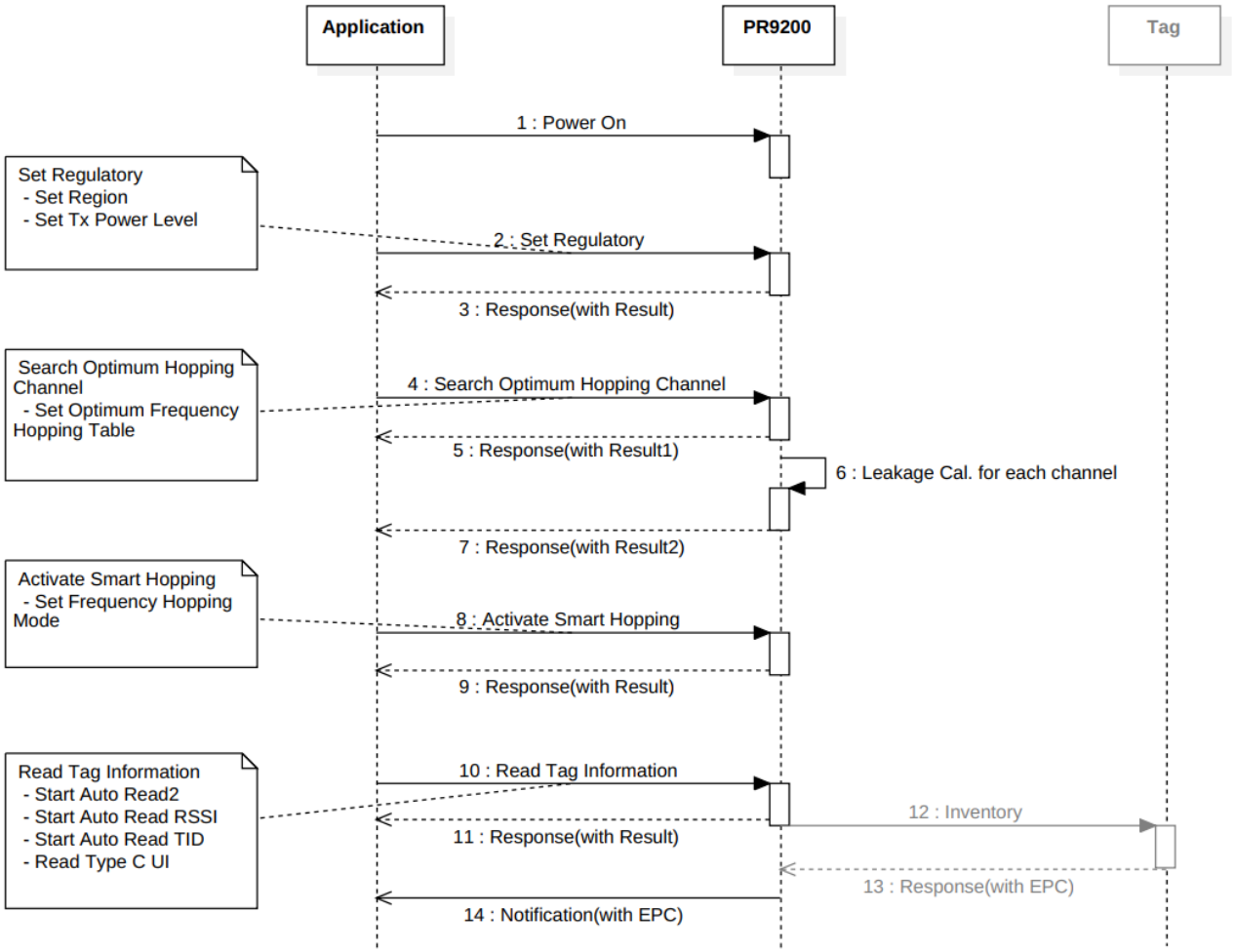
[Response] Write Type C Tag Data
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x46	0x00	0x01	0x00	0x7E	0xNNNN

5.2 Activate the Smart-hopping Table

Use a good channel selected by the RSSI value in the entire channel.

5.2.1 Command Sequence



5.2.2 Command Example

[Command] Set Region
Region = US Wide

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x00	0x07	0x00	0x01	0x21	0x7E	0xNNNN

[Response] Set Region
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x07	0x00	0x01	0x00	0x7E	0xNNNN

[Command] Set Tx Power Level
PWR = 200 (20.0 dBm)

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PWR (MSB)	PWR (LSB)	End Mark
0xBB	0x00	0x16	0x00	0x02	0x00	0xC8	0x7E

CRC-16
0xNNNN

[Response] Set Tx Power Level
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x16	0x00	0x01	0x00	0x7E	0xNNNN

[Command] Set Optimum Frequency Hopping Table

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	End Mark	CRC-16
0xBB	0x00	0xE4	0x00	0x00	0x7E	0xNNNN

[Response] Set Optimum Frequency Hopping Table
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0xE4	0x00	0x01	0x00	0x7E	0xNNNN

[Command] Set Frequency Hopping Mode
Smart Hopping Mode

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x00	0xE6	0x00	0x01	0x01	0x7E	0xNNNN

[Response] Set Frequency Hopping Mode
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0xE6	0x00	0x01	0x00	0x7E	0xNNNN

[Command] Start Auto Read 2
MTNU = 0, MTIME = 0, Repeat Cycle = 100

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Reserve	MTNU	MTIME
0xBB	0x00	0x36	0x00	0x05	0x02	0x00	0x00
RC(MSB)	RC(LSB)	End Mark	CRC-16				
0x00	0x64	0x7E	0xNNNN				

[Response] Start Auto Read 2
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x36	0x00	0x01	0x00	0x7E	0xNNNN

[Notification] Start Auto Read 2
PC = 0x3000, EPC = 0xE2003411B802011383258566

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PC(MSB)	PC(LSB)	EPC (MSB)
0xBB	0x02	0x22	0x00	0x0E	0x30	0x00	0xE2
0x00	0x34	0x11	0xB8	0x02	0x01	0x13	0x83
		EPC (LSB)	End Mark	CRC-16			
0x25	0x85	0x66	0x7E	0xNNNN			

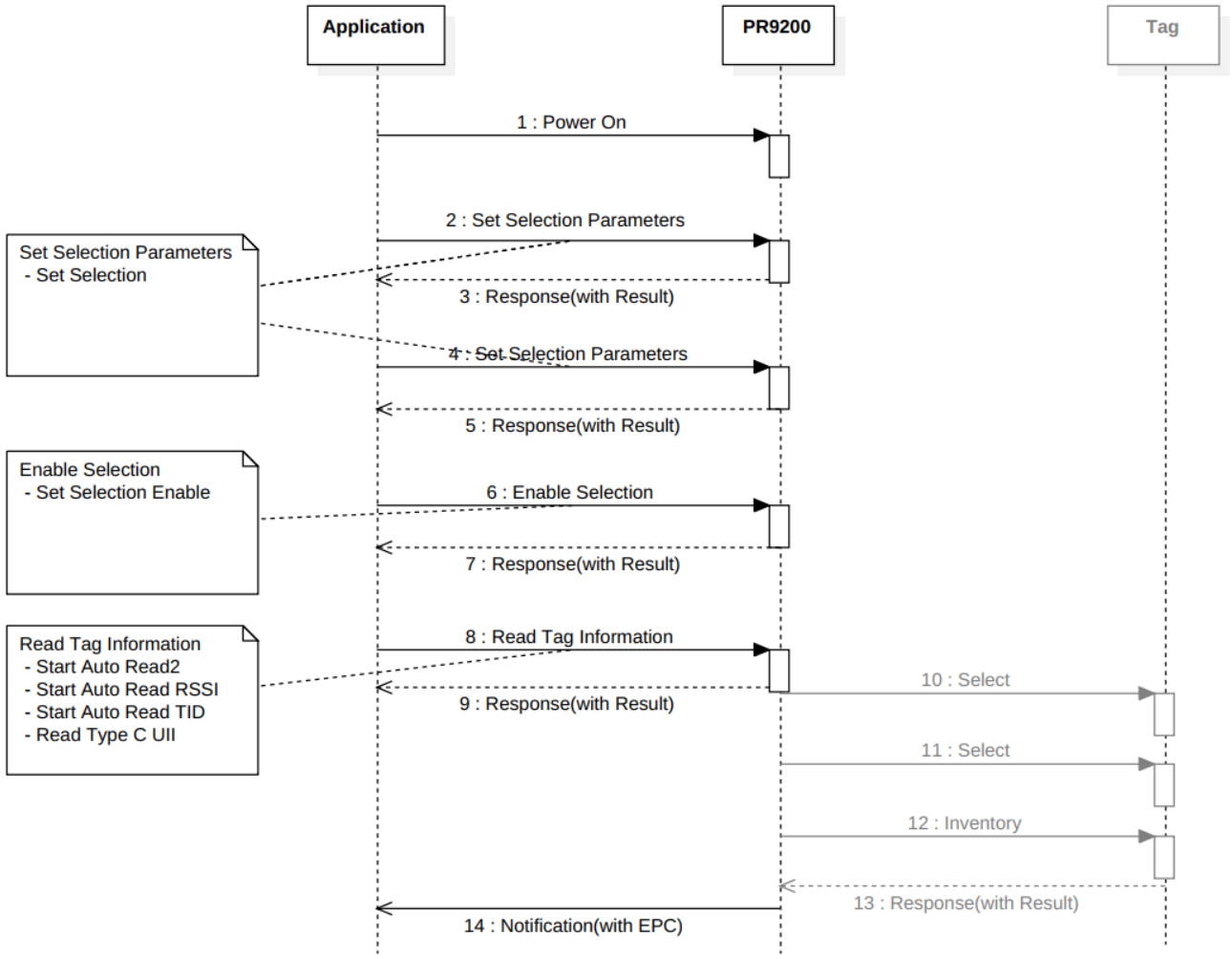
5.3 Select the Multiple Tags

Use to select multiple tags.
When there are several tags in the field, only some Tag can be selected and read. This is an example for reading Tag 1, 2, 4 of the Tags with EPC as below.

- Tag 1: 0xAAAA 1111 1111 1111 1111 1111
- Tag 2: 0xAAAA 2222 2222 2222 2222 2222
- Tag 3: 0xBBBB 3333 3333 3333 3333 3333
- Tag 4: 0xBBBB 4444 4444 4444 4444 4444
- Tag 5: 0xCCCC 5555 5555 5555 5555 5555

Tag 1, 2 masks MSB 1 word '0xAAAA' and Tag 4 masks the entire EPC for selection.
At this time, Select the 'Action' parameter differently. In the first Select set the 'Action' parameter to 0 so that only the matching Tag is inventoried flag as A and the not-matching Tag is B. In the second Select only the matching tag is set to A and the not-matching tag is set to 1 so that the existing inventoried flag is maintained.

5.3.1 Command Sequence



5.3.2 Command Example

[Command] Set Selection (Frist)
Index = 1, Target=S0, Action=assert SL or inventoried → A(Matching), deassert SL or inventoried → B (Not-Matching), MB=EPC, Pointer=0x00000020, Length=0x10, T=0, Mask=0xAAAA

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Index	Target	Action
0xBB	0x00	0xAF	0x00	0x09	0x01	0x00	0x00
MB	Pointer (MSB)	Pointer (LSB)	Length	Mask (MSB)	Mask (LSB)	End Mark	CRC-16
0x01	0x00	0x20	0x10	0xAA	0xAA	0x7E	0xNNNN

[Response] Set Selection
Success

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

[Command] Set Selection (Second)
Index = 2, Target=S0, Action= assert SL or inventoried→ A(Matching), do nothing (Not-Matching),
MB=EPC, Pointer = 0x00000020, Length =0x60, T=0, Mask = 0xBBBB 4444 4444 4444 4444 4444

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Index	Target	Action
0xBB	0x00	0xAF	0x00	0x13	0x02	0x00	0x01
MB	Pointer (MSB)	Pointer (LSB)	Length	Mask (MSB)			
0x01	0x00	0x20	0x60	0xBB	0xBB	0x44	0x44
							Mask (LSB)
0x44	0x44	0x44	0x44	0x44	0x44	0x44	0x44
End Mark	CRC-16						
0x7E	0xNNNN						

[Response] Set Selection
Success

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

[Command] Set Selection Enable
Selection Enable

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Enable	End Mark	CRC-16
0xBB	0x00	0x8F	0x00	0x01	0x03	0x7E	0xNNNN

[Response] Set Selection Enable
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x8F	0x00	0x01	0x00	0x7E	0xNNNN

[Command] Start Auto Read 2
MTNU = 0, MTIME = 0, Repeat Cycle = 100

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Reserve	MTNU	MTIME
0xBB	0x00	0x36	0x00	0x05	0x02	0x00	0x00
RC(MSB)	RC(LSB)	End Mark	CRC-16				
0x00	0x64	0x7E	0xNNNN				

[Response] Start Auto Read 2
Success

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	Arg	End Mark	CRC-16
0xBB	0x01	0x36	0x00	0x01	0x00	0x7E	0xNNNN

[Notification] Start Auto Read 2
PC = 0x3000, EPC = 0xAAAA11111111111111111111

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PC(MSB)	PC(LSB)	EPC (MSB)
0xBB	0x02	0x22	0x00	0x0E	0x30	0x00	0xAA
0xAA	0x11	0x11	0x11	0x11	0x11	0x11	0x11
		EPC (LSB)	End Mark	CRC-16			
0x11	0x11	0x11	0x7E	0xNNNN			

[Notification] Start Auto Read 2
PC = 0x3000, EPC = 0xAAAA22222222222222222222

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PC(MSB)	PC(LSB)	EPC (MSB)
0xBB	0x02	0x22	0x00	0x0E	0x30	0x00	0xAA
0xAA	0x22	0x22	0x22	0x22	0x22	0x22	0x22
		EPC (LSB)	End Mark	CRC-16			
0x22	0x22	0x22	0x7E	0xNNNN			

[Notification] Start Auto Read 2
PC = 0x3000, EPC = 0xBBBB33333333333333333333333

Preamble	Msg Type	Code	PL (MSB)	PL (LSB)	PC(MSB)	PC(LSB)	EPC (MSB)
0xBB	0x02	0x22	0x00	0x0E	0x30	0x00	0xBB
0xBB	0x33	0x33	0x33	0x33	0x33	0x33	0x33
		EPC (LSB)	End Mark	CRC-16			
0x33	0x33	0x33	0x7E	0xNNNN			

6 References

- ISO/IEC 18000-6 "Information technology - Radio frequency identification (RFID) for item management - Part6: Parameters for air interface communications at 860MHz to 960MHz"
- EPC™ "Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID Protocol for Communications at 860 MHz - 960 MHz"
- TTA, MRFS-1-06-R1-v1.0, “Mobile RFID Reader Control Protocol”

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