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Introduction to M900/WZ-RP9X RFID chipset firmware commands V3.2

Change history

Version	Day	Description
V1.1	15 Oct 2013	M900 chipset firmware instruction
V2.0	20 Dec 2019	Commands Revision
V2.1	10 Jan 2020	Correct GPIO typo mistake
V2.2	5 Aug 2020	Add comment
V3.0	24 Oct 2020	Correct typo mistake
V3.1	25 Oct 2020	Antenna switching explanation Section 4.38
V3.2	22 Jun 2021	Elaborate explanation

1.Table of content

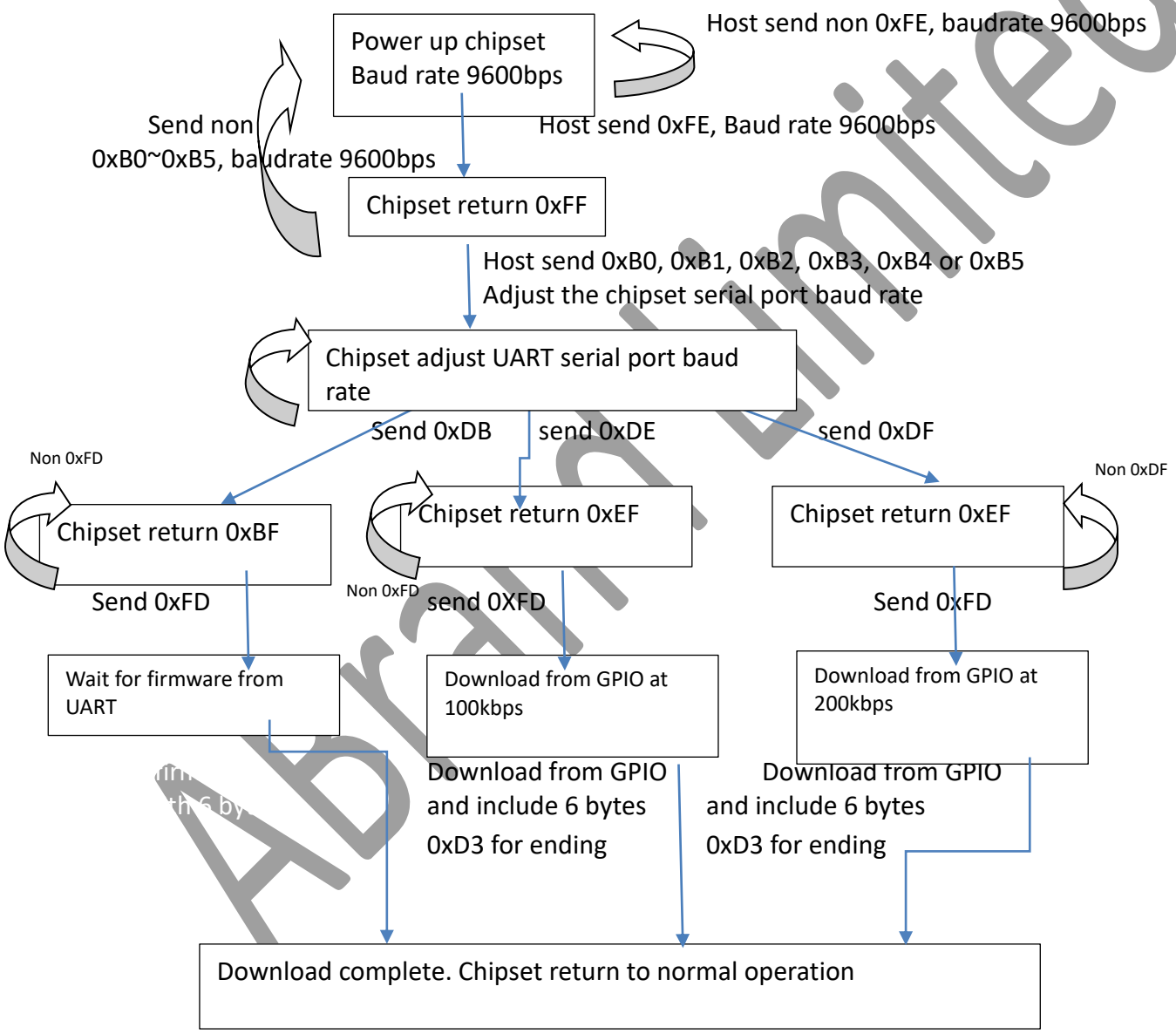
2. Introduction to M900 internal MCU

M900 chipset has been built-in with 8-bit 8051 MCU, 256 byte internal memory , 16k byte program memory and 3 timers (Timer 2 reserved for baud rate generator, timer 0 for FHSS controller, timer 1 can be used by user). Built-in 8k RAM for data, shared by MCU and decoding. RAM cannot be accessed by MCU during data receiving.

The firmware of M900 MCU can be programed by UART serial port or GPIO (P1.0 and 1.1) from external I2C EEPROM

The serial port of UART is 8 bits. One stop bit. No parity check.

M900 download can be completed by a series of hand-shacking protocol as below



Baud rate setting

Type	Baud rate (bps)
0xB0	9600
0xB1	19200
0xB2	28800
0xB3	38400
0xB4	57600
0xB5	115200

3. Firmware command explanation

3.1 Frame command format

Firmware command is consisted with frame header, type, command code, command parameter length, Antenna Number, parameter, checksum and frame-end. All are in HEX format.

e.g.

Header	Type	Command	PL(MSB)/ANT	PL(LSB)	Parameter	Checksum	End
AA	00	07	00	01	01	09	DD

Header: 0xAA
Type: 0x00
Command: 0x07
ANT: 0x00 (For inventory command or access command, this byte represent the Antenna Number)
PL: 0x0001 Command parameter

Parameter: 0x01
Checksum: 0x09
End: 0xDD
Checksum covers the accumulated sum from Type to Parameter . Only take the lower byte (LSB).

3.2 Frame command category

Type	Description
0x00	Command frame, host send to M900
0x01	Response frame, M900 send to host
0x02	Acknowledgement, M900 send to PC

For each command frame, there should be a specific response frame. The response frame confirm the execution of the command.
Single and multiple inventory will also be followed by acknowledgement frame. The quantity of acknowledgement frame is determined by MCU according to the situation. When reader read a tag, it will send out one acknowledgement frame. If read multiple tags, it will send out multiple acknowledgement frames.

4. Firmware command definition

4.1 To get reader module info commands

Hardware version, firmware version and manufacturer info.

4.1.1 Frame format

Type: 0x00
Command: 0x03
Parameter:
Hardware version: 0x00
Firmware version: 0x01
Manufacturer: 0x02

e.g. Below to get the reader hardware version:

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	00	03	00	01	00	04	DD

Type: 0x00
Command: 0x03
PL: 0x0001
Parameter 0x00 (Hardware version)
Checksum: 0x04

4.1.2 Response frame format

Type: 0x01
Command: 0x03
Parameter: Variable (ASCII)

The first byte of response frame data is module information type:
Hardware version: 0x00
Firmware version: 0x01
Manufacturer: 0x02
All the remaining bytes are ASCII code.

e.g. Response frame of getting the Module hardware version

Header	Type	Command	PL(MSB)	PL(LSB)	Info Type	Info	
AA	0	03	00	0B	00	55 (U)	48(H)
46(F)	20( )	33(3)	30(0)	64(d)	42(B)	6D (m)	20 ( )
Checksum	End						
56(V)	31(1)	2E(.)	30(0)	8C	DD		

Type: 0x01
Command: 0x03
PL: 0x000B
Info Type: 0x00 (Hardware version)
Info: 55 48 46 20 33 30 64 42 6D 20 56 31 2E 30 (“UHF 30dBm V1.0” ASCII code)
Checksum: 0x8C

4.2 Single inventory command

4.2.1 Command Frame format

After a complete EPC Class 1 Gen 2 protocol inventory operation, not include the Select operation, It is automatically enable and disable power amplifier before and after the execution. In single inventory , There is another command to set the parameter of Query. Firmware built in with default values. Single inventory command as below:

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End
AA	00	22	00	00	22	DD

Type: 0x00
Command: 0x22
PL: 0x0000
Checksum: 0x22

4.2.2 Acknowledgement frame format

When the chipset receives the single inventory command, if the chipset read a tag with valid CRC parameters, it will response with RSSI, PC, EPC and CRC data. It will send out response according to the number of tag read in correct. One response for one valid tag.

e.g.

Header	Type	Command	ANT	PL(LSB)	RSSI	PC(MSB)	PC(LSB)
AA	02	22	01	11	C9	34	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	CRC(MSB)	CRC(LSB)	Checksum	End
E3	D5	0D	70	3A	76	F0	DD

Type: 0x02
Command: 0x22
ANT: 0x01
PL: 0x0011
RSSI : 0XC9
PC: 0X3400
EPC 0X30751FEB705C5904E3D50D70
CRC 0x3A76
CHECKSUM 0xF0

The RSSI value reflect the chipset input port current value, not include the antenna gain and directional coupler attenuation. It is the chipset input terminal value, signed HEX value, in dBm representation. In above example, RSSI is 0xC9, the input signal strength is -55dBm at chipset input terminal.

4.2.3 Response frame format

If no valid tag is received, or CRC is incorrect, below response frame will be received: (Error code 0x15 as shown below)

Header	Type	Command	ANT	PL(LSB)	Parameter	Checksum	End
AA	01	FF	01	01	15	17	DD

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x01
Parameter 0x15
Checksum 0x17

4.3 Multiple inventory cycle command

4.3.1 Frame format

This command to request chipset for Multiple inventory operation. Range from 0-65535 cycle. For example, inventory cycle quantity is 10000

Header	Type	Command	PL(MSB)	PL(LSB)	Reserved	CNT(MSB)	CNT(LSB)
AA	00	27	00	03	22	27	10
Checksum	End						
83	DD						

Type: 0x00
Command: 0x27
PL: 0x0003
Reserved 0x22
CNT 0x2710
Checksum 0x83

4.3.2 Acknowledge frame format

The frame format and definition is similar to single inventory as shown below:

Header	Type	Command	ANT	PL(LSB)	RSSI	PC(MSB)	PC(LSB)
AA	02	22	01	11	C9	34	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	CRC(MSB)	CRC(LSB)	Checksum	End
E3	D5	0D	70	3A	76	F0	DD

Type: 0x02
Command: 0x27
ANT: 0x01
PL: 0x0011
RSSI : 0XC9
PC: 0X3400
EPC 0X30751FEB705C5904E3D50D70
CRC 0x3A76
CHECKSUM 0xF0

4.3.3 Response frame format

If chipset cannot receive any tag or the CRC is incorrect, it will response with error code 0x15, as below

Header	Type	Command	ANT	PL(LSB)	Parameter	Checksum	End
AA	01	FF	01	01	15	17	DD

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x01
Parameter 0x15
Checksum 0x17

4.4 Command to stop multiple inventory

4.4.1 Command frame format

During MCU is carrying out multiple inventory operation, we can stop (not pause) the operation by using this command

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End
AA	00	28	00	00	28	DD

Type: 0x00
Command: 0x28
PL: 0x0000
Checksum: 0x28

4.4.2 Response frame format

After successfully stopped the multiple inventory operation, the chipset will response as below.

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	01	28	00	01	00	2A	DD

Type: 0x01
Command: 0x28
PL: 0x0001
Parameter 0x00
Checksum 0x2A

4.5 Parameter setting for Select command

4.5.1 Command frame format

When setting the “Select” parameter, at the same time, it will set the “Select” mode to be 0x02 (Before carry out the inventory operation, it is necessary to send the “Select “ command) . Under many tags situation, we can use “Select” parameter to inventory or read/write operation specific to only ONE particular tag as below.

Header	Type	Command	PL(MSB)	PL(LSB)	SelParam	Ptr(MSB)	
AA	00	0C	00	13	01	00	00
	Ptr(LSB)	MaskLen	Truncate	Mask(MSB)			
00	20	60	00	30	75	1F	EB
							Mask(LSB)
70	5C	59	04	E3	D5	0D	70
Checksum	End						
AD	DD						

Type 0x00
Command 0x0C
PL 0x0013
SelParam 0x01(target:3’b000, Action: 3’b000, MemBank: 2’b01)
Ptr 0x00000020(unit:bit, not word), start from EPC memory
MaskLen 0x60 (mask length, 6 words, 96 bits)
Truncate 0x00 (0x00 disable truncation, 0x80 enable truncation)
Mask 0x30751FEB705C5904E3D50D70
Checksum 0xAD

SelParam is 1 Byte, (Target is the 3 MSB bits, Action is middle 3 bits, MemBank is last 2 bits。
MemBank ：
2’b00: Tag RFU memory bank
2’b01: Tag EPC memory bank
2’b10: Tag TID memory bank
2’b11: Tag User memory bank

For the meaning of Target and Action, please refer to EPC Gen2 protocol.
When the length of “Select Mask” is greater than 80bits (5 words), Send Select command to set all tags with Inventoried Flag to A, SL Flag changed to ~SL state. And then follow by necessary Action operation.
When the length of “Select Mask” within 80-bits (5 words), it will NOT use the Select command to set the “Inventoried Flag “ to A and SL Flag changing to ~SL state in advance.

4.5.2 Response frame format

After set the Select parameter successfully, the chipset will response as below

Header	Type	Command	PL(MSB)	PL(LSB)	Data	Checksum	End
AA	01	0C	00	01	00	0E	DD

Type: 0x01
Command: 0x0C
PL: 0x0001
Data 0x00
Checksum 0x0E

4.6 Getting Select command info

4.6.1 Command frame format

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End	
AA	00	0B	00	00	0B	DD	

Type: 0x00
Command: 0x0B
PL: 0x0000
Checksum 0x0B

4.6.2 Response frame format

Getting the "Select" parameter, the chipset will response as below

Header	Type	Command	PL(MSB)	PL(LSB)	SelParam	Ptr(MSB)	
AA	01	0B	00	13	01	00	00
	Ptr(LSB)	MaskLen	Truncate	Mask(MSB)			
00	20	60	00	30	75	1F	EB
							Mask(LSB)
70	5C	59	04	E3	D5	0D	70
Checksum	End						
AD	DD						

Type: 0x01
Command: 0x0B
PL: 0x0013
SelParam: 0x01 (Target: 3' b000, Action: 3' b000, MemBank: 2' b01)
Ptr: 0x00000020 (unit bit , Not word) , Start from EPC memory
Mask /MaskLen: 0x60 (6 words , 96-bits)
Truncate or not : 0x00 (0x00 is Disable truncation, 0x80 is Enable truncation)
Mask : 0x30751FEB705C5904E3D50D70
Checksum: 0xAD

4.7 Setting Select Mode command

4.7.1 Command frame format

Please set the Select parameters in advance. Execute below command to set the Select Mode. For example cancel the “Select” command as shown below:

Header	Type	Command	PL(MSB)	PL(LSB)	Mode	Checksum	End
AA	00	12	00	01	01	14	DD

Type: 0x00
Command: 0x12
PL: 0x0001
Select Mode: 0x01
Checksum 0x14

Select Mode definition ：
0x00: Send Select tag command to select specific tag before any tag operation
0x01: No Select command transmit before any tag operation
0x02: Only send Select command for the tags which has been inventoried . Need to use Select command to select tag specific tag before Read, Write, Lock, Kill operation。

4.7.2 Response frame format

After successfully cancel or sending Select command, the chipset will response as below

Header	Type	Command	PL(MSB)	PL(LSB)	Data	Checksum	End
AA	01	0C	00	01	00	0E	DD

Type: 0x01
Command: 0x0C
PL: 0x0001
Data: 0x00 (execution success)
Checksum: 0x0E

4.8 Read the tag memory bank

4.8.1 Command frame format

For single tag, to read a specific memory bank address and data length. Read the memory bank address shift (SA) and read the memory bank data length (DL) . The unit is word (two bytes / 16-bits). Need to send out the Select parameters in advance. If the access password is all zero, it will not send out Access command.

Header	Type	Command	PL(MSB)	PL(LSB)	AP(MSB)		
AA	00	39	00	09	00	00	FF
AP(LSB)	MemBank	SA(MSB)	SA(LSB)	DL(MSB)	DL(LSB)	Checksum	End
FF	03	00	00	00	02	45	DD

Type 0x00
Command 0x39
PL 0x0009
Access Password 0x0000FFFF
MemBank: 0x03 (User bank)
Shift Address SA: 0x0000
Data Length DL: 0x0002
Checksum: 0x45

4.8.2 Response frame format

After reading the specific memory bank of the tag, and the CRC is correct, it will will response as below:

Header	Type	Command	ANT	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	39	01	13	0E	34	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	Data(MSB)			Data(LSB)
E3	D5	0D	70	12	34	56	78
Checksum	End						
B1	DD						

Type 0x01
Command 0x39
ANT: 0x01
PL: 0x0013
PC+EPC , length UL: 0x0E
PC: 0x3400
EPC: 0x30751FEB705C5904E3D50D70
Data: 0x12345678
Checksum: 0xB1

If the tag not exist or the EPC is not correct, the response will be error code 0x09, e.g.

Header	Type	Command	ANT	PL(LSB)	Error Code	Checksum	End
AA	01	FF	01	01	09	0B	DD

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x0001
Error code: 0x09
Checksum 0x0B

If the access password is not correct, the response error code is 0x16, and then reply with PC+EPC of the tag e.g.

Header	Type	Command	ANT	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	01	10	16	0E	34
PC(LSB)	EPC(MSB)						
00	30	75	1F	EB	70	5C	59
				EPC(LSB)	Checksum	End	
04	E3	D5	0D	70	76	DD	

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x0010
Error code: 0x16
PC+EPC Length UL: 0x0E
PC: 0x3400
ECP: 0x30751FEB705C5904E3D50D70
Checksum 0x76

If the tag replies with error code based on EPC Gen2 protocol definition, the EPC Gen2 defines that the error codes only valid for lower 4 bits. The response frame will reply error code after 0xA0.
For example, when the Shift Address or the Data length is incorrect in the transmit command. The length of memory read is more than actual. According to the EPC Gen2 protocol, the tag will return error code 0xA3 (memory overrun). The response frame will return the error code 0xA3 and the PC+EPC , as shown below:

Header	Type	Command	ANT	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	01	10	A3	0E	34
PC(LSB)	EPC(MSB)						
00	30	75	1F	EB	70	5C	59
				EPC(LSB)	Checksum	End	
04	E3	D5	0D	70	03	DD	

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x0010
Error code: 0xA3
PC+EPC length UL: 0x0E
PC: 0x3400
EPC: 0x30751FEB705C5904E3D50D70
Checksum: 0x03

4.9 Write the Memory bank of tag

4.9.1 Command frame format

For single tag, write to the memory bank with specific address and data length. For the memory bank shift address (SA) and Data length (DL), their units are word (2 bytes/ 16 bits). Before execute this command, It is necessary to send out “Select” parameters first in order to a specific tag for writing to the memory bank. If the Access password is all zero, it will not send out Access command.

The length of data to be written into memory bank is DT which cannot be greater than 32 words (or 64 bytes/ 512 bits)

Header	Type	Command	PL(MSB)	PL(LSB)	AP(MSB)		
AA	00	49	00	0D	00	00	FF
AP(LSB)	MemBank	SA(MSB)	SA(LSB)	DL(MSB)	DL(LSB)	DT(MSB)	
FF	03	00	00	00	02	12	34
	DT(LSB)	Checksum	End				
56	78	6D	DD				

Type 0x00
Command 0x49
PL 0x000D
Access password 0x0000FFFF
MemBank: 0x03
Shift Address SA 0x0000
Data Length DL 0x0002
Written Data DT 0x12345678
Checksum 0x6D

4.9.2 Response frame format

After writing data into the tag memory bank, if the chipset receive the acknowledgement value is correct, it will provide below response.

Header	Type	Command	ANT	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	49	01	10	0E	34	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	Parameter	Checksum	End	
E3	D5	0D	70	00	AA	DD	

Type: 0x01
Command: 0x49
ANT: 0x01
PL: 0x0010
PC+EPC Length UL: 0x0E
PC: 0X3400
EPC: 0x30751FEB705C5904E3D50D70
Parameter: 0x00 (execution success)
Checksum 0xAA

If the tag number is not exist or the EPC code is incorrect, the response error code will be 0x10, e.g.

Header	Type	Command	ANT	PL(LSB)	Parameter	Checksum	End
AA	01	FF	01	01	10	0B	DD

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x0001
Parameter: 0x10
Checksum 0x0B

If the Access Password is incorrect, the response error code will be 0x16, and also return specific tag PC+EPC e.g.

Header	Type	Command	ANT	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	01	10	16	0E	34
PC(LSB)	EPC(MSB)						
00	30	75	1F	EB	70	5C	59
				EPC(LSB)	Checksum	End	
04	E3	D5	0D	70	76	DD	

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x0016
Error code: 0x16
PC+EPC, length UL: 0x0E
PC: 0X3400
EPC: 0x30751FEB705C5904E3D50D70
Checksum 0x76

If the tag reply with the EPC Gen2 error codes, the error code will be taken logic “OR” operation with 0xB0. Then response frame will reply the final logic OR result.

For example, if the shift address or the data length is incorrect, the length of data to be written into memory is over the user bank, error code is 0x03 (Memory Overrun) will be returned according to EPC Gen2 protocol. It will response with final error code 0xB3 together with PC+EPC , e.g.

Header	Type	Command	ANT	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	01	10	B3	0E	34
PC(LSB)	EPC(MSB)						
00	30	75	1F	EB	70	5C	59
				EPC(LSB)	Checksum	End	
04	E3	D5	0D	70	13	DD	

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x0010
Error code: 0xB3
PC+EPC length UL: 0x0E
PC: 0X3400
EPC: 0x30751FEB705C5904E3D50D70
Checksum 0x13

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4.10 Lock the tag memory bank

4.10.1 Command frame format

For a single tag, to lock or unlock the memory bank. Please set the “Select” parameters in advance in order to select a specific tag. For example to lock the Access Password, The command as below:

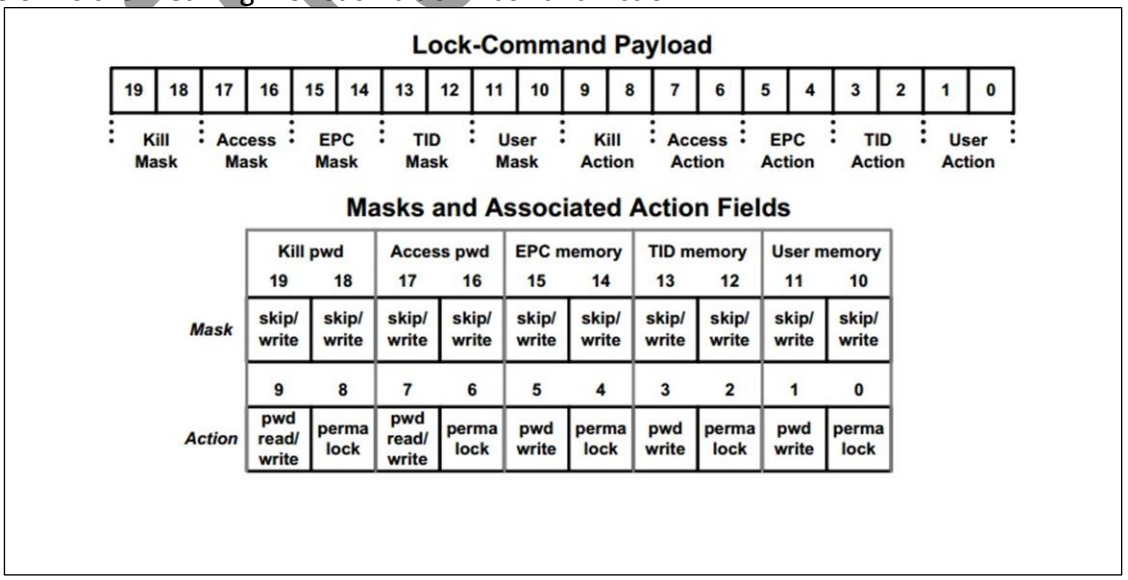
Header	Type	Command	PL(MSB)	PL(LSB)	AP(MSB)		
AA	00	82	00	07	00	00	FF
AP(LSB)	LD(MSB)		LD(LSB)	Checksum	End		
FF	02	00	80	09	DD		

Type 0x00
Command 0x82
PL 0x0007
Access Password 0x0000FFFF
Lock operation LD 0x020080
Checksum 0x09

The Upper 4 bit of LD parameter for Lock operation is reserved. The remaining payload 20 bits which include the Mask and Action of Lock operation, each with 10 bits from high to low bit . For more detail , please reference EPC Gen2 section 6.3.2, 11.3.5 of revision 1.2.0.

Mask is a mask template, when this bit is 1 , Action is effective. Each memory bank ‘s Action contains 2 bits, 00~11, sequentially corresponding to the meaning :00 unlock, 01 always unlock, 01 lock, 11 always lock respectively.

For example, for the Kill Mask which contain 2 bits is = 00, no matter the Kill Action is, it will not be effective.
Whenever the Kill Action are 2-bits =10, it means that the Kill Password has been Lock (Not Permanent Lock). Read/Write operation can only be performed via a valid Access Password.
Below is the meaning of each bit of Mask and Action :



pwd-write	permalock	Description
0	0	Associated memory bank is writeable from either the **open** or **secured** states.
0	1	Associated memory bank is permanently writeable from either the **open** or **secured** states and may never be locked.
1	0	Associated memory bank is writeable from the **secured** state but not from the **open** state.
1	1	Associated memory bank is not writeable from any state.
pwd-read/write	**permalock**	**Description**
0	0	Associated password location is readable and writeable from either the **open** or **secured** states.
0	1	Associated password location is permanently readable and writeable from either the **open** or **secured** states and may never be locked.
1	0	Associated password location is readable and writeable from the **secured** state but not from the **open** state.
1	1	Associated password location is not readable or writeable from any state.

4.10.2 Response frame format

If lock operation execute correctly, the tag will reply with valid feedback. The response frame will be.

Header	Type	Command	ANT	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	82	01	10	0E	34	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	Parameter	Checksum	End	
E3	D5	0D	70	00	E3	DD	

Type: 0x01
Command: 0x82
ANT: 0x01
PL: 0x0010
PC+EPC length UL: 0x0E
PC: 0X3400
EPC: 0x30751FEB705C5904E3D50D70
Parameter: 0x00 (Execution Success)
Checksum 0xE3

If the tag does not exist or the EPC code is incorrect, the response error code will be 0x13, e.g.

Header	Type	Command	ANT	PL(LSB)	Parameter	Checksum	End
AA	01	FF	01	01	13	15	DD

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x0001
Data 0x13
Checksum 0x15

If the Access Password is incorrect, the response error code will be 0x16, and also return the PC+EPC, e.g.

Header	Type	Command	ANT	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	01	10	16	0E	34
PC(LSB)	EPC(MSB)						
00	30	75	1F	EB	70	5C	59
				EPC(LSB)	Checksum	End	
04	E3	D5	0D	70	76	DD	

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x0016
Error code: 0x16
PC+EPC length UL: 0x0E
PC: 0X3400
EPC: 0x30751FEB705C5904E3D50D70
Checksum 0x76

If there is EPC Gen2 error codes returned, the error code will be taken logic “OR” operation with 0x0C. Then response frame will reply the final logic OR result.
For example, if the tag TID is permanent locked, set the TID to unlock through Lock command, Then there will be error code 0x04 (Memory locked) returned according to EPC Gen2. The response frame also include the final error code 0xC4. There will also return the tag’s PC +EPC as below:

Header	Type	Command	ANT	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	01	10	C4	0E	34
PC(LSB)	EPC(MSB)						
00	30	75	1F	EB	70	5C	59
				EPC(LSB)	Checksum	End	
04	E3	D5	0D	70	24	DD	

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x0010
Error code: 0xC4
PC+EPC UL: 0x0E
PC: 0X3400
EPC: 0x30751FEB705C5904E3D50D70
Checksum 0x24

4.11 Kill the tag

4.11.1 Command frame format

Need to set the Select parameters command before executing this command in order to select a specific tag number for Kill operation. Kill operation for single tag as below:

Header	Type	Command	PL(MSB)	PL(LSB)	KP(MSB)		
AA	00	65	00	04	00	00	FF
KP(LSB)	Checksum	End					
FF	67	DD					

Type 0x00
Command 0x65
PL 0x0004
Kill Password 0x0000FFFF
Checksum 0x67

4.11.2 Response frame format

If kill operation execute correctly and the return CRC is correct, the tag will reply with valid feedback. The response frame will be.

Header	Type	Command	ANT	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	65	01	10	0E	34	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	Parameter	Checksum	End	
E3	D5	0D	70	00	C6	DD	

Type 0x01
Command 0x65
ANT 0x01
PL 0x0010
PC+EPC(UL length) 0x0E
PC 0x3400
EPC 0x30751FEB705C5904E3D50D70
Parameter 0x00 (execution success)
Checksum 0xC6

If the tag is not exist or the EPC code is incorrect, the response error code will be 0x12 e.g.

Header	Type	Command	ANT	PL(LSB)	Parameter	Checksum	End
AA	01	FF	01	01	12	14	DD

Type: 0x01
Command: 0xFF
ANT: 0x01
PL: 0x0001
Parameter: 0x12
Checksum 0x14

If the tag reply with EPC Gen2 error code, the error code will be taken logic "OR" operation with 0xD0. Then response frame will reply the final logic OR result.

Note: If the tag without setting the Kill Password, that mean the password will be all 0. The tag will not be killed according to the Gen2 protocol. Then the return final error code will be 0xD0, as shown below:

Header	Type	Command	ANT	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	01	10	D0	0E	34
PC(LSB)	EPC(MSB)						
00	30	75	1F	EB	70	5C	59
				EPC(LSB)	Checksum	End	
04	E3	D5	0D	70	30	DD	

Type 0x01
Command 0xFF
ANT 0x01
PL 0x0010
Error code 0xD0
PC+EPC(UL length) 0x0E
PC 0x3400
EPC 0x30751FEB705C5904E3D50D70
Checksum 0x30

4.12 Setting the Baudrate

4.12.1 Command Frame format

Need to connect with the reader in advance. Then setting the baudrate afterwards. Below example is to set the baudrate to 19200bps :

Header	Type	Command	PL(MSB)	PL(LSB)	Pow(MSB)	Pow(LSB)	Checksum
AA	00	11	00	02	00	C0	D3
End							
DD							

Type 0x01
Command 0x11
PL 0x0002
Pow (Power parameter) :0x00C0 (Baudrate/100 is HEX value, e.g. 19200/100=192 =0xC0
Checksum 0xD3

4.12.2 Response frame definition

There is no response frame for this command. Therefore, it will use the new baudrate to communicate with host. The host also need to change to new baudrate accordingly for new connection with the reader.

4.13 Obtain the Query parameter

4.13.1 Command frame format

To obtain the Query parameters from the firmware, the command as below

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End	
AA	00	0D	00	00	0D	DD	

Type: 0x00
Command: 0x0D
Parameter Length PL: 0x0000
Checksum 0x0D

4.13.2 Response frame format

If the Query command execute correctly, the response frame will be

Header	Type	Command	PL(MSB)	PL(LSB)	Para(MSB)	Para(LSB)	Checksum
AA	01	0D	00	02	10	20	40
End							
DD							

Type 0x01
Command 0x0D
PL 0x0002
Query Parameter 0x1020
Checksum 0x40

Parameter has 2 words, below explain the setting within the Query parameters
DR=8, M=1, TRext=Use pilot tone, Sel=00, Session=00, Target=A, Q=4

DR(1-bit) DR=8(1'b0), DR=64/3(1'b1). Only support DR=8 mode
M(2-bits) M=1(2'b00), M=2(2'b01),M=4(2'b10),M=8(2'b11). Only support M=1 mode
TRext(1-bit) No pilot tone(1'b0), Use pilot tone(1'b1). Only support "Use pilot tone" (1'b1) mode
Sel(2 bits) ALL(2'b00/ 2'b01), ~SL(2'b10), SL(2'b11)
Session (2 bits) S0(2'b00), S1(2'b01), S2(2'b10), S3(2'b11)
Target(1 bit) A(1'b0), B(1'b1)
Q(4 bit) 4'b0000-4'b1111

4.14 setting the Query parameter

4.14.1 Command frame format

Below are the related parameters for the Query command parameters. There are 2 words (combined bits for below parameters).

DR(1-bit) DR=8(1'b0), DR=64/3(1'b1). Only support DR=8 mode
M(2-bits) M=1(2'b00), M=2(2'b01),M=4(2'b10),M=8(2'b11). Only support M=1 mode
TRext(1-bit) No pilot tone(1'b0), Use pilot tone(1'b1). Only support "Use pilot tone" (1'b1) mode
Sel(2 bits) ALL(2'b00/ 2'b01), ~SL(2'b10), SL(2'b11)
Session (2 bits) S0(2'b00), S1(2'b01), S2(2'b10), S3(2'b11)
Target(1 bit) A(1'b0), B(1'b1)
Q(4 bit) 4'b0000-4'b1111

If DR=8 , M=1, TRext=Use pilot tone, Sel=00, Session=00, Target=A, Q=4, the command will be as below

Header	Type	Command	PL(MSB)	PL(LSB)	Para(MSB)	Para(LSB)	Checksum
AA	00	0E	00	02	10	20	40
End							
DD							

Type 0x01
Command 0x0E
PL 0x0002
Query Parameter 0x1020
Checksum 0x40

4.14.2 Response frame format

If the Query execute properly, the response frame will be

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	01	0E	00	01	00	10	DD

Type: 0x01
Command: 0x0E
PL: 0x0001
Parameter: 0x00
Checksum 0x10

4.15 Setting the operating region (Country)

4.15.1 Command frame format

To set the reader operating region, for example China is operating at 900MHz, as shown blow

Header	Type	Command	PL(MSB)	PL(LSB)	Region	Checksum	End
AA	00	07	00	01	01	09	DD

Type: 0x00
Command: 0x07
PL: 0x0001
Region 0x01
Checksum 0x09

Country/region code as shown below:

Region	Parameter
China 900MHz	01
China 800MHz	04
USA	02
Europe	03
Korea	06

4.15.2 Response frame format

If the region setting execute properly, the response frame will be

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	01	07	00	01	00	09	DD

Type: 0x01
Command: 0x07
PL: 0x0001
Parameter 0x00
Checksum 0x09

4.16 Get the operating region (Country)

4.16.1 Command frame format

Use below command format to get the region of operation

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End
AA	00	08	00	00	08	DD

Type: 0x00
Command: 0x08
PL: 0x0000
Checksum 0x08

4.16.2 Response frame format

If operation is correct, below response frame will be received

Header	Type	Command	PL(MSB)	PL(LSB)	Region	Checksum	End
AA	01	08	00	01	01	0B	DD

Type: 0x01
Command: 0x08
PL: 0x0001
Parameter 0x01
Checksum 0x0B

Country/region code as shown below:

Region	Parameter
China 900MHz	01
China 800MHz	04
USA	02
Europe	03
Korea	06

4.17 Setting the operating frequency channel

4.17.1 Command frame format

For China 900MHz band as an example, to set the operating channel 920.375MHz as shown below

Header	Type	Command	PL(MSB)	PL(LSB)	CH Index	Checksum	End
AA	00	AB	00	01	01	AC	DD

Type: 0x00
Command: 0xAB
PL: 0x0001
Channel Index 0x01
Checksum 0xAC

For China 900MHz channels, Freq_CH= frequency channel
CH_Index =(Freq_CH-920.125M)/0.25MHz

For China 800MHz channels, Freq_CH= frequency channel
CH_Index =(Freq_CH-840.125M)/0.25MHz

For USA, Freq_CH= frequency channel
CH_Index =(Freq_CH-902.25M)/0.5MHz

For Europe, Freq_CH= frequency channel
CH_Index =(Freq_CH-865.1M)/0.2MHz

For Korea, Freq_CH= frequency channel
CH_Index =(Freq_CH-917.1M)/0.2MHz

4.17.2 Response frame format

If the channel setting is executed successfuly, the response frame will be

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	01	AB	00	01	00	AD	DD

Type: 0x01
Command: 0xAB
PL: 0x0001
Parameter 0x00
Checksum 0xAD

4.18 Get the operating channel

4.18.1 Command frame format

For a specific operating region, to get the operating channel by using below command format

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End
AA	00	AA	00	00	AA	DD

Type 0x00
Command 0xAA
PL 0x0000
Checksum 0xAA

4.18.2 Response frame format

If the operating channel request executed successfully, it will response will be

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	01	AA	00	01	00	AC	DD

Type: 0x01
Command: 0xAA
PL: 0x0001
Parameter 0x00 (Channel_Index is 0x00)
Checksum 0xAC

For China 900MHz channels, Freq_CH = frequency channel
Freq_CH = CH_Index *0.25M +920.125M

For China 800MHz channels, Freq_CH = frequency channel
Freq_CH = CH_Index *0.25M +840.125M

For USA, Freq_CH = Freq_CH = frequency channel
Freq_CH = CH_Index *0.5M +902.25M

For Europe, Freq_CH = frequency channel
Freq_CH = CH_Index *0.2M +865.1M

For Korea, Freq_CH = frequency channel
Freq_CH = CH_Index *0.2M +917.1M

4.19 Set Automatic FHSS(frequency hopping spread spectrum)

4.19.1 Command frame format

Setup the automatic FHSS or cancel the automatic FHSS function. Under the automatic FHSS mode, if customer is executing the insertion frequency command, the reader will follow the customer frequency list for automatic FHSS. If there is no customer insertion frequency list, the reader will follow the default internal random hopping frequency list .

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	00	AD	00	01	FF	AD	DD

Type: 0x00
Command: 0xAD
PL: 0x0001
Parameter 0xFF (0xFF set to automatic FHSS, 0x00 cancel automatic FHSS)
Checksum 0xAD

4.19.2 Response frame format

If setup or cancel FHSS command executed successfully, there will be response frame as below

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	01	AD	00	01	00	AF	DD

Type: 0x01
Command: 0xAD
PL: 0x0001
Parameter 0x00
Checksum 0xAF

4.20 Insertion frequency channel

4.20.1 Command frame format

Insertion frequency channel mode allow user to customize the hopping channel table. After executing this command, reader will hop randomly according to the frequency channels within the customized frequency table. As shown below:

Header	Type	Command	PL(MSB)	PL(LSB)	CH Cnt	CH list (MSB)	
AA	00	A9	00	06	05	01	02
		CH list (LSB)	Checksum	End			
03	04	05	C3	DD			

Type: 0x01
Command: 0xA9
PL: 0x0006
Channel Count: 0x05 (if 0, clear the hopping table, reader hopping all available default channels)
CH Index 0x01, 0x02, 0x03, 0x04, 0x05 { channel table is a list of channel index}
Checksum: 0xC3

4.20.2 Response frame format

If execution is correct, below response frame will be received:

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	01	A9	00	01	00	AB	DD

Type: 0x01
Command: 0xA9
PL: 0x0001
Parameter 0x00
Checksum 0xAB

4.21 Get the transmit power

4.21.1 Command frame format

To get the current transmit power value.

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End
AA	00	B7	00	00	B7	DD

Type 0x00
Command 0xB7
PL 0x0000
Checksum 0xB7

4.21.2 Response frame format

If execution is successful, the response frame will be as shown below:

Header	Type	Command	PL(MSB)	PL(LSB)	Pow(MSB)	Pow(LSB)	Checksum
AA	01	B7	00	02	07	D0	91
End							
DD							

Type 0x01
Command 0xB7
PL 0x0002
Pow 0x07D0 (current power value =2000 decimal , equivalent to 20dBm)
Checksum 0x91

4.22 Setting the transmit power

4.22.1 Command frame format

To set the transmit power

Header	Type	Command	PL(MSB)	PL(LSB)	Pow(MSB)	Pow(LSB)	Checksum
AA	00	B6	00	02	07	D0	8F
End							
DD							

Type 0x00
Command 0xB6
PL 0x0002
Pow 0x07D0 (current power value =2000 decimal , equivalent to 20dBm)
Checksum 0x8F

4.22.2 Response frame format

If command setting is executed successfully, the response frame will be

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	01	B6	00	01	00	B8	DD

Type: 0x01
Command: 0xB6
PL: 0x0001
Parameter 0x00
Checksum 0xB8

4.23 Setting continuous Carrier Wave (CW) transmit

4.23.1 Command frame format

To set up continuously CW transmit power or to cancel the CW transmit power as below

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	00	B0	00	01	FF	B0	DD

Type: 0x00
Command: 0xB0
PL: 0x0001
Parameter 0xFF(0xFF is to enable the continuous CW wave transmission, 0x00 is disable)
Checksum 0xB0

4.23.2 Response frame format

If command is executed properly, the response frame is as below

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	01	B0	00	01	00	B2	DD

Type: 0x01
Command: 0xB0
PL: 0x0001
Parameter 0x00
Checksum 0xB2

4.24 Get the receiver demodulation parameter

4.24.1 Command frame format

To retrieve the demodulator parameters which include Mixer gain, IF AMP gain, demodulator threshold.

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End
AA	00	F1	00	00	F1	DD

Type 0x00
Command 0xF1
PL 0x0000
Checksum 0xF1

4.24.2 Response frame format

If command executed successfully, it will response as below

Header	Type	Command	PL(MSB)	PL(LSB)	Mixer_G	IF_G	Thrd(MSB)
AA	01	F1	00	04	03	06	01
Thrd(LSB)	Checksum	End					
B0	B0	DD					

Type 0x01
Command 0xF1
PL 0x0004
Mixer_G 0x03 (mixer gain is 9dB)
IF_G 0x06 (IF AMP gain is 36dB)

Thrd 0x01B0 (the lower the demodulator threshold, it can demodulate lower RSSI value from the tag. However the lower the demodulator threshold, the demodulation is less stable. Below certain value of RSSI , received signal will be no longer be demodulated.

On the oppsite, the higher the threshold value setting, the higher the RSSI value from tag can be detected and demodulated. The reader distance is shorter, but more stable. Recommended lowest value is 0x1B0.

Checksum 0xB0

Mixer Gain table

Type	Mixer_G(dB)
0x00	0
0x01	3
0x02	6
0x03	9
0x04	12
0x05	15
0x06	16

IF AMP Gain table

Type	IF_G(dB)
0x00	12
0x01	18
0x02	21
0x03	24
0x04	27
0x05	30
0x06	36
0x07	40

4.25 Setting the receiver demodulation parameter

4.25.1 Command frame format

To setup the current demodulator parameters which include Mixer gain, IF AMP gain, demodulator threshold.

Header	Type	Command	PL(MSB)	PL(LSB)	Mixer_G	IF_G	Thrd(MSB)
AA	00	F0	00	04	03	06	01
Thrd(LSB)	Checksum	End					
B0	AE	DD					

Type 0x00
Command 0xF0
PL 0x0004
Mixer_G 0x03 (mixer gain is 9dB)
IF_G 0x06 (IF AMP gain is 36dB)

Thrd 0x01B0 (the lower the demodulator threshold, it can demodulate lower RSSI value from the tag. However the lower the demodulator threshold, the demodulation is less stable. Below certain value of RSSI , received signal will be no longer be demodulated.

On the oppsite, the higher the threshold value setting, the higher the RSSI value from tag can be detected and demodulated. The reader distance is shorter, but more stable. Recommended lowest value is 0x1B0.

Checksum 0xAE

Mixer Gain table

Type	Mixer_G(dB)
0x00	0
0x01	3
0x02	6
0x03	9
0x04	12
0x05	15
0x06	16

IF AMP Gain table

Type	IF_G(dB)
0x00	12
0x01	18
0x02	21
0x03	24
0x04	27
0x05	30
0x06	36
0x07	40

4.25.2 Response frame format

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	01	F0	00	01	00	F2	DD

Type: 0x01
Command: 0xF0
PL: 0x0001
Parameter 0x00
Checksum 0xF2

4.26 Test RF Input Port Blocking Signal

4.26.1 Command frame format

Test the RF input port blocking signal (Scan jammer) is to test the antenna port jammer level for each frequency channel at that location .

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End
AA	00	F2	00	00	F2	DD

Type: 0x00
Command: 0xF2
PL: 0x0000
Checksum 0xF2

4.26.2 Response frame format

For example, in China, there are totally 20 channels. If the command executed successfully, it will return the response below:

Header	Type	Command	PL(MSB)	PL(LSB)	CH_L	CH_H	JMR(MSB)
AA	01	F2	00	16	00	13	F2
F1	F0	EF	EC	EA	E8	EA	EC
EE	F0	F1	F5	F5	F5	F6	F5
		JMR(LSB)	Checksum	End			
F5	F5	F5	DD	DD			

Type 0x01
Command 0xF2
PL 0x0016
CH_L 0x00 (For starting frequency channel with index =0)
CH_H 0x13(For ending frequency channel with index=19)
JMR 0xF2F1F0EFECEAE8EAECEEF0F1F5F5F5F6F5F5F5F5
(Each signed byte represents the blocking signal level for each channel,
for example 0xF2 =-14dBm)
Checksum 0xDD

4.27 Testing frequency channel RSSI

4.27.1 Command frame format

To test the antenna port radio frequency (RF) channel RSSI value, it is used to determine whether any other reader in operation in the same region.

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End
AA	00	F3	00	00	F3	DD

Type: 0x00
Command: 0xF3
PL: 0x0000
Checksum 0xF3

4.27.2 Response frame format

For example, in China, there are totally 20 channels. If the RSSI command executed successfully, it will response with

Header	Type	Command	PL(MSB)	PL(LSB)	CH_L	CH_H	RSSI(MSB)
AA	01	F3	00	16	00	13	BA
BA	BA	BA	BA	BA	BA	BA	BA
BA	BA	BA	BA	BA	BA	BA	BA
		RSSI(LSB)	Checksum	End			
BA	BA	BA	A5	DD			

Type 0x01
Command 0xF3
PL 0x0016
CH_L 0x00 (For starting frequency channel with index =0)
CH_H 0x13(For the last frequency channel with index=19)
RSSI 0xBA BA BA BA BA BA BA BA BA BA BA BA BA BA BA BA BA BA BA
The RSSI of each channel is represented by a signed byte
For example , 0xBA =-70dBm,
The minimum RSSI value that the reader can detect is -70dBm

Checksum 0xA5

4.28.Control the GPIO port

4.28.1. Command frame format

Read the GPIO level and Set the GPIO level:

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Parameter	Parameter
AA	00	1A	00	03	01	04	01
Checksum	**End**						
23	DD						

Type: 0x00
Command: 0x1A
PL: 0x0003
Parameter: 0x01 0x04 0x01
Checksum: 0x23

Description:

No	Value	Length	Description
0	0	1 byte	Options: 0x01：Set IO level； 0x02：Read IO level。 The IO pin number is specified at parameter Value 1
1	1	1 byte	Value range 0x01~0x04，corresponding to IO1~IO4 respectively IO1~ IO2= INPUT，IO3~ IO4 =OUTPUT
2	2	1 byte	Parameter Value 0x00 or 0x01。 **Parameter Value 0** / **Parameter Value 1** / **Parameter Value 2** **0x01** / **0x00** / **Set IO low** **0x01** / **0x01** / **Set IO high** If Value 0 =0x02，invalid。

4.28.2. Response frame format

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter0	Parameter1	Parameter2
AA	01	1A	00	03	01	04	01
Checksum	**End**						
24	DD						

Type: 0x01
Command: 0x1A
PL: 0x0003
Parameter: 0x01 0x04 0x01
Checksum: 0x24

<table>
<tr><th>No</th><th>Value</th><th>length</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>1 byte</td><td>Operation options:
0x01：set IO level；
0x02：read IO level。
The IO pin number is
specified at parameter Value
1</td></tr>
<tr><td>1</td><td>1</td><td>1 byte</td><td>Parameters Range 0x01~0x04，for IO1~IO4 respectively，
IO1~ IO2=input，IO3~ IO4= output</td></tr>
<tr><td>2</td><td>2</td><td>1 byte</td><td>Parameters Value 0x00 or 0x01。
<table>
<tr><td>Parameter0</td><td>Parameter2</td><td>description</td></tr>
<tr><td>0x01</td><td>0x00</td><td>Set IO failure</td></tr>
<tr><td>0x01</td><td>0x01</td><td>Set IO success</td></tr>
<tr><td>0x02</td><td>0x00</td><td>The assign port is low</td></tr>
<tr><td>0x02</td><td>0x01</td><td>The assign port is high</td></tr>
</table></td></tr>
</table>

4.29 Sleep mode

4.29.1. Command frame format

Sleep mode allow the module to enter power-saving sleep mode. It can be woke up by sending one byte of data through the serial port, however, that byte of data will be discarded. Therefore, the reader will not response to first command which for wake it up, the purpose of first command is to power reset the MCU. After wake-up, the MCU will automatically reload the firmware into the chipset. And then it will reload some of the parameters which are back-up from before entering sleep-mode. These parameters are power, frequency channel, hopping mode, sleep duration, receiver demodulator parameters after wake up. However, this is NOT including the Select mode and associated Select parameters ..etc. Therefore, some parameters need to be set again.

Command frame

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End
AA	00	17	00	00	17	DD

Type: 0x00
Command: 0x17
PL: 0x0000
Checksum: 0x17

4.29.2. Response frame

If execute successfully：

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	01	17	00	01	00	19	DD

Type: 0x01
Command: 0x17
PL: 0x0001
Parameter: 0x00
Checksum: 0x19

4.30.Set idle time duration before entering sleep mode

4.30.1. Command frame format

To set the idle time duration before entering the sleep mode. After entered sleep mode, it can be woke up by sending one byte of data through the serial port, however, that byte of data will be discarded. Therefore, the reader will not response to first command which for wake it up, the purpose of first command is to power reset the MCU. After wake-up, the MCU will automatically reload the firmware into the chipset. And then it will reload some of the parameters which are back-up from before entering sleep-mode. These parameters are power, frequency channel, hopping mode, sleep duration, receiver demodulator parameters after wake up. However, this is NOT including the Select mode and associated Select parameters ..etc. Therefore, some parameters need to be set again.

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	00	1D	00	01	02	20	DD

Type: 0x00
Command: 0x1D
PL: 0x0001
Parameter: 0x02 (idle duration= 2min，enter sleep mode after 2 minutes idle time. range from 1~30min，0x00 mean no sleep mode)
Checksum: 0x20

4.30.2. Response frame

If executed correctly：

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	01	1D	00	01	02	21	DD

Type: 0x01
Command: 0x1D
PL: 0x0001
Parameter: 0x02（idle time duration）
Checksum: 0x21

4.31. Idle mode

4.31.1. Command

This command force reader into idle mode. Under the idle mode, only the digital and communication interface circuitry are still operating. All other analog and RF sections are powered off to minimize the power consumption. In idle mode, communication with reader module is normal. All parameters settings are valid. Reader will response to Host commands. After entering idle mode, the first time inventory (or read/write commands which need to communicate with tag) will wake up the module to enter into normal operation mode. However, the first time inventory command may be unstable as it will take time for the RF section to become stable.

Header	Type	Command	PL(MSB)	PL(LSB)	Enter	Reserved	IDLE Time
AA	00	04	00	03	01	01	03
Checksum	**End**						
0C	DD						

Type: 0x00
Command: 0x04
PL: 0x0003
IDLE Enter: 0x01(enter idle mode，0x00: exit idle model)
Reserved: 0x01(reserved，fix value: 0x01)
IDLE mode/ IDLE Time: 0x03(enter idle mode if 3 minutes without operation. Range 0-30 minutes，0x00 represent Not automatic entering idle mode)
Checksum: 0x0C

4.31.2. Response frame

If executed correctly：

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	01	04	00	01	00	06	DD

Type: 0x01
Command: 0x04
PL: 0x0001
Parameter: 0x00（successful）
Checksum: 0x06

4.32.NXP ReadProtect / Reset ReadProtect command

NXP G2X supports ReadProtect/Reset ReadProtect commands。If the tag execute ReadProtect commands successfully, the tag's ProtectEPC and ProtectTID bits will be set to '1'，The tag will be entered data protection mode. To exit the data protection mode, it is necessary to execute the Reset ReadProtect command in order to resume to normal mode. However it is necessary to execute the set Select parameter command in advance, in order to specify which tag for the operation.

4.32.1. Command frame

ReadProtect/Reset ReadProtect Command frame :

Header	Type	Command	PL(MSB)	PL(LSB)	AP(MSB)		
AA	00	E1	00	05	00	00	FF
AP(LSB)	**Reset**	**Checksum**	**End**				
FF	00	E4	DD				

Type: 0x00

Command: 0xE1

PL: 0x0005

Access Password: 0x0000FFFF

ReadProtect/Reset ReadProtect: 0x00(0x00 means to execute ReadProtect，0x01 means to execute Reset ReadProtect)

Checksum: 0x0B

4.32.2. Response frame

If ReadProtect command executed correctly

Header	Type	Command	PL(MSB)	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	E1	00	10	0E	30	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	**Paramete**	**Checksum**	**End**	
E3	D5	0D	70	00	3D	DD	

Type: 0x01

Command: 0xE1

PL: 0x0010

PC+EPC Length UL: 0x0E

PC: 0x3000

EPC: 0x30751FEB705C5904E3D50D70

Parameter: 0x00(success)

Checksum: 0x3D

If Reset ReadProtect command executed correctly

Header	Type	Command	PL(MSB)	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	E2	00	10	0E	30	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	**Paramete**	**Checksum**	**End**	
E3	D5	0D	70	00	3E	DD	

Type: 0x01

Command: 0xE2

PL: 0x0010
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0x30751FEB705C5904E3D50D70
Parameter: 0x00(success)
Checksum: 0x3E

If during executing ReadProtect (Set/Reset parameter= 0x00) command，the tag is not in range or EPC code not correct , or no response from tag, error code 0x2A will be received：

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	01	FF	00	01	2A	2B	DD

Type: 0x01
Command: 0xFF
PL: 0x0001
Parameter: 0x2A
Checksum: 0x2B

If during executing Reset ReadProtect(Set/Reset parameter 0x01) command，the tag is not in range or EPC code not correct , or no response from tag, error code 0x2B will be received：

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	01	FF	00	01	2B	2C	DD

Type: 0x01
Command: 0xFF
PL: 0x0001
Parameter: 0x2B
Checksum: 0x2C

If Access Password is not correct, error code 0x16 and PC+EPC will be received：

Header	Type	Command	PL(MSB)	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	00	10	16	0E	34
PC(LSB)	**EPC(MSB)**						
00	30	75	1F	EB	70	5C	59
				EPC(LSB)	**Checksum**	**End**	
04	E3	D5	0D	70	75	DD	

Type: 0x01
Command: 0xFF
PL: 0x0016
Error Code: 0x16
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0x30751FEB705C5904E3D50D70
Checksum: 0x75

4.33.NXP Change EAS command

NXP G2X tags support Change EAS command. When the tag executing Change EAS command successfully, the tag's PSF bit will automatically change to '1' or '0' accordingly。When the tag's PSF location is "1" , it will response to the EAS_Alarm command，Otherwise it will not response to the EAS_Alarm command。 Need to set the Select parameters command in advance

4.33.1. Command frame definition:

Header	Type	Command	PL(MSB)	PL(LSB)	AP(MSB)		
AA	00	E3	00	05	00	00	FF
AP(LSB)	**PSF**	**Checksum**	**End**				
FF	01	E7	DD				

Type: 0x00
Command: 0xE3
PL: 0x0005
Access Password: 0x0000FFFF
Set/Reset: 0x01(0x01 mean to set PSF bit ='1'，0x00 mean to set PSF bit='0')
Checksum: 0xE7

4.33.2. Response frame

If Change EAS executed correctly

Header	Type	Command	PL(MSB)	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	E3	00	10	0E	30	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	**Paramete**	**Checksum**	**End**	
E3	D5	0D	70	00	3F	DD	

Type: 0x01
Command: 0xE3
PL: 0x0010
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0x30751FEB705C5904E3D50D70
Parameter: 0x00(success)
Checksum: 0x3F

When during executing Change EAS command，the specific tag not exist, or the EPC is not correct, or no response from tag, error code 0x1B will be received：

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	01	FF	00	01	1B	1C	DD

Type: 0x01
Command: 0xFF
PL: 0x0001
Parameter: 0x1B
Checksum: 0x1C

If error happen during executing Access Password，error code 0x16 and PC+EPC will be received：

Header	Type	Command	PL(MSB)	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	00	10	16	0E	34
PC(LSB)	**EPC(MSB)**						
00	30	75	1F	EB	70	5C	59
				EPC(LSB)	**Checksum**	**End**	
04	E3	D5	0D	70	75	DD	

Type: 0x01
Command: 0xFF
PL: 0x0016
Error Code: 0x16
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0x30751FEB705C5904E3D50D70
Checksum: 0x75

4.34. NXP EAS_Alarm command

NXP G2X tags support EAS_Alarm command。After the tag receiving EAS_Alarm command, it will automatically return with 64-bits EAS-Alarm code. This happen only when the PSF bit is set to “1”. Otherwise the tag will not response.

4.34.1. Command

EAS_Alarm

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End
AA	00	E4	00	00	E4	DD

Type: 0x00
Command: 0xE4
PL: 0x0000
Checksum: 0xE4

4.34.2. Response frame

If EAS_Alarm command executed successful, tag will return with 64bits EAS-Alarm code，

Header	Type	Command	PL(MSB)	PL(LSB)	EAS-Alarm code(MSB)		
AA	01	E4	00	08	69	0A	E
				EAS-Alarm code(LSB)	Checksum	End	
7C	D2	15	D8	F9	80	D	

Type: 0x01
Command: 0xE3
PL: 0x0001
Parameter: 0x00
Checksum: 0xE5

If during executing command EAS_Alarm，there is no tag reply. Error code 0x1D will be received：

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	01	FF	00	01	1D	1E	DD

Type: 0x01
Command: 0xFF
PL: 0x0001
Parameter: 0x1D
Checksum: 0x1E

4.35. NXP ChangeConfig Command

Some NXP G2X tags series such as G2iM and G2iM+ series which support the ChangeConfig command. We can use this command to read and modify the NXP G2X tags 16bits Config-Word. The config-Word of NXP G2X tags is located in Bank 01 (EPC region) with address 0x20h (word address). It can use normal read command to get the content. When the tag is in Secured mode, the Config-Word can be modified. It is necessary to set the Select parameters in advance.

4.35.1. Command frame of ChangeConfig:

Header	Type	Command	PL(MSB)	PL(LSB)	AP(MSB)		
AA	00	E0	00	06	00	00	FF
AP(LSB)	**Config(MSB**	**Config (LSB)**	**Checksum**	**End**			
FF	00	00	E4	DD			

Type: 0x00
Command: 0xE0
PL: 0x0006
Access Password: 0x0000FFFF
Config-Word: 0x0000(if All 0 : tag will return non-modified Config-Word .)
Checksum: 0xE4

4.35.2. Response frame

If ChangeConfig executed correctly：

Header	Type	Command	PL(MSB)	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	E0	00	11	0E	30	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	**Config(MSB)**	**Config(LSB)**	**Checksum**	**End**
E3	D5	0D	70	00	41	7E	DD

Type: 0x01
Command: 0xE0
PL: 0x0011
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0x30751FEB705C5904E3D50D70
Config-Word: 0x0041
Checksum: 0x7E

When executing ChangeConfig command, if the tag is not exist or the EPC is incorrect or tag not response, there will be error code 0x1A return：

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	01	FF	00	01	1A	1B	DD

Type: 0x01
Command: 0xFF
PL: 0x0001

Parameter: 0x1A
Checksum: 0x1B

If the Access Password is incorrect， error code 0x16 and PC+EPC will be returned:

Header	Type	Command	PL(MSB)	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	00	10	16	0E	34
PC(LSB)	**EPC(MSB)**						
00	30	75	1F	EB	70	5C	59
				EPC(LSB)	**Checksum**	**End**	
04	E3	D5	0D	70	75	DD	

Type: 0x01
Command: 0xFF
PL: 0x0016
Error Code: 0x16
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0x30751FEB705C5904E3D50D70
Checksum: 0x75

4.36.Impinj Monza QT command

Impinj Monza 4 QT tags support QT command. This command can modify the tag's QT Control word. Setting the QT_SR location can reduce the range when the tag in Open and Secured state. Modifying the QT_MEM bit can switch the tag to use Public Memory Map or Private Memory Map. It is necessary to set the Select parameters in advance to specify the tag.

4.36.1. Command Frame

QT frame definition，(e.g. set the QT_MEM bit to 1 and write to non-volatile memory location):

Header	Type	Command	PL(MSB)	PL(LSB)	AP(MSB)		
AA	00	E5	00	08	00	00	FF
AP(LSB)	**Read/Writ**	**Persistence**	**Payload0**	**Payload1**	**Checksum**	**End**	
FF	01	01	40	00	2D	DD	

Type: 0x00
Command: 0xE5
PL: 0x0008
Access Password: 0x0000FFFF
Read/Write: 0x01(0x00: Read，0x01: Write)
Persistence: 0x01(0x00: write to volatile memory，
0x01: write to non-volatile memory
Payload: 0x4000(QT Control，Most significant 2 bits are QT_SR and QT_MEM)
Checksum: 0x2D

4.36.2. Response frame

If QT command is executed correct (Read/Write data 0x00) Response frame：

Header	Type	Command	PL(MSB)	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	E5	00	11	0E	30	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	**QT Control0**	**QT**	**Checksum**	**End**
E3	D5	0D	70	00	00	42	DD

Type: 0x01
Command: 0xE5
PL: 0x0011
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0x30751FEB705C5904E3D50D70
QT Control Word: 0x0000
Checksum: 0x42

If QT command is executed correctly(Read/Write data is 0x01)，response frame：

Header	Type	Command	PL(MSB)	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	E6	00	10	0E	30	00
EPC(MSB)							
30	75	1F	EB	70	5C	59	04
			EPC(LSB)	**Parameter**	**Checksum**	**End**	
E3	D5	0D	70	00	42	DD	

Type: 0x01
Command: 0xE6
PL: 0x0010
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0x30751FEB705C5904E3D50D70
Parameter: 0x00(success)
Checksum: 0x42

When executing QT command: if the tag is not exist, or the EPC is incorrect or no response. Error code 0x2E will be received：

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	01	FF	00	01	2E	2F	DD

Type: 0x01
Command: 0xFF
PL: 0x0001
Parameter: 0x2E
Checksum: 0x2F

If Access Password is incorrect，there is error code 0x16 and PC+EPC will be returned：

Header	Type	Command	PL(MSB)	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	00	10	16	0E	34
PC(LSB)	**EPC(MSB)**						
00	30	75	1F	EB	70	5C	59
				EPC(LSB)	**Checksum**	**End**	
04	E3	D5	0D	70	75	DD	

Type: 0x01
Command: 0xFF
PL: 0x0016
Error Code: 0x16
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0x30751FEB705C5904E3D50D70
Checksum: 0x75

4.37.BlockPermalock command

BlockPermalock can be used to permanently lock some user bank blocks, or read state. Set Select parameter command is needed to be executed in advance.

4.37.1. command frame

BlockPermalock command frame (BlockPermalock for writing process of blocks 5, 6, and 7):

Header	Type	Command	PL(MSB)	PL(LSB)	AP(MSB)		
AA	00	D3	00	0B	00	00	FF
AP(LSB)	**Read/Lock**	**MemBan**	**BlockPtr1**	**BlockPtr0**	**BlockRange**	**Mask(MSB**	**Mask(LSB)**
FF	01	03	00	00	01	07	00
Checksum	**End**						
E8	DD						

Type: 0x00
Command: 0xD3
PL: 0x0009
Access Password: 0x0000FFFF
Read/Lock: 0x00(0x00: Read，0x01:Lock)
BlockPtr: 0x0000 (Mask start Block address, 16 block for one batch)
BlockRange: 0x01 (16 block for one batch)
Mask: 0x0700 (when Read/Lock data field is 0x00 , mean the data field will be ignored.)
Checksum: 0xE8

4.37.2. response frame

If BlockPermalock command is executed correctly(Read/Lock data is 0x00)：

Header	Type	Command	PL(MSB)	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	D3	00	12	0E	30	00
EPC(MSB)							
E2	00	30	16	66	06	00	69
			EPC(LSB)	**BlockRange**	**Data(MSB)**	**Data(LSB)**	**Checksum**
11	60	9F	94	01	07	00	CD
End							
DD							

Type: 0x01
Command: 0xD3
PL: 0x0012
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0xE20030166606006911609F94
BlockRange: 0x01
BlockPermalock status: 0x0700
Checksum: 0xCD

If BlockPermalock command is executed correctly(when Read/Lock data field is 0x01)：

Header	Type	Command	PL(MSB)	PL(LSB)	UL	PC(MSB)	PC(LSB)
AA	01	D4	00	10	0E	30	00
EPC(MSB)							
E2	00	30	16	66	06	00	69
			EPC(LSB)	**Parameter**	**Checksum**	**End**	
11	60	9F	94	00	C4	DD	

Type: 0x01
Command: 0xD4 (Read/Lock is 0x00 response is different)
PL: 0x0010
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0xE20030166606006911609F94
Parameter: 0x00(success)
Checksum: 0xC4

When executing BlockPermalock: if the tag is not exist or the EPC code not exist, or the tag no response . Error code 0x14 will be received：

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	01	FF	00	01	14	15	DD

Type: 0x01
Command: 0xFF
PL: 0x0001
Parameter: 0x14
Checksum: 0x15

When executing BlockPermalock, the tag return with error code defined by EPC Gen2. Since the error code of EPC Gen2 only valid for lower 4 bit. Error code 0xE0 will be returned afterward.
For example, sending BlockPtr command and exceed the block limit. There will be error code 0x03 returned (Memory Overrun). Also error code 0xE3 and PC+EPC will be returned. Response frame as below:

Header	Type	Command	PL(MSB)	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	00	10	E3	0E	30
PC(LSB)	**EPC(MSB)**						
00	E2	00	30	16	66	06	00
				EPC(LSB)	**Checksum**	**End**	
69	11	60	9F	94	D2	DD	

Type: 0x01
Command: 0xFF
PL: 0x0010
Error Code: 0xA3
PC+EPC length UL: 0x0E
PC: 0x3400
EPC: 0xE20030166606006911609F94
Checksum: 0xD2

If Access Password is incorrect， error code 0x16 and PC+EPC is returned：

Header	Type	Command	PL(MSB)	PL(LSB)	Error Code	UL	PC(MSB)
AA	01	FF	00	10	16	0E	34
PC(LSB)	**EPC(MSB)**						
00	E2	00	30	16	66	06	00
				EPC(LSB)	**Checksum**	**End**	
69	11	60	9F	94	05	DD	

Type: 0x01
Command: 0xFF
PL: 0x0016
Error Code: 0x16
PC+EPC length UL: 0x0E
PC: 0x3000
EPC: 0xE20030166606006911609F94
Checksum: 0x05

4.38.Set and change antenna

4.38.1. command frame

Setting active reader antenna：

Header	Type	Command	PL(MSB)	PL(LSB)	ANT(MSB)	ANT(LSB)
AA	00	A8	00	03	00	01
Antstaytime	**Checksum**	**End**				
01	AD	DD				

Type: 0x00

PL: 0x0003

ANT： 0x0001

(For example, if using antenna 1 and 3, value should be 0x0005,

Binary format: 0000000000000101_2.

Total antenna cycle is about 400ms)

Dwell time Antstaytime: 01(1~5 : 5 duration. One time slot =200ms)

Command: 0xA8

Checksum: 0xAD

4.21.2. response frame

If execution is successful：

Header	Type	Command	PL(MSB)	PL(LSB)	Parameter	Checksum	End
AA	01	A8	00	01	00	AA	DD

Type: 0x01

Command: 0xA8

PL: 0x0001

Parameter: 0x00

Checksum: 0xAA

4.39. Get antenna information

4.21.1. command frame

To get the active antenna information：

Header	Type	Command	PL(MSB)	PL(LSB)	Checksum	End
AA	00	A7	00	00	A7	DD

Type: 0x00
Command: 0xA7
PL: 0x0000
Checksum: 0xA7

4.21.2. response frame

If execution is correct：

Header	Type	Command	PL(MSB)	PL(LSB)	ANT(MSB)	ANT(LSB)	Antstaytime
AA	01	A7	00	03	00	01	01
Checksum	**End**						
AD	DD						

Type: 0x01
Command: 0xA7
PL: 0x0003
ANT：0x0001
Dwell time Antstaytime: 01 (1~5 : 5 duration. One time slot =200ms)
Checksum: 0xAD

5. Commands set summary

Code	Descriptio
0x03	Get reader module information
0x22	Single inventory command
0x27	Multiple inventory command
0x28	Stop multiple inventory command
0x0C	Setup “Select” parameter
0x0B	Get “Select” parameter
0x12	Setup Select sending command
0x39	Read tag memory bank
0x49	Write tag memory bank
0x82	Lock tag memory bank
0x65	Kill tag
0x0D	Get Query parameter
0x0E	Setup Query parameter
0x07	Setup operation region (country)
0xAB	Setup operating frequency channel
0xAA	Get operating frequency channel
0xAD	Setup automatic FHSS frequency hopping
0xB7	Get transmit RF power
0xB6	Setup transmit RF power
0xB0	Setup continuous carrier wave (CW)
0xF1	Get demodulation parameters
0xF0	Setup demodulation parameters
0xF2	Testing RF input port blocking signal
0xF3	Testing receive channel RSSI
0x1A	Control IO ports
0x17	Reader module sleep mode
0x1D	Setup module idle duration for sleep mode
0xE0	NXP ChangeConfig command

0xE1	NXP ReadProtec/Reset ReadProtect command
0xE3	NXP Change EAS command
0xE4	NXP EAS-Alarm command
0xE5/0xE6	Impinj Monza 4 QT command
0xD3/0xD4	BlockPermalock command
0xA8	Setup and switch active antenna
0xA7	Get active antenna

6. Summary of frame failure response

If command frame execution fail, the M900/RP9X chipset will report to PC with failure response (share common error code 0xFF). If no EPC received before failure, only 1 byte error code. If EPC has been received before failure, it will return 1 byte error code together with PC+EPC data. For example, if there is failure for inventory command, if received CRC is incorrect, it will report with error code 0x15 as shown below

Header	Type	Command	PL(MSB)	PL(LSB)	Paramete	Checksum	End
AA	01	FF	00	01	15	16	DD

Type: 0x01
Command: 0xFF (0xFF means command execution fail)
PL: 0x01
Parameter: 0x15 (error code)
Checksum: 0x16
Error code summary:

Type	Code	Descrip
Command Error	0x17	Command frame code error
FHSS Fail	0x20	Timeout of FHSS search, all channels are occupied
Inventory Fail	0x15	Inventory operation failure. No tag response or CRC error
Access Fail	0x16	Tag Access failure. Maybe password incorrect
Read Fail	0x09	Read memory bank failure. No tag response or CRC error
Read Error	0xA0 | Error code	Read Tag memory bank failure. Reply code at 0xA0. Refer error code table.
Write Fail	0x10	Write Tag memory bank error. No tag response or CRC error
Write Error	0xB0 | Error code	Write Tag memory bank error. Reply code at 0xB0. Refer error code table
Lock Fail	0x13	Lock memory bank failure. No tag response or CRC error
Lock Error	0xC0 | Error code	Lock memory bank error. Reply code at 0x0C. Refer error code table
Kill Fail	0x12	Kill tag failure. No response from tag or CRC incorrect
Kill Error	0xD0 | Error code	Kill tag failure. Reply code at 0xD0 byte . Refer to Error Code table.
BlockPermalock Fail	0x14	BlockPermalock execution failure. No tag response or CRC error
BlockPermalock Error	0xE0 | Error code	BlockPermalock failure. Reply code at 0xE0 . Refer to Error Code table .

NXP G2X tag command failure explanation：

ChangeConfig Fail	0x1A	ChangeConfig failure. No reply from tag or the CRC is incorrect.
ReadProtect Fail	0x2A	ReadProtect failure . No reply from tag or the CRC is incorrect.
Reset ReadProtect Fail	0x2B	Reset ReadProtect failure. No reply from tag or the CRC is incorrect.
Change EAS Fail	0x1B	Change EAS failure. No reply from tag or the CRC is incorrect.
EAS_Alarm Fail	0x1D	EAS_Alarm failure. No tag reply the correct Alarm Code
Specific error code	0xE0 | Error code	Specific command tag return error code. Reply code at 0xE0 byte or error code from previous tag.

Impinj Monza QT tag error code maining:

QT Fail	0x2E	QT command failure. No reply from tag or the CRC is incorrect.
Specific command error code	0xE0 | Error code	Specific command tags error cod. Reply code at 0xE0 byte or error code from previous tag.

Error-code	Error Code	Error code	Error Description
Error-specific	000000002	Other error	For error not mentioned in this table/document.
	000000112	Memory overrun	The access memory bank not exist. The tag not support the EPC length (e.g. XPC)
	000001002	Memory locked	The access memory bank has been locked which either permanent locked or not allow to read or write
	000010112	Insufficient	Tag has insufficient energy to carry out write operation
Non-specific	000011112	Non-specific	Tag not support error-code response

End.