IND8002 UHF RFID Reader serial Interface protocol

V2.38

1 Specification of the Data Packet

This protocol is a communication specification for controlling the UHF RFID reader by its host computer via serial interface.

Commands and responses consist of byte streams. The lengths of the streams are variable, and the packets are checked by checksum.

1.1 RS-232 Configurations

The physical interface is compatible with the RS – 232 specifications.
1start bit、8 data bits、1 stop bit、no even odd check..
The baud rate can be set to 38400bps or 115200bps. The default baud rate is 115200bps.

1.2 Data Packet Definition

1.2.1 Host Command Data Packet Definition

Head	Len	Address	Cmd	Data	Check
0xA0	1 Byte	1 Byte	1 Byte	N Bytes	1 Byte
Parameter Description		Head		Head of the packet, every packet starts with 0xA0.	
		Len		Length of the packet bytes. Starts from the third byte, the Head, Len bytes are exclusive.	
		Address		Reader's address for RS-485 connection. The common addresses are 0～254(0xFE)，255（0xFF）is the public address. The reader accepts the address of itself and the public address.	
		Cmd		Command byte.	
		Data		Command parameters.	
		Check		Checksum. Check all the bytes except itself.	

1.2.2 Response Packet Definition

Head	Len	Address	Data	Check
0xA0	1 Byte	1 Byte	N Bytes	1 Byte
Parameter Description		Head	Head of the packet, every packet starts with 0xA0.	
		Len	Length of the packet bytes. Starts from the third byte, the Head, Len bytes are exclusive.	
		Address	Reader's address.	
		Data	Data from the reader.	
		Check	Checksum. Check all the bytes except itself.	

2 Command Definition

Comprehensive Command Table

ID	Code	Name	Description
Reader Control Commands			
1	**0x70**	**cmd_reset**	Reset reader.
2	**0x71**	**cmd_set_uart_baudrate**	Set baud rate of serial port.
3	**0x72**	**cmd_get_firmware_version**	Get firmware version.
4	**0x73**	**cmd_set_reader_address**	Set reader's address.
5	**0x74**	**cmd_set_work_antenna**	Set working antenna.
6	**0x75**	**cmd_get_work_antenna**	Query current working antenna.
7	**0x76**	**cmd_set_output_power**	Set RF output power.
8	**0x77**	**cmd_get_output_power**	Query current RF output power.
9	**0x78**	**cmd_set_frequency_region**	Set RF frequency spectrum.
10	**0x79**	**cmd_get_frequency_region**	Query RF frequency spectrum.
11	**0x7A**	**cmd_set_beeper_mode**	Set reader's buzzer hehavior.
12	**0x7B**	**cmd_get_reader_temperature**	Check reader's internal temperature.
13	**0x60**	**cmd_read_gpio_value**	Get GPIO1, GPIO2 status.
14	**0x61**	**cmd_write_gpio_value**	Set GPIO3, GPIO4 status.
15	**0x62**	**cmd_set_ant_connection_detector**	Set antenna detector status.
16	**0x63**	**cmd_get_ant_connection_detector**	Get antenna detector status.
17	**0x66**	**cmd_set_temporary_output_power**	Set RF power without saving to flash.
18	**0x67**	**cmd_set_reader_identifier**	Set reader's identification bytes.
19	**0x68**	**cmd_get_reader_identifier**	Get reader's identification bytes.
20	**0x69**	**cmd_set_rf_link_profile**	Set RF link profile.
21	**0x6A**	**cmd_get_rf_link_profile**	Get RF link profile.
22	**0x7E**	**cmd_get_rf_port_return_loss**	Get current antenna port's return loss.
18000-6C Commands			
23	**0x80**	**cmd_inventory**	Inventory EPC C1G2 tags to buffer.

24	**0x81**	**cmd_read**	Read EPC C1G2 tag(s).
25	**0x82**	**cmd_write**	Write EPC C1G2 tag(s).
26	**0x83**	**cmd_lock**	Lock EPC C1G2 tag(s).
27	**0x84**	**cmd_kill**	Kill EPC C1G2 tag(s).
28	**0x85**	**cmd_set_access_epc_match**	Set tag access filter by EPC.
29	**0x86**	**cmd_get_access_epc_match**	Query access filter by EPC.
30	**0x89**	**cmd_real_time_inventory**	Inventory tags in real time mode.
31	**0x8A**	**cmd_fast_switch_ant_inventory**	Real time inventory with fast ant switch.
32	**0x8B**	**cmd_customized_session_target_inventory**	Inventory with desired session and inventoried flag.
33	**0x8C**	**cmd_set_impinj_fast_tid**	Set impinj FastTID function. (Without saving to FLASH)
34	**0x8D**	**cmd_set_and_save_impinj_fast_tid**	Set impinj FastTID function. (Save to FLASH)
35	**0x8E**	**cmd_get_impinj_fast_tid**	Get current FastTID setting.
ISO18000-6B Commands			
36	**0xB0**	**cmd_iso18000_6b_inventory**	Inventory 18000-6B tag(s).
37	**0xB1**	**cmd_iso18000_6b_read**	Read 18000-6B tag.
38	**0xB2**	**cmd_iso18000_6b_write**	Write 18000-6B tag.
39	**0xB3**	**cmd_iso18000_6b_lock**	Lock 18000-6B tag data byte.
40	**0xB4**	**cmd_iso18000_6b_query_lock**	Query lock 18000-6B tag data byte.
Buffer control Commands			
41	**0x90**	**cmd_get_inventory_buffer**	Get and clear buffered data.
42	**0x91**	**cmd_get_and_reset_inventory_buffer**	Get buffered data without clearing.
43	**0x92**	**cmd_get_inventory_buffer_tag_count**	Query how many tags are buffered.
44	**0x93**	**cmd_reset_inventory_buffer**	Clear buffer.

2.1 Reader Control Commands

2.1.1 cmd_reset

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x70	

◆**Succeeded:** No data response, reader resets and restarts. Buzzer beeps.

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x70		
Parameter Description	ErrorCode	Error code.			

2.1.2 cmd_set_uart_baudrate

Host packet:

Head	Len	Address	Cmd	BaudRate	Check
0xA0	0x04		0x71		
Parameter Description	BaudRate	0x03	38400 bps.		
		0x04	115200 bps.		

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x71	CommandSuccess	

When reader gets this command right, it responses with previous baud rate, then reader resets. The new baud rate parameter is preserved in the internal flash, won't be lost when power off.

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x71		
Parameter Description	ErrorCode	Error code.			

2.1.3 cmd_get_firmware_version

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x72	

Response packet:

Head	Len	Address	Cmd	Major	Minor	Check
0xA0	0x05		0x72			
Parameter Description	Major	The major firmware version.				
	Minor	The minor firmware version.				

2.1.4 cmd_set_reader_address

Host packet:

Head	Len	Address	Cmd	Address	Check
0xA0	0x04		0x73		
Parameter Description	Address	Reader's address, from 0 to 254.			

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x73	CommandSuccess	

The new reader address takes effect immediately, and preserved in the internal flash, won't be lost when power off.

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x73		
Parameter Description	ErrorCode	Error code.			

2.1.5 cmd_set_work_antenna

Host packet:

Head	Len	Address	Cmd	AntennaID	Check
0xA0	0x04		0x74		
Parameter Description	AntennaID	Working Antenna	0x00	Antenna 1.	
			0x01	Antenna 2.	
			0x02	Antenna 3.	
			0x03	Antenna 4.	

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x74	CommandSuccess	

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x74		
Parameter Description	ErrorCode	Error code.			

2.1.6 cmd_get_work_antenna

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x75	

Response packet:

Head	Len	Address	Cmd	AntennaID	Check
0xA0	0x04		0x75		
Parameter Description	AntennaID (Current Working Antenna)		0x00	Antenna 1.	
			0x01	Antenna 2.	
			0x02	Antenna 3.	
			0x03	Antenna 4.	

2.1.7 cmd_set_output_power

Host packet:

Head	Len	Address	Cmd	RfPower	Check
0xA0	0x04		0x76		
Parameter Description	RfPower	RF output power, range from 0 to 33(0x00 – 0x21), the unit is dBm.			

Or:

Head	Len	Address	Cmd	Power1	Power2	Power3	Power4	Check
0xA0	0x07		0x76					
参数说明	Power1	Output power of antenna 1, range from 0 to 33(0x00 – 0x21), the unit is dBm.						
	Power2	Output power of antenna 2, range from 0 to 33(0x00 – 0x21), the unit is dBm.						
	Power3	Output power of antenna 3, range from 0 to 33(0x00 – 0x21), the unit is dBm.						
	Power4	Output power of antenna 4, range from 0 to 33(0x00 – 0x21), the unit is dBm.						

◆Succeeded:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x76	CommandSuccess	

◆Failed:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x76		
Parameter Description	ErrorCode	Error code.			

The output power value will be saved to the internal flash so that it won't be lost after power off.

Attention:

★This command consumes more than 100mS.

★ If you want you change the output power frequently, please use Cmd_set_temporary_output_power command, which doesn't reduce the life of the internal flash memory.

2.1.8 cmd_get_output_power

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x77	

If all antennas have the same output power value, then

Response packet:

Head	Len	Address	Cmd	OutputPower	Check
0xA0	0x04		0x77		
Parameter Description	OutputPower	Current RF output power.			

Otherwise response packet is:

Head	Len	Address	Cmd	Power1	Power2	Power3	Power4	Check
0xA0	0x07		0x77					

参数说明	Power1	Output power of antenna 1, range from 0 to 33(0x00 – 0x21), the unit is dBm.
	Power2	Output power of antenna 2, range from 0 to 33(0x00 – 0x21), the unit is dBm.
	Power3	Output power of antenna 3, range from 0 to 33(0x00 – 0x21), the unit is dBm.
	Power4	Output power of antenna 4, range from 0 to 33(0x00 – 0x21), the unit is dBm.

2.1.9 cmd_set_frequency_region

There are two methods to define the RF spectrum.

Method A: Use system default frequencies (Please see frequency parameter reference table).

Host packet:

Head	Len	Address	Cmd	Region	StartFreq	EndFreq	Check
0xA0	0x06		0x78				

Parameter Description	Region	Spectrum regulation	0x01	FCC
			0x02	ETSI
			0x03	CHN
	StartFreq	Start frequency of the spectrum		Setup the range of the RF output spectrum. The rules are: 1,Start frequency and end frequency should be in the range of the specified regulation. 2,Start frequency should be equal or lower than end frequency. 3, End frequency equals start frequency means use single frequency point.
	EndFreq	End frequency of the spectrum		

Method B: Use user defined frequencies.

Host packet:

Head	Len	Address	Cmd	Region	FreqSpace	RreqQuantity	StartFreq	Check
0xA0	0x09		0x78	0x04			3bytes	

参数说明	Region	Spectrum regulation	This byte is fixed to 0x04.
	FreqSpace	Frequency space	Frequency space = FreqSpace x 10KHz.
	FreqQuantity	Frequency Quantity	This quantity includes the start frequency, if set this byte to 1, it means use start frequency as the single carrier frequency . This byte should be larger than 0.
	StartFreq	Start Frequency	The unit is KHz. Set the start frequency with hex format, for example, 915000KHz = 0D F6 38 KHz.

◆Succeeded:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x78	CommandSuccess	

◆Failed:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x78		
Parameter Description	ErrorCode	Error code.			

2.1.10 cmd_get_frequency_region

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x79	

If system frequencies are used, the response packet is:

Head	Len	Address	Cmd	Region	StartFreq	EndFreq	Check
0xA0	0x06		0x79				

Parameter Description	Region	Spectrum regulation	0x01	FCC.
			0x02	ETSI.
			0x03	CHN.
	StartFreq	Start frequency		Start frequency of the spectrum.
	EndFreq	End frequency		End frequency of the spectrum.

If user defined frequencies are used, the response packet is:

Head	Len	Address	Cmd	Region	FreqSpace	RreqQuantity	StartFreq	Check
0xA0	0x09		0x79	0x04			3bytes	

参数说明	Region	Spectrum regulation	This byte is fixed to 0x04.
	FreqSpace	Frequency space	Frequency space = FreqSpace x 10KHz.
	FreqQuantity	Frequency Quantity	This quantity includes the start frequency, if set this byte to 1, means use start frequency as the single frequency. This byte shouldn't be set to 0.
	StartFreq	Start Frequency	The unit is KHz. Get the start frequency with hex format, for example, 915000KHz = 0D F6 38 KHz.

2.1.11 cmd_set_beeper_mode

Host packet:

Head	Len	Address	Cmd	Mode	Check
0xA0	0x04		0x7A		
Parameter Description	Mode (Buzzer behavior)		0x00	Quiet.	
			0x01	Beep after every inventory round if tag(s) identified.	
			0x02	Beep after every tag has identified.	

◆Succeeded:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x7A	CommandSuccess	

If this command succeeded, the value will be stared in the internal flash, won't be lost when power off.

Attention:

★Buzzer behavior 0x02(Beep after every tag has identified) occupies CPU process time that affects anti-collision algorithm significantly. It is recommended that this option should be used for tag test.

◆Failed:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x7A		
Parameter Description	ErrorCode	Error code.			

2.1.12 cmd_get_reader_temperature

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x7B	

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	PlusMinus	Temp	Check
0xA0	0x05		0x7B			

Parameter Description	PlusMinus	0x00	Plus.
		0x01	Minus.
	Temp	Celsius degree.	

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x7B		

Parameter Description	ErrorCode	Error code.

2.1.13 cmd_read_gpio_value

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x60	

Response packet:

Head	Len	Address	Cmd	Gpio_1	Gpio_2	Check
0xA0	0x05		0x60			

Parameter Description	Gpio_1	0x00	Gpio1 is low.
		0x01	Gpio1 is high.
	Gpio_2	0x00	Gpio2 is low.
		0x01	Gpio2 is high.

2.1.14 cmd_write_gpio_value

Host packet:

Head	Len	Address	Cmd	ChooseGpio	GpioValue	Check
0xA0	0x05		0x61			

Parameter Description	ChooseGpio	0x03	Set GPIO 3.
		0x04	Set GPIO 4.
	GpioValue	0x00	Set to low level.
		0x01	Set to high level.

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x61		

Parameter Description	ErrorCode	Error code.

2.1.15 cmd_set_ant_connection_detector

Host packet:

Head	Len	Address	Cmd	DetectorSensitivity	Check
0xA0	0x04		0x62		
Parameter Description		DetectorSensitivity	0x00	Close connection detector.	
				Set the sensitivity of the antenna detector, the value is the return loss of the antenna port. The unit is dB. The impedance match requirement is more stringent when this value gets bigger.	

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x62		
Parameter Description	ErrorCode	Error code.			

2.1.16 cmd_get_ant_connection_detector

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x63	

Response packet:

Head	Len	Address	Cmd	DetectorSensitivity	Check
0xA0	0x04		0x63		
Parameter Description		DetectorSensitivity	0x00	Connection detector is closed.	
				The sensitivity of the antenna detector, the value is the return loss of the antenna port. The unit is dB.	

2.1.17 cmd_set_temporary_output_power

Host packet:

Head	Len	Address	Cmd	RfPower	Check
0xA0	0x04		0x66		
Parameter Description	RfPower	RF output power, range from 20-33(0x14 – 0x21), the unit is dBm.			

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x66	CommandSuccess	

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x66		
Parameter Description	ErrorCode	Error code.			

The output power value will **Not** be saved to the internal flash memory so that the output power will be restored from the internal flash memory after restart or power off.

Attention:

★**This command consumes less than 10uS.**

★**If you want you change the output power frequently, please use this command, which doesn't reduce the life of the internal flash memory.**

2.1.18 cmd_set_reader_identifier

Host packet:

Head	Len	Address	Cmd	Identifier	Check
0xA0	0x0F		0x67	12 Bytes	
Parameter Description	Identifier	Reader's identifier (12 bytes).			

◆**Succeeded:**

Response packet:：

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x67	CommandSuccess	

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x67		
Parameter Description	ErrorCode	Error code.			

The identifier is stored in internal flash.

2.1.19 cmd_get_reader_identifier

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x68	

◆Succeeded:

Response packet:

Head	Len	Address	Cmd	Identifier	Check
0xA0	0x0F		0x68	12 Bytes	
Parameter Description	Identifier	Reader's identifier (12 bytes).			

2.1.20 cmd_set_rf_link_profile

Host packet:

Head	Len	Address	Cmd	ProfileID	Check
0xA0	0x04		0x69		
Parameter Description	ProfileID	0xD0	Profile 0: Tari 25uS,FM0 40KHz.		
		0xD1	Profile 1: Tari 25uS, Miller 4 250KHz. Profile 1 is the recommended and default setting.		
		0xD2	Profile 2: Tari 25uS,Miller 4 300KHz.		
		0xdD3	Profile 3: Tari 6.25uS,FM0 400KHz.		

◆Succeeded:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x69	CommandSuccess	

◆Failed:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x69		
Parameter Description	ErrorCode	Error code.			

If this command succeeded, reader will be reset, and the profile configuration is stored in the internal flash.

2.1.21 cmd_get_rf_link_profile

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x6A	

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	ProfileID	Check
0xA0	0x04		0x6A		
Parameter Description	ProfileID	0xD0	Profile 0: Tari 25uS,FM0 40KHz.		
		0xD1	Profile 1: Tari 25uS, Miller 4 250KHz. Profile 1 is the recommended and default setting.		
		0xD2	Profile 2: Tari 25uS,Miller 4 300KHz.		
		0xdD3	Profile 3: Tari 6.25uS,FM0 400KHz.		

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x6A		
Parameter Description	ErrorCode	Error code.			

2.1.22 cmd_get_rf_port_return_loss

Host packet:

Head	Len	Address	Cmd	FreqParameter	Check
0xA0	0x04		0x7E		
Parameter Description	FreqParameter	Please see the frequency parameter reference table. System will measure the return loss of current antenna port at the desired frequency.			

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	ReturnLoss	Check
0xA0	0x04		0x7E		
Parameter Description	ReturnLoss	Return loss value , the unit is dB. VSWR = $(10^{RL/20} + 1)/ (10^{RL/20} - 1)$.			

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x7E		
Parameter Description	ErrorCode	Error code.			

2.2 18000-6C Commands

2.2.1 cmd_inventory

Host packet:

Head	Len	Address	Cmd	Repeat	Check
0xA0	0x04		0x80		
Parameter Description	Repeat	Repeat time of inventory round. When Repeat = 255, The inventory duration is minimized. For example, if the RF field only has one or two tags, the inventory duration could be only 30-50 mS, this function provides a possibility for fast antenna switch applications on multi-ant devices.			

When reader gets this command, the inventory for EPC GEN2 tags starts, tag data will be stored in the internal buffer.

Attention:

★When sets Repeat parameter to 255(0xFF), the anti-collision algorithm is optimized for applications with small tag quantity, which provide better efficiency and less response time.

◆Succeeded:

Response packet:

Head	Len	Address	Cmd	AntID	TagCount	ReadRate	TotalRead	Check
0xA0	0x0C		0x80		2 Bytes	2Bytes	4Bytes	

Parameter Description	AntID	Antenna ID just used.
	TagCount	How many tags have been identified. Tags are differed by EPC, Tags with the same EPC are considered as one. If reader buffer is not cleared, tag count will be added up if reader buffer is not cleared.
	ReadRate	Tag identification speed (tag/second). Communications from the same tag are counted.
	TotalRead	Total tag identification count. Communications from the same tag are counted.

◆Failed:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x80		
Parameter Description	ErrorCode	Error code			

2.2.2 cmd_read

Host packet:

Head	Len	Address	Cmd	MemBank	WordAdd	WordCnt	Check
0xA0	0x06		0x81				
Parameter Description	MemBank (Tag memory bank)				0x00	RESERVED.	
					0x01	EPC.	
					0X02	TID.	
					0X03	USER.	
	WordAdd (Read start address)				Please see the tag's spec for more information.		
	WordCnt (Read data length)				Data length in WORD(16bits) unit. Please see the tag's spec for more information.		

◆**Succeeded:**

Response packet: This command may have multiple response packets, The quantity of response packets equals to the quantity of tags that response.

Head	Len	Address	Cmd	TagCount	DataLen	Data	ReadLen	AntID	ReadCount	Check
0xA0			0x81	2 Bytes		N Bytes				

Parameter Description	TagCount	How many tags has been read.16bits.
	DataLen	Length of useful data for a tag.（PC+CRC+EPC+ read data）, unit is byte.
	Data	Useful data of the tag. PC (2 bytes) + EPC (bytes) + CRC (2 bytes) + read data.
	ReadLen	Length of read data, unit is byte.
	AntID	The high 6 bits are frequency parameter; the low 2 bits are antenna ID.
	ReadCount	How many times the tag has been successfully read.

Attention:

★**If two tags have the same EPC, but different read data, then these two tags are considered different tags.**

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x81		
Parameter Description	ErrorCode	Error code			

2.2.3 cmd_write

Host packet:

Head	Len	Address	Cmd	PassWord	MemBank	WordAdd	WordCnt	Data	Check
0xA0			0x82	4 Bytes				WordCnt *2	

Parameter Description	PassWord	Access password, 4 bytes.	
	MenBank (Tag memory bank)	0x00	RESERVED
		0x01	EPC
		0x02	TID
		0x03	USER
	WordAdd (Write start address)	The unit is WORD(16bits). When write EPC area, notice that EPC starts from address 02, the first two 2 words are for PC+CRC.	
	WordCnt (Write data length)	The unit is WORD(16 bits)	

◆**Succeeded:**

Response packet: This command may have multiple response packets; the quantity of response packets equals to the quantity of tags that response.

Head	Len	Address	Cmd	TagCount	DataLen	Data	ErrCode	AntID	WriteCount	Check
0xA0			0x82	2 Bytes		N Bytes				

Parameter Description	TagCount	How many tags have been written, 16 bits.
	DataLen	Length of useful data of a tag.（PC+CRC+EPC）. The unit is byte.
	Data	Useful data of the tag. PC(2 bytes) + EPC (bytes) + CRC (2bytes)
	ErrCode	Operation result which is Error code.
	AntID	The high 6 bits are frequency parameter; the low 2 bits are antenna ID.
	WriteCount	How many times the tag has been written.

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x82		

Parameter Description	ErrorCode	Error code

2.2.4 cmd_lock

Host packet:

Head	Len	Address	Cmd	PassWord	Menbank	LockType	Check
0xA0	0x09		0x83	4 Bytes			

Parameter Description	PassWord	Access password, 4 bytes.	
	Menbank (Tag memory bank)	0x01	User Memory.
		0x02	TID Memory.
		0x03	EPC Memory.
		0x04	Access Password.
		0x05	Kill Password.
	LockType (Lock operation type)	0x00	Open.
		0x01	Lock.
		0x02	Permanent open.
		0x03	Permanent lock.

◆**Succeeded:**

Response packet: This command may have multiple response packets, The quantity of response packets equals to the quantity of tags that response.

Head	Len	Address	Cmd	TagCount	DataLen	Data	ErrCode	AntID	LockCount	Check
0xA0			0x83	2 Bytes		N Bytes				

Parameter Description	TagCount	How many tags have been locked.16 bits.
	DataLen	Useful data for the tag（PC+CRC+EPC）.The unit is byte.
	Data	Useful data of the tag. PC(2 bytes) + EPC (bytes) + CRC (2bytes)
	ErrCode	Operation result which is Error code.
	AntID	The high 6 bits are frequency parameter; the low 2 bits are antenna ID.
	LockCount	How many times the tag has been locked.

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x83		

Parameter Description	ErrorCode	Error code

2.2.5 cmd_kill

Host packet:

Head	Len	Address	Cmd	PassWord	Check
0xA0	0x07		0x84	4 Bytes	
Parameter Description	PassWord	Kill password			

◆**Succeeded:**

Response packet: This command may have multiple response packets, The quantity of response packets equals to the quantity of tags that response.

Head	Len	Address	Cmd	TagCount	DataLen	Data	ErrCode	AntID	KillCount	Check
0xA0			0x84	2 Bytes						

Parameter Description	TagCount	How many tags have been killed.16bits.
	DataLen	Useful data for the tag（PC+CRC+EPC）.The unit is byte.
	Data	Useful data of the tag. PC(2 bytes) + EPC (bytes) + CRC (2bytes).
	ErrCode	Operation result which is Error code.
	AntID	The high 6 bits are frequency parameter; the low 2 bits are antenna ID.
	KillCount	In this case, this byte only can be 1, because a tag only can be killed once.

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x84		
Parameter Description	ErrorCode	Error code.			

2.2.6 cmd_set_access_epc_match

Host packet:

Head	Len	Address	Cmd	Mode	EpcLen	Epc	Check
0xA0			0x85				
Parameter Description	Mode		0x00	Set EPC match effective.			
			0x01	Clear EPC match.			
	EpcLen		Length of EPC.				
	Epc		EPC, Length equals EpcLen.				

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x85		
Parameter Description	ErrorCode	Error code.			

2.2.7 cmd_get_access_epc_match

Host packet:

Head	Len	Address	Cmd	Check
0xA0			0x86	

Response packet:

Head	Len	Address	Cmd	Status	EpcLen	EPC	Check
0xA0			0x86				
Parameter Description	Status	0x00	EPC match is effective.				
		0x01	EPC match is not effective.				
	EpcLen	The length of the EPC which EPC match is effective, if EPC match is not effective, this byte doesn't return from reader.					
	EPC	The EPC which EPC match is effective, if EPC match is not effective, this byte doesn't return from reader.					

2.2.8 cmd_real_time_inventory

Host packet:

Head	Len	Address	Cmd	Repeat	Check
0xA0	0x04		0x89		
Parameter Description	Repeat	Repeat time of inventory round . When Repeat = 255, The inventory duration is minimized. For example, if the RF field only has one or two tags, the inventory duration could be only 30-50 mS, this function provides a possibility for fast antenna switch applications on multi-ant devices.			

When reader gets this command, the inventory for EPC GEN2 tags starts, tag data will **NOT** be stored in the internal buffer. The tag data is transferred in real time.

Attention:

★**The hardware has a dual CPU architecture, main CPU is responsible for tag inventory, and assistant CPU is responsible for data management. Inventory and data transfer are parallel and simultaneous. So the data transfer via serial port doesn't affect the efficiency of reader.**

If there is(are) tag(s), reader responses below packets(multiple).

Head	Len	Address	Cmd	FreqAnt	PC	EPC	RSSI	Check
0xA0			0x89		2 bytes	N bytes		

Parameter Description	FreqAnt	The high 6 bits are frequency parameter; the low 2 bits are antenna ID.
	PC	Tag's PC. 2 bytes.
	EPC	Tag's EPC.
	RSSI	The RSSI when tag is identified.

After that, the command response is:

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	AntID	ReadRate	TotalRead	Check
0xA0	0x0A		0x89		2 bytes	4 bytes	
Parameter Description	AntID	The antenna ID of this inventory round.					
	ReadRate	Tag ReadRate of this command (tag/sec).					
	TotalRead	Total tag identification count. Communications from the same tag are counted.					

◆**Failed:**

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x89		
Parameter Description	ErrorCode	Error code.			

2.2.9 cmd_fast_switch_ant_inventory

Host packet:

Head	Len	Address	Cmd	A	Stay	B	Stay	C	Stay	D	Stay	Interval	Repeat	Check
0xA0	0x0D		0x8A											

参数说明	A	First working ant (00 – 03). If set this byte above 03 means ignore it.
	Stay	Inventory round for an antenna. Every antenna has this parameter.
	B	Second working ant (00 – 03). If set this byte above 03 means ignore it.
	C	Third working ant (00 – 03). If set this byte above 03 means ignore it.
	D	Fourth working ant (00 – 03). If set this byte above 03 means ignore it.
	Interval	Rest time between switching antennas. During the cause of rest, RF output will be cancelled, thus power consumption and heat generation are both reduced.
	Repeat	Repeat the inventory with above ant switch sequence.

When reader gets this command, the inventory for EPC GEN2 tags starts, tag data will **NOT** be stored in the internal buffer. The tag data is transferred in real time.

Meanwhile, the inventory duration is minimized in order to switch to the next antenna as soon as possible. If there's no tag, or only one or two tags in the RF field, the inventory duration on one antenna could be around 30mS. If there are more tags, the inventory duration on one antenna will increase. This command is an ideal solution for fast antenna switch applications on multi ant devices.

Attention:

★**The hardware has a dual CPU architecture, main CPU is responsible for tag inventory, and assistant CPU is responsible for data management. Inventory and data transfer are parallel and simultaneous. So the data transfer via serial port doesn't affect the efficiency of reader.**

★**In massive tag applications, please use cmd_real_time_inventory command which is more effective for large tag quantity applications.**

If there is(are) tag(s), reader responses below packets(multiple).

Head	Len	Address	Cmd	FreqAnt	PC	EPC	RSSI	Check
0xA0			0x8A		2 bytes	N bytes		

Parameter Description	FreqAnt	The high 6 bits are frequency parameter; the low 2 bits are antenna ID.
	PC	Tag's PC. 2 bytes.
	EPC	Tag's EPC.
	RSSI	The RSSI when tag is identified.

If the antenna detector is on, and antenna is not well connected, you might get below data package:

Head	Len	Address	Cmd	AntID	ErrorCode	Check
0xA0	0x05		0x8A		0x22	
Parameter Description	AntID	Unconnected antenna ID(00 – 03).				
	ErrorCode	0x22, error code for antenna is missing.				

After that, the command response is:

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	TotalRead	CommandDuration	Check
0xA0	0x0A		0x8A	3 bytes	4 bytes	
Parameter Description	TotalRead	How many tag data have been sent. an integer is stored in 3 bytes, high bits are aligned to the left.				
	CommandDuration	Command duration in millisecond, an integer is stored in 4 bytes, high bits are aligned to the left.				

◆**Failed:**

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x8A		
Parameter Description	ErrorCode	Error code.			

2.2.10 cmd_customized_session_target_inventory

Host packet:

Head	Len	Address	Cmd	Session	Target	Repeat	Check
0xA0	0x06		0x8B				

Parameter Description	Session	Desired session ID.
	Target	Desired Inventoried Flag, 00 = A, 01= B.
	Repeat	Number of times of repeating this inventory.

When reader gets this command, the inventory for EPC GEN2 tags starts, tag data will **NOT** be stored in the internal buffer. The tag data is transferred in real time.

Attention:

★**The hardware has a dual CPU architecture, main CPU is responsible for tag inventory, and assistant CPU is responsible for data management. Inventory and data transfer are parallel and simultaneous. So the data transfer via serial port doesn't affect the efficiency of reader.**

If there is(are) tag(s), reader responses below packets(multiple).

Head	Len	Address	Cmd	FreqAnt	PC	EPC	RSSI	Check
0xA0			0x8B		2 bytes	N bytes		

Parameter Description	FreqAnt	The high 6 bits are frequency parameter; the low 2 bits are antenna ID.
	PC	Tag's PC. 2 bytes.
	EPC	Tag's EPC.
	RSSI	The RSSI when tag is identified.

After that, the command response is:

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	AntID	ReadRate	TotalRead	Check
0xA0	0x0A		0x8B		2bytes	4 bytes	

Parameter Description	AntID	The antenna ID of this inventory round.
	ReadRate	Tag ReadRate of this command (tag/sec).
	TotalRead	Total tag identification count. Communications from the same tag are counted.

◆**Failed:**

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x8B		
Parameter Description	ErrorCode	Error code.			

2.2.11 cmd_set_impinj_fast_tid

Host packet:

Head	Len	Address	Cmd	FastTID	Check
0xA0	0x04		0x8C		
Parameter Description	FastTID	Any value except 0x8D	Close FastTID		
		0x8D	Open FastTID		

Attention:

★This function is only affective for some of Impinj Monza tag types.

★This function improves the performance of identifying tag's TID.

★When this function takes effect, tag's TID will be included to tag's EPC, therefore, tag's EPC will be altered; the original data (PC + EPC) will be changed to altered PC + EPC + EPC's CRC + TID.

★If error occurred during identifying TID, only the original data (PC + EPC) will be sent.

★If you don't need this function, please turn it off, otherwise there will be unnecessary time consumption.

★This command doesn't store the status to internal flash. After reset or power on, the value stored in flash will be restored.

◆Succeeded:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x8C	CommandSuccess	

◆Failed:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x8C		
Parameter Description	ErrorCode	Error code.			

2.2.12 cmd_set_and_save_impinj_fast_tid

Please see cmd_set_impinj_fast_tid command.

This command stores the configuration to internal flash. It won't be lost after power off.

2.2.13 cmd_get_impinj_fast_tid

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x8E	

Response packet:

Head	Len	Address	Cmd	FastTID	Check
0xA0	0x04		0x8E		
Parameter Description	FastTID	0x8D	Open FastTID		
		0x00	Close FastTID		

2.3 ISO 18000-6B Commands

2.3.1 cmd_iso18000_6b_inventory

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0xB0	

When reader gets this command, the inventory for EPC GEN2 tags starts, tag data will **NOT** be stored in the internal buffer. The tag data is transferred in real time.

If there is(are) tag(s), reader responses below packets(multiple).

Head	Len	Address	Cmd	AntID	UID	Check
0xA0	0x0C		0xB0		8 bytes	
Parameter Description	AntID	Antenna ID.				
	UID	ISO 18000-6B tag UID (8 bytes).				

After that, the command response is:

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	AntID	TagFound	Check
0xA0	0x05		0xB0			
Parameter Description	AntID	The antenna ID of this inventory round.				
	TagFound	How many unique tags are found.				

◆**Failed:**

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0xB0		
Parameter Description	ErrorCode	Error code			

2.3.2 cmd_iso18000_6b_read

Host packet:

Head	Len	Address	Cmd	UID	StartAddress	Length	Check
0xA0	0x0D		0xB1	8 bytes			
Parameter Description	UID	The UID of the tag which is being read.					
	StartAddress	Start address for read.					
	Length	Read data length.					

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	AntID	Data	Check
0xA0			0xB1		N bytes	
Parameter Description	AntID	The antenna ID of this read operation.				
	Data	Read data.				

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0xB1		
Parameter Description	ErrorCode	Error code.			

2.3.3 cmd_iso18000_6b_write

Host packet:

Head	Len	Address	Cmd	UID	StartAddress	Length	Data	Check
0xA0			0xB2				N bytes	

Parameter Description	UID	The UID of the tag which is being written.
	StartAddress	Start address for write.
	Length	Write data length.
	Data	Data to be written.

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	AntID	WrittenCount	Check
0xA0	0x05		0xB2			

Parameter Description	AntID	The antenna ID of this read operation.
	WrittenCount	How many bytes have been successfully written.

Attention:

★**This command can write multiple bytes once. But when a byte is failed to write, the following bytes won't be written. Then the response packet returns the quantity of successfully written bytes.**

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0xB2		

Parameter Description	ErrorCode	Error code.

2.3.4 cmd_iso18000_6b_lock

Host packet:

Head	Len	Address	Cmd	UID	LockAddress	Check
0xA0	0x0C		0xB3	8 bytes		
Parameter Description	UID	The UID of the tag which is being locked.				
	LockAddress	The address to be locked.				

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	AntID	Status	Check
0xA0	0x05		0xB3			
Parameter Description	AntID	The antenna ID of this read operation.				
	Status	0x00	The byte is successfully locked.			
		0xFE	The byte is already locked.			
		0xFF	The byte can't be locked.			

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0xB3		
Parameter Description	ErrorCode	Error code.			

2.3.5 cmd_iso18000_6b_query_lock

Host packet:

Head	Len	Address	Cmd	UID	QueryAddress	Check
0xA0	0x0C		0xB4	8 bytes		
Parameter Description	UID	The UID of the tag which is being locked.				
	QueryAddress	The address to be queried.				

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	AntID	Status	Check
0xA0	0x05		0xB4			
Parameter Description	AntID	The antenna ID of this read operation.				
	Status	0x00	The byte is not locked.			
		0xFE	The byte is locked.			

◆**Failed:**

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0xB4		
Parameter Description	ErrorCode	Error code.			

2.4 Buffer Operation Commands

2.4.1 cmd_get_inventory_buffer

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x90	

◆Succeeded:

Response packet: This command may have multiple response packets, the quantity of response packets equals to the quantity of tags that stored.

Head	Len	Address	Cmd	TagCount	DataLen	Data	RSSI	FREQ	FreqAnt	InvCount	Check
0xA0			0x90	2 Bytes		N bytes					

Parameter Description	TagCount	How many tags are stored. 16bits.
	DataLen	Length of useful data for a tag.（PC+CRC+EPC）, unit is byte.
	Data	Useful data of the tag. PC (2 bytes) + EPC (bytes) + CRC (2 bytes)
	RSSI	The RSSI of the tag that has been identified in the first time.
	FreqAnt	The high 6 bits are frequency parameter; the low 2 bits are antenna ID.
	InvCount	How many time the tag has been successfully identified. If the value is 0xFF, that means the identification time is equal or greater than 255.

Attention:

★The data in the buffer won't be lost after execution of this command.

★If the cmd_inventory is executed again, the tag data escalate in the buffer.

★Other 18000-6C commands can clear the buffer.

◆Failed:

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x90		

Parameter Description	ErrorCode	Error code.

2.4.2 cmd_get_and_reset_inventory_buffer

Please see cmd_get_inventory_buffer command.
After execution of this command, the buffer is cleared.

2.4.3 cmd_get_inventory_buffer_tag_count

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x92	

◆**Succeeded:**

Response packet:

Head	Len	Address	Cmd	TagCount	Check
0xA0	0x05		0x92	2 Bytes	
Parameter Description	TagCount	How many tags are stored.			

2.4.4 cmd_reset_inventory_buffer

Host packet:

Head	Len	Address	Cmd	Check
0xA0	0x03		0x93	

Response packet:

Head	Len	Address	Cmd	ErrorCode	Check
0xA0	0x04		0x93	CommandSuccess	

3 Error code

序号	Code	Name	Description
1	0x10	CommandSuccess	Command succeeded.
2	0x11	command_fail	Command failed.
3	0x20	mcu_reset_error	CPU reset error.
4	0x21	cw_on_error	Turn on CW error.
5	0x22	antenna_missing_error	Antenna is missing.
6	0x23	write_flash_error	Write flash error.
7	0x24	read_flash_error	Read flash error.
8	0x25	set_output_power_error	Set output power error.
9	0x31	tag_inventory_error	Error occurred when inventory.
10	0x32	tag_read_error	Error occurred when read.
11	0x33	tag_write_error	Error occurred when write.
12	0x34	tag_lock_error	Error occurred when lock.
13	0x35	tag_kill_error	Error occurred when kill.
14	0x36	no_tag_error	There is no tag to be operated.
15	0x37	inventory_ok_but_access_fail	Tag Inventoried but access failed.
16	0x38	buffer_is_empty_error	Buffer is empty.
17	0x40	access_or_password_error	Access failed or wrong password.
18	0x41	parameter_invalid	Invalid parameter.
19	0x42	parameter_invalid_wordCnt_too_long	WordCnt is too long.
20	0x43	parameter_invalid_membank_out_of_range	MemBank out of range.
21	0x44	parameter_invalid_lock_region_out_of_range	Lock region out of range.
22	0x45	parameter_invalid_lock_action_out_of_range	LockType out of range.
23	0x46	parameter_reader_address_invalid	Invalid reader address.
24	0x47	parameter_invalid_AntennaID_out_of_range	AntennaID out of range.
25	0x48	parameter_invalid_output_power_out_of_range	Output power out of range.
26	0x49	parameter_invalid_frequency_region_out_of_range	Frequency region out of range.

27	0x4A	parameter_invalid_baudrate_out_of_range	Baud rate out of range.
28	0x4B	parameter_beeper_mode_out_of_range	Buzzer behavior out of range.
29	0x4C	parameter_epc_match_len_too_long	EPC match is too long.
30	0x4D	parameter_epc_match_len_error	EPC match length wrong.
31	0x4E	parameter_invalid_epc_match_mode	Invalid EPC match mode.
32	0x4F	parameter_invalid_frequency_range	Invalid frequency range.
33	0x50	fail_to_get_RN16_from_tag	Failed to receive RN16 from tag.
34	0x51	parameter_invalid_drm_mode	Invalid DRM mode.
35	0x52	pll_lock_fail	PLL can not lock.
36	0x53	rf_chip_fail_to_response	No response from RF chip.
37	0x54	fail_to_achieve_desired_output_power	Can't achieve desired output power level.
38	0x55	copyright_authentication_fail	Can't authenticate firmware copyright.
39	0x56	spectrum_regulation_error	Spectrum regulation wrong.
40	0x57	output_power_too_low	Output power is too low.

4 Frequency Parameter Reference Table

Freq Para	Corresponding Frequency	Freq Para	Corresponding Frequency
0(0x00)	865.00 MHz	30(0x1E)	913.50 MHz
1(0x01)	865.50 MHz	31(0x1F)	914.00 MHz
2(0x02)	866.00 MHz	32(0x20)	914.50 MHz
3(0x03)	866.50 MHz	33(0x21)	915.00 MHz
4(0x04)	867.00 MHz	34(0x22)	915.50 MHz
5(0x05)	867.50 MHz	35(0x23)	916.00 MHz
6(0x06)	868.00 MHz	36(0x24)	916.50 MHz
7(0x07)	902.00 MHz	37(0x25)	917.00 MHz
8(0x08)	902.50 MHz	38(0x26)	917.50 MHz
9(0x09)	903.00 MHz	39(0x27)	918.00 MHz
10(0x0A)	903.50 MHz	40(0x28)	918.50 MHz
11(0x0B)	904.00 MHz	41(0x29)	919.00 MHz
12(0x0C)	904.50 MHz	42(0x2A)	919.50 MHz
13(0x0D)	905.00 MHz	43(0x2B)	920.00 MHz
14(0x0E)	905.50 MHz	44(0x2C)	920.50 MHz
15(0x0F)	906.00 MHz	45(0x2D)	921.00 MHz
16(0x10)	906.50 MHz	46(0x2E)	921.50 MHz
17(0x11)	907.00 MHz	47(0x2F)	922.00 MHz
18(0x12)	907.50 MHz	48(0x30)	922.50 MHz
19(0x13)	908.00 MHz	49(0x31)	923.00 MHz
20(0x14)	908.50 MHz	50(0x32)	923.50 MHz
21(0x15)	909.00 MHz	51(0x33)	924.00 MHz
22(0x16)	909.50 MHz	52(0x34)	924.50 MHz
23(0x17)	910.00 MHz	53(0x35)	925.00 MHz
24(0x18)	910.50 MHz	54(0x36)	925.50 MHz
25(0x19)	911.00 MHz	55(0x37)	926.00 MHz
26(0x1A)	911.50 MHz	56(0x38)	926.50 MHz
27(0x1B)	912.00 MHz	57(0x39)	927.00 MHz
28(0x1C)	912.50 MHz	58(0x3A)	927.50 MHz
29(0x1D)	913.00 MHz	59(0x3B)	928.00 MHz

5 RSSI Parameter Reference Table

RSSI Para	Corresponding Signal Strength	RSSI Para	Corresponding Signal Strength
98(0x62)	-31dBm	64(0x40)	-66dBm
97(0x61)	-32dBm	63(0x3F)	-67dBm
96(0x60)	-33dBm	62(0x3E)	-68dBm
95(0x5F)	-34dBm	61(0x3D)	-69dBm
94(0x5E)	-35dBm	60(0x3C)	-70dBm
93(0x5D)	-36dBm	59(0x3B)	-71dBm
92(0x5C)	-37dBm	58(0x3A)	-72dBm
91(0x5B)	-38dBm	57(0x39)	-73dBm
90(0x5A)	-39dBm	56(0x38)	-74dBm
89(0x59)	-41dBm	55(0x37)	-75dBm
88(0x58)	-42dBm	54(0x36)	-76dBm
87(0x57)	-43dBm	53(0x35)	-77dBm
86(0x56)	-44dBm	52(0x34)	-78dBm
85(0x55)	-45dBm	51(0x33)	-79dBm
84(0x54)	-46dBm	50(0x32)	-80dBm
83(0x53)	-47dBm	49(0x31)	-81dBm
82(0x52)	-48dBm	48(0x30)	-82dBm
81(0x51)	-49dBm	47(0x2F)	-83dBm
80(0x50)	-50dBm	46(0x2E)	-84dBm
79(0x4F)	-51dBm	45(0x2D)	-85dBm
78(0x4E)	-52dBm	44(0x2C)	-86dBm
77(0x4D)	-53dBm	43(0x2B)	-87dBm
76(0x4C)	-54dBm	42(0x2A)	-88dBm
75(0x4B)	-55dBm	41(0x29)	-89dBm
74(0x4A)	-56dBm	40(0x28)	-90dBm
73(0x49)	-57dBm	39(0x27)	-91dBm
72(0x48)	-58dBm	38(0x26)	-92dBm
71(0x47)	-59dBm	37(0x25)	-93dBm
70(0x46)	-60dBm	36(0x24)	-94dBm
69(0x45)	-61dBm	35(0x23)	-95dBm
68(0x44)	-62dBm	34(0x22)	-96dBm
67(0x43)	-63dBm	33(0x21)	-97dBm
66(0x42)	-64dBm	32(0x20)	-98dBm
65(0x41)	-55dBm	31(0x1F)	-99dBm

6 Checksum Function(Standard C Language)

```
unsigned char    CheckSum(unsigned char *uBuff, unsigned char uBuffLen)
{
    unsigned char i,uSum=0;
    for(i=0;i<uBuffLen;i++)
    {
        uSum = uSum + uBuff[i];
    }
    uSum = (~uSum) + 1;
    return uSum;
}
```