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Advanced settings

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Agenda

- UART data's integrity
- UART frame control
- Power save management
- TCP maintenance settings
- Multiple AP roaming and dual mode
- Firmware update mode, MFG mode

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UART data's integrity

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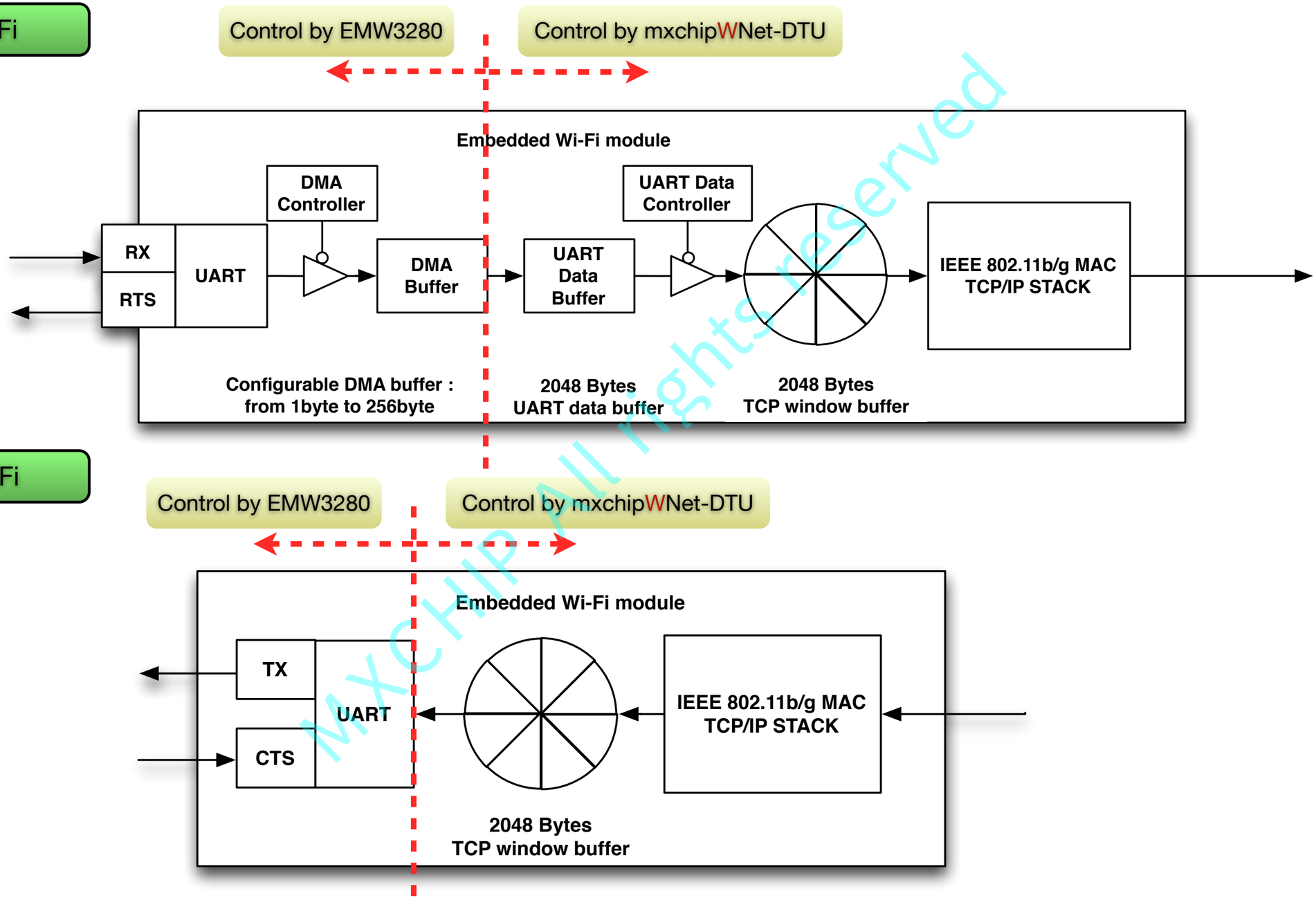
UART<->Wi-Fi data conversion block

UART->Wi-Fi



UART<-Wi-Fi

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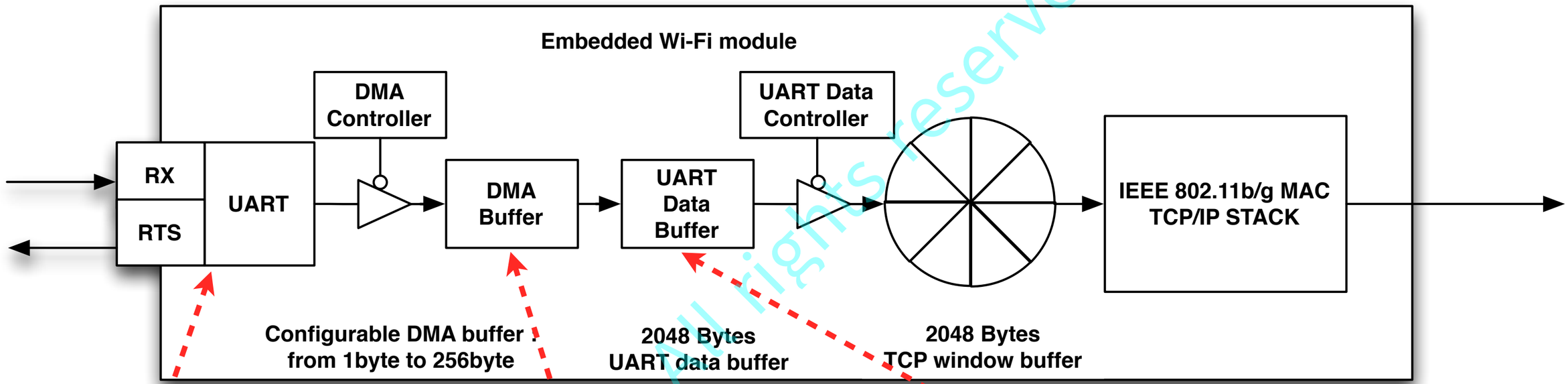
Related settings in UART->Wi-Fi

UART->Wi-Fi



UART settings

Purpose: Set UART working parameters

Possible settings:
Baud rate; data length; parity method; CTS/RTS ...

DMA buffer size

Purpose: reduce the CPU time spending when receiving UART data

Possible settings:
No buffer; 8 Bytes; 16bytes; 32 bytes; 64 bytes; 128 bytes; 256 bytes

UART->WiFi conversion

Purpose: Set different methods that convert UART data to network package

Possible settings:
Data flow mode; Time stamp mode; Data package mode, Auto frame mode...

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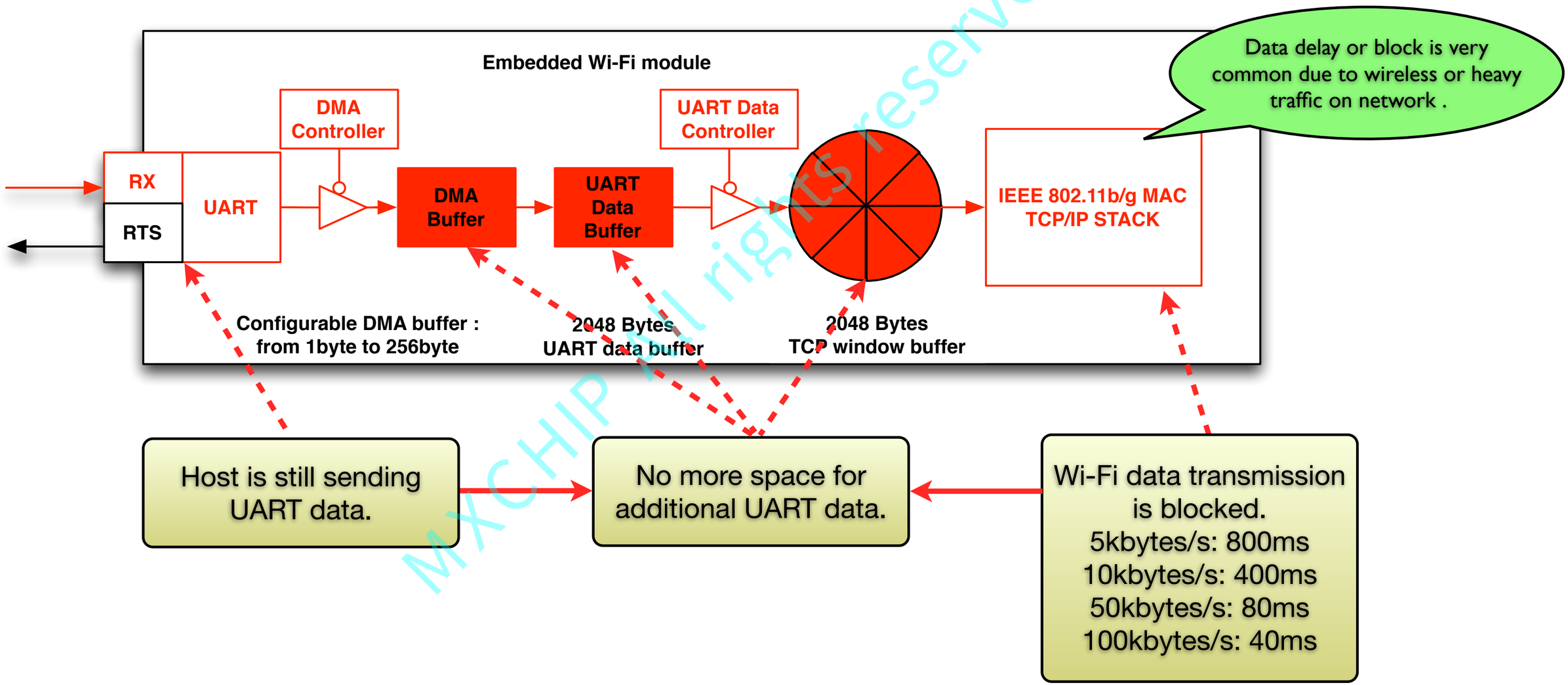
UART data lost case in UART->Wi-Fi

UART->Wi-Fi



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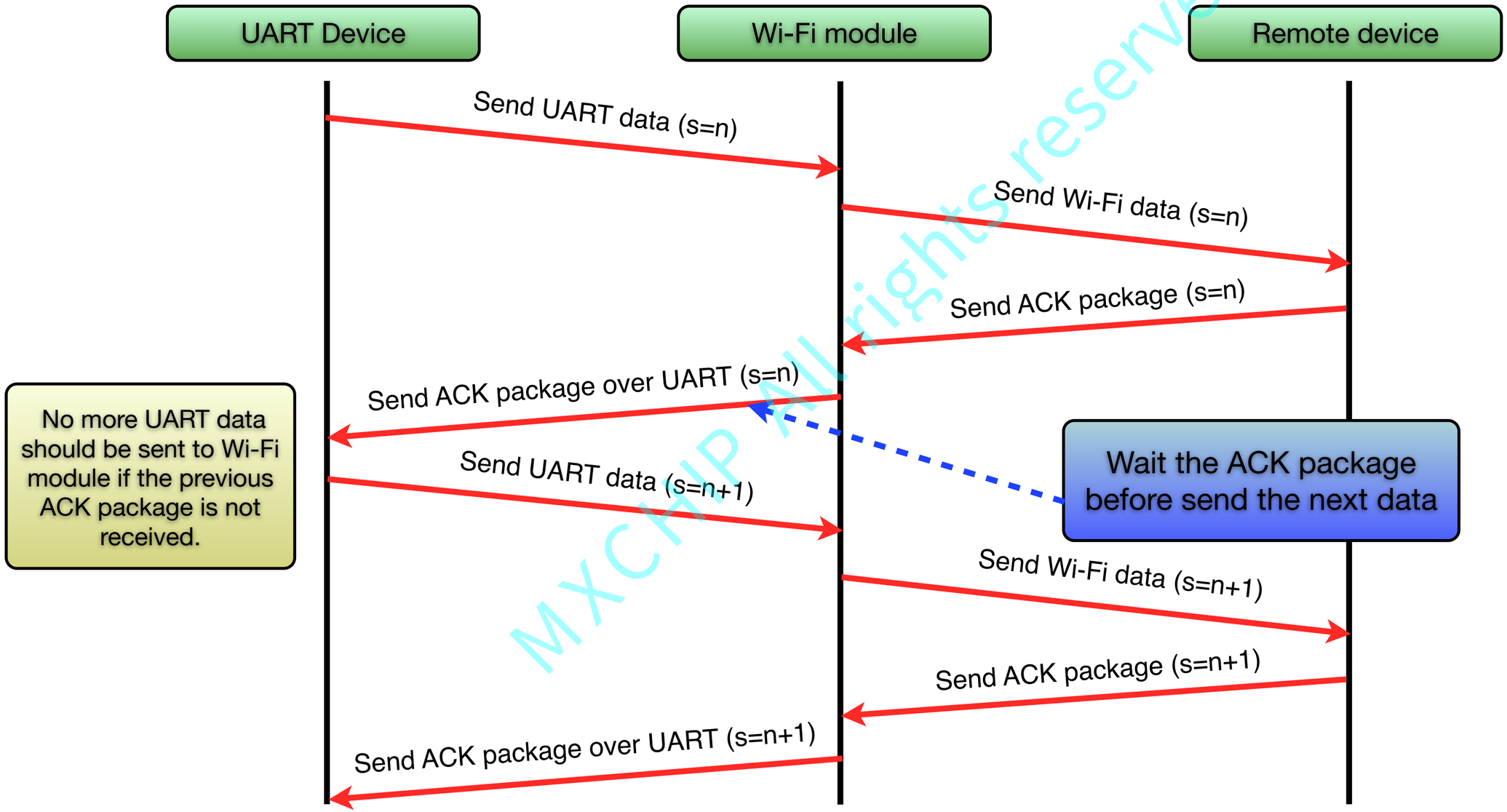
UART data integrity, Method 1

Add an ACK mechanism over communication protocol



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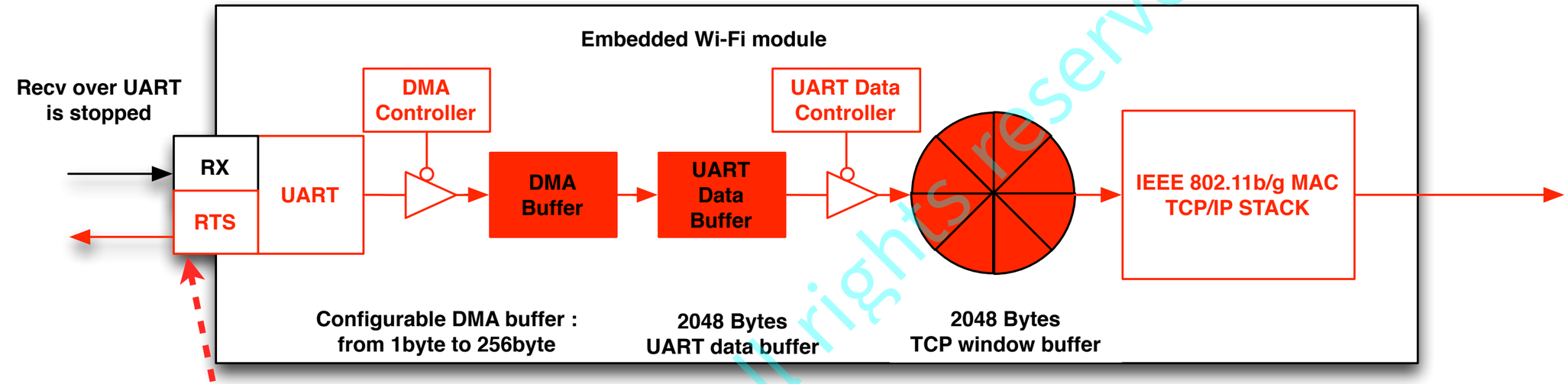
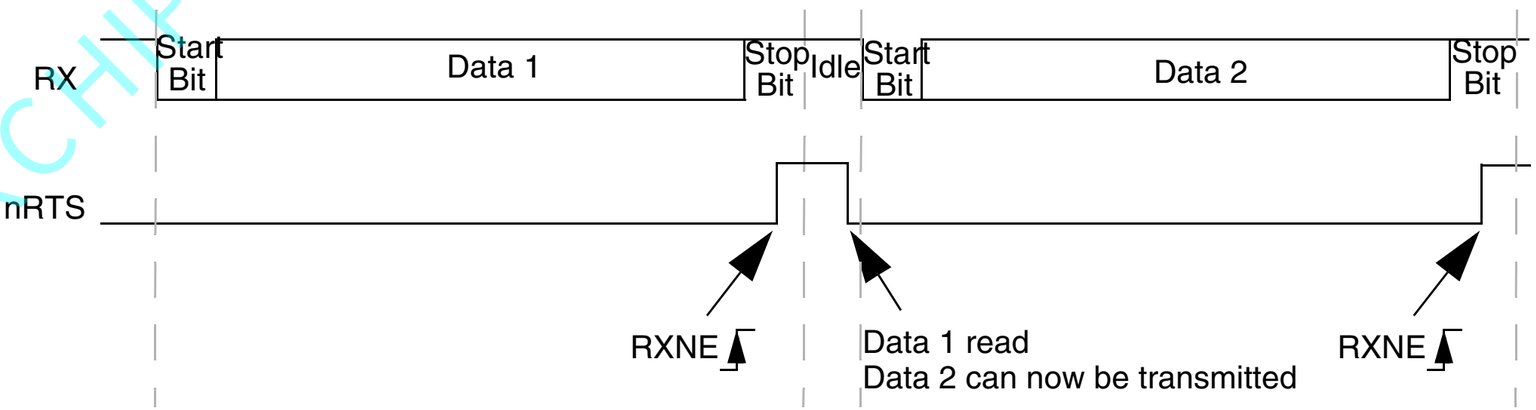
UART data integrity, Method 2

Enable hardware flow control on both host and module.



RTS signal is asserted.
No more UART data should be sent to Wi-Fi module.



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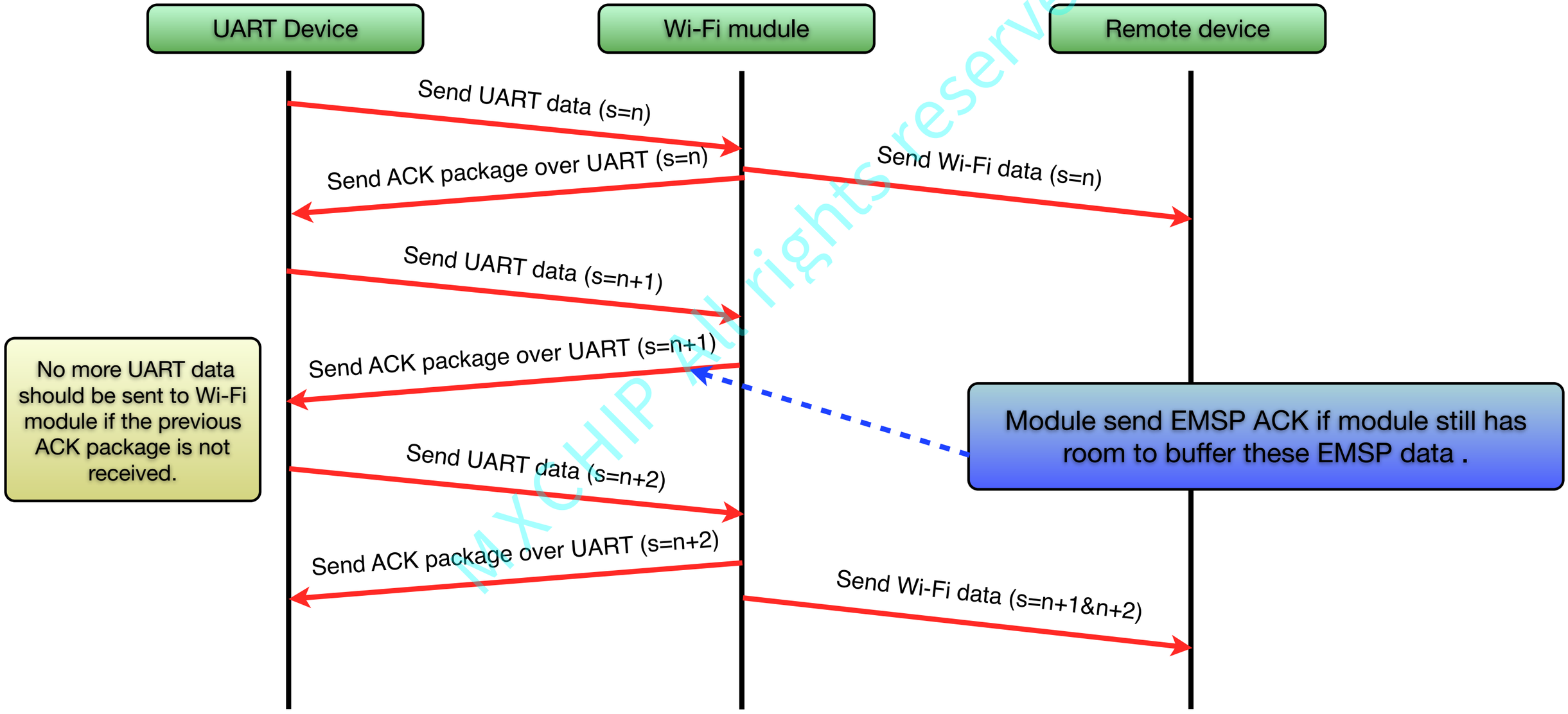
UART data integrity, Method 3

Use EMSP command for data transmission



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Comparison

	Method 1	Method 2	Method 3
Additional hardware connection	No	Yes	No
Transfer speed	Low	Fast	Middle, but much faster than method 1
UART data package format	User define	User define	EMSP command
Configuration	DTU mode (status = 1) CTS/RTS == Enable	DTU mode (status = 1) CTS/RTS == Enable DMA buffer size > 16	EMSP mode (status = 0)

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UART frame control

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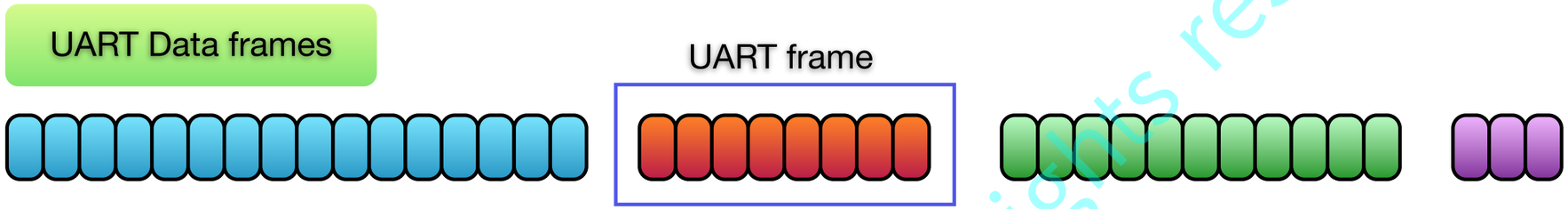
UART frame control: Data flow mode

- Data frame is used to fetch the target data from data flow
  - Wi-Fi network has standard data package definition: TCP, UDP, HTML, etc...
  - UART data formats are all user defined

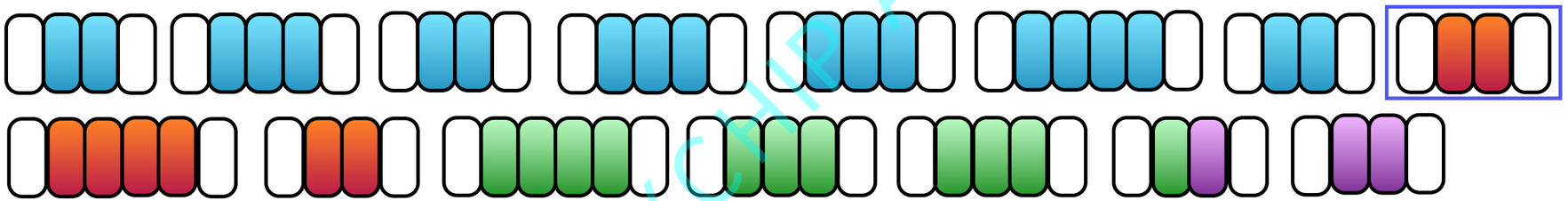


Recv n bytes at one time, rebuild the UART data frame in receiver's UART buffer.

Recv n package bytes at one time, rebuild the UART data frame in receiver's data buffer.

TCP frame

Treat UART data as data flow: DATA mode = Data Flow Mode, UART DMA Size=0, TCP data frame:



Treat UART data as data flow: DATA mode = Data Flow Mode, UART DMA Size=8, TCP data frame

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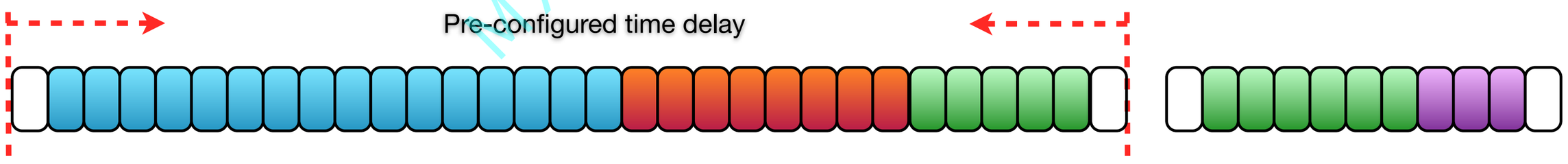
Time stamp mode

- Data flow mode
  - If UART data buffer has data ,try to send them as soon as possible.
  - Advantage: UART data is sent to Wi-Fi very fast.
  - Disadvantage: TCP data is fragmental, each TCP package has little useful UART data, and import too much TCP framework data (TCP head and TCP tail) .
- Time stamp mode
  - If UART data buffer has data, wait a pre-configured time or buffer is full, then send them.
  - Advantage: The quality of TCP package is reduced, Network performance is better.
  - Disadvantage: Data has a delay if UART data length is short



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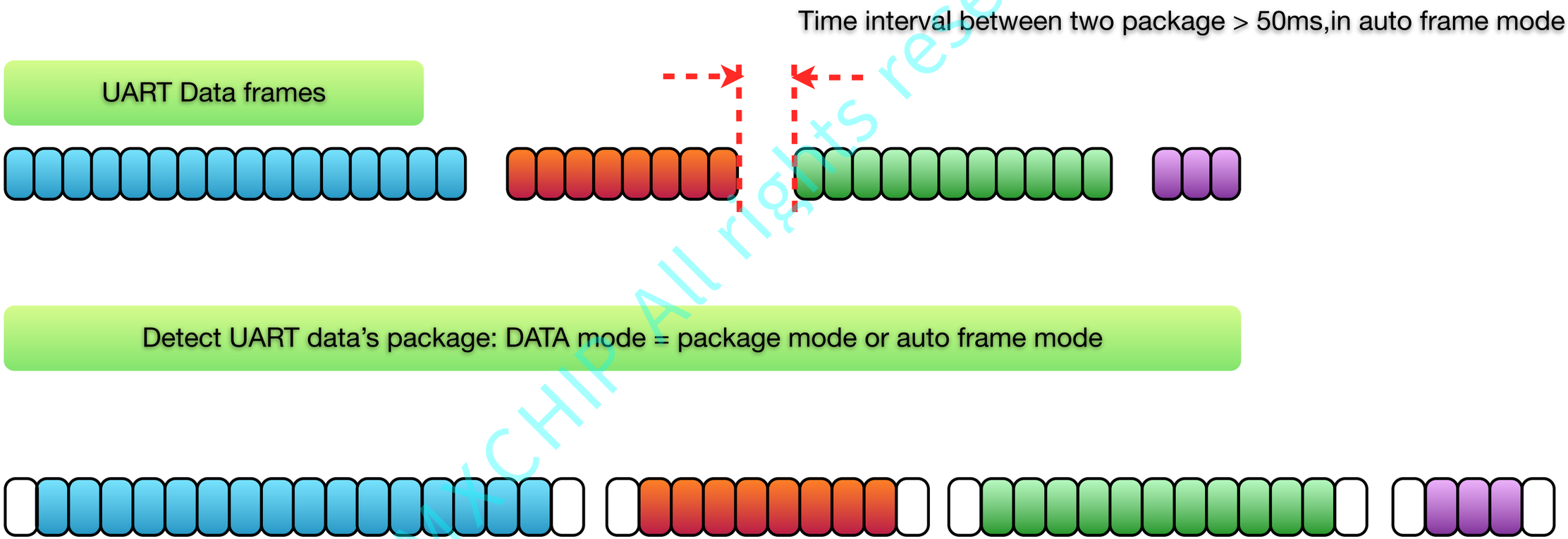
Package mode and Auto frame mode

- Put one UART package in one network package would simplify the package recognition on the remote network device.



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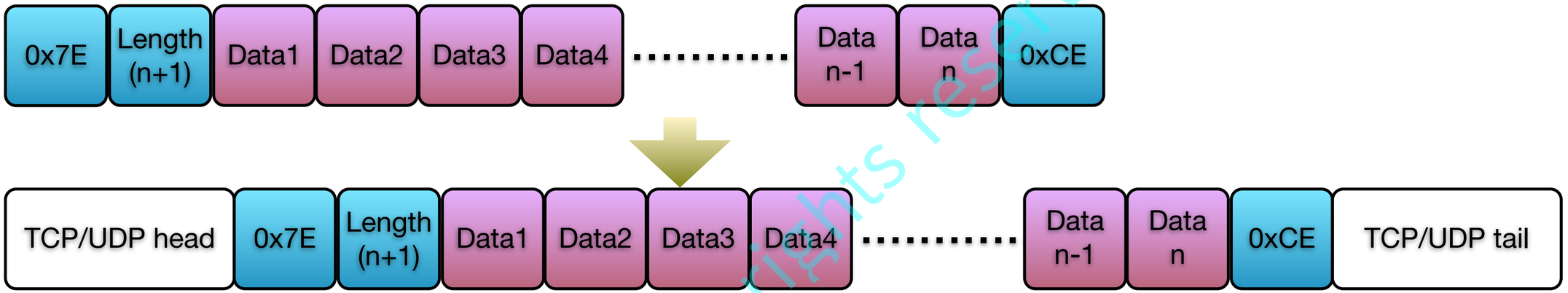
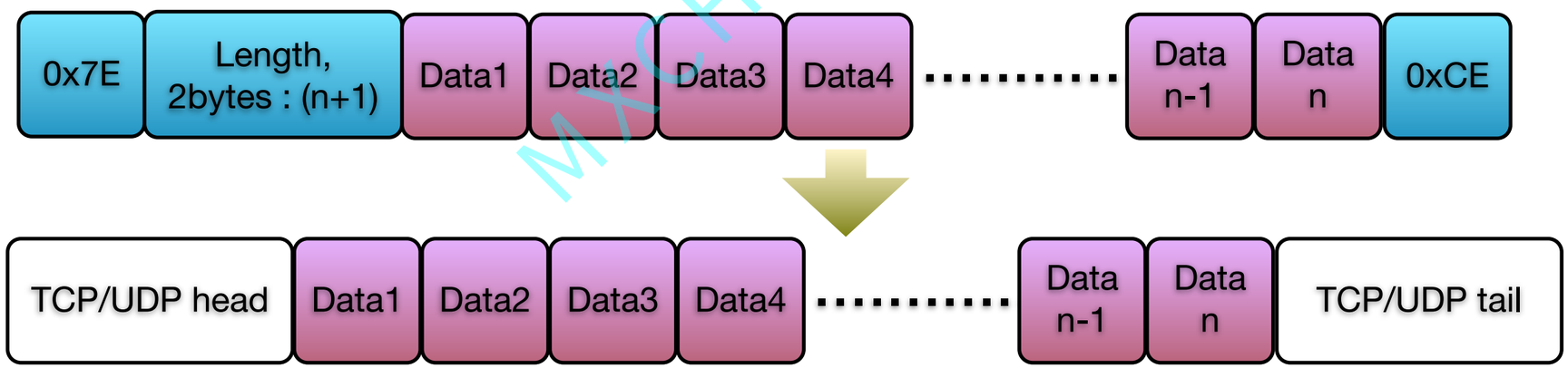
Package mode format

Package mode 1



Package mode 2



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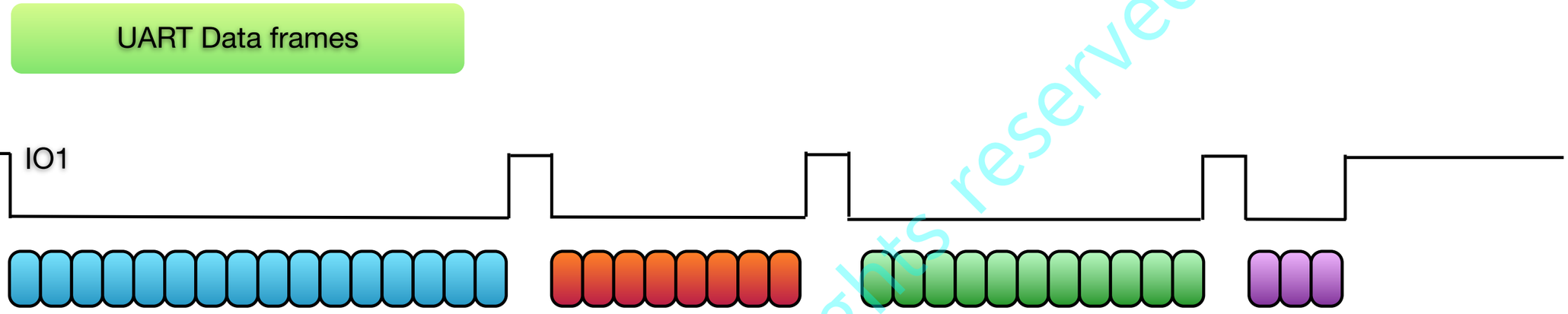
IO1: Frame control mode



Detect UART data's package: DATA mode = Dara Flow mode, IO1 = Frame control mode

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Low Power Modes

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Different Power Mode On EMW3280

	Standby mode	Stop mode (Under develop)	IEEE power save mode	Full Power Up
Fast boot	80uA	1-5mA	40-65mA	185mA-220mA
Entry	Asserted low on nWakeup pin	EMSP cmd (Plan): EMSP_CMD_STOP	EMSP cmd: EMSP_CMD_SET_PS_MODE	Disable any low power mode
Exit	Deasserted on nWakeup pin	Any UART data	EMSP cmd: EMSP_CMD_SET_PS_MODE	Into any low power mode
Wakeup Time	750ms	<20ms	<10us, managed by IEEE PS standard	
Usage	Lowest power	Low power, but fast recover	Keep network connection	Real time response
Limitation			Only in AP client mode	

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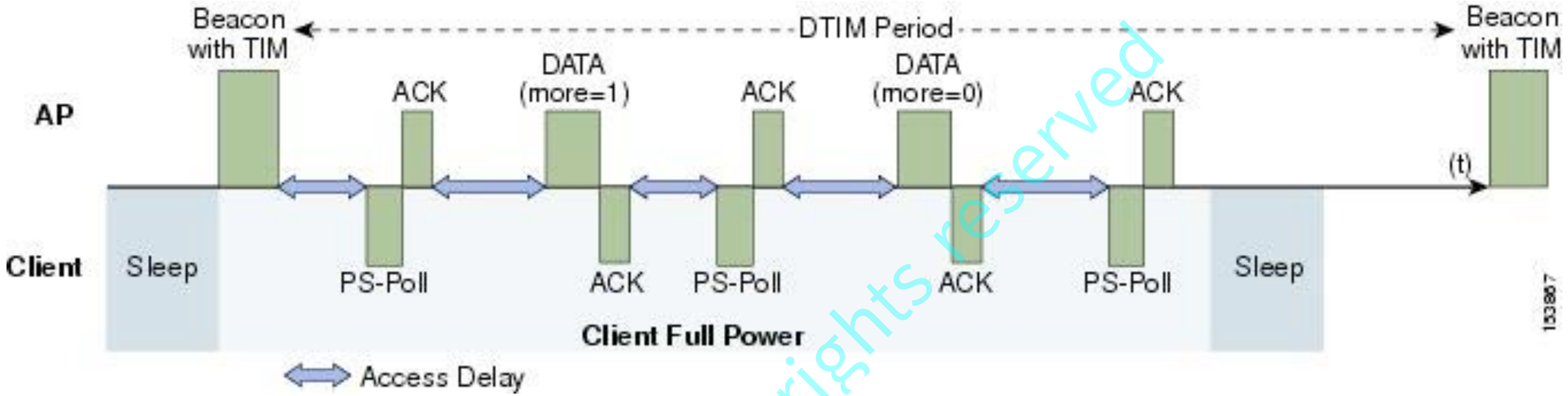
IEEE PS mode: Principle



Power saving basics

To assist stations with power saving, Access Points (APs) are designed to buffer frames for a station when that station is in power save mode and to transmit them later to the station when the AP knows the station will listen. When a station is in power save mode, it turns off its transmitter and receiver to preserve energy. It takes less power for a station to turn its receiver on to listen to frames than to turn it its transmitter on to transmit frames.

Target Beacon Transmission Time Time (TBTT) and beacon interval

The TIM information element

Delivery Traffic Indication Map (DTIM), DTIM period(DTIM=1 beacon interval in current case)

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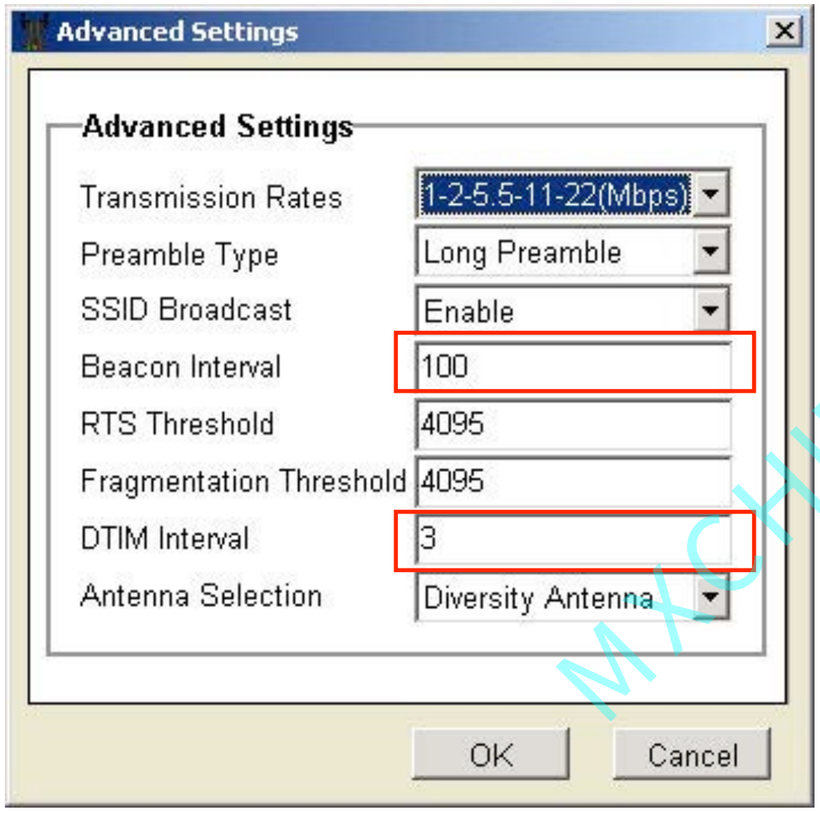
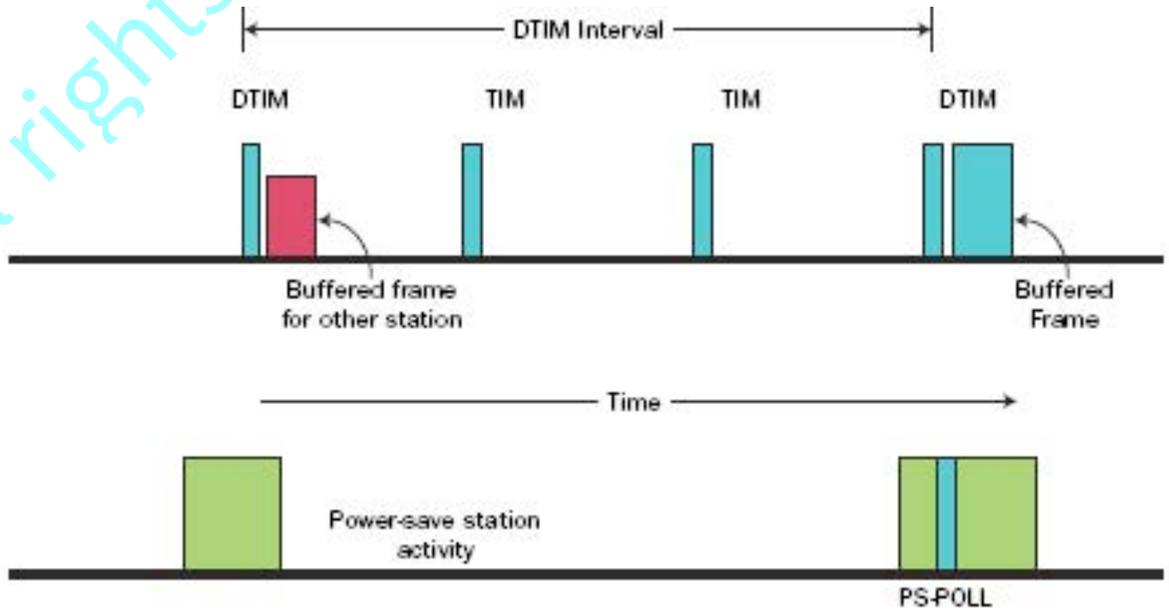
IEEE PS mode: Settings on AP

Beacon interval and Delivery Traffic Indication Map (DTIM)

Wi-Fi module would wake up every DTIM x Beacon Interval

Save more power if the wake up interval is longer, but device would suffer more network latency





Example:Wake up interval = 100x3 = 300ms

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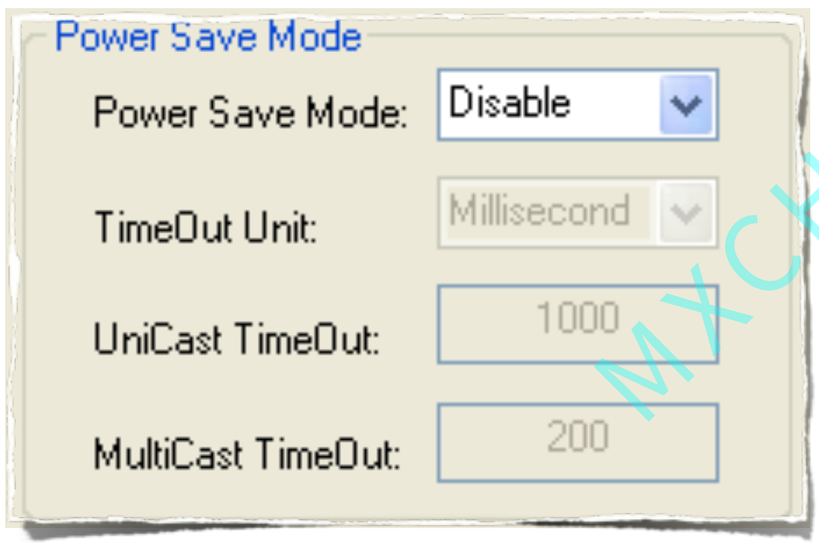
IEEE PS mode: Settings on EMW module

Power Save Mode: Enable or disable IEEE power save mode

Remain wakeup after receive data:

- **Timeout Unit:** Beacon Interval or Millisecond
- **UniCast Timeout:** Remain Nx(Timeout unit) after receive unicast data
- **MultiCast Timeout:** Remain Nx(Timeout unit) after receive multicast or broadcast data



Network delay is reduced after module receive the first data. Network performance is better in discontinuous data reception mode but more power is consumed.

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Manage TCP Connections

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Read TCP connection status

TCP connection can guarantee a successful data transmission, TCP status info is very useful for terminal device.

EMSP_CMD_GET_STATUS

This command is used for reading the network state.

The host sends request: 08 00 0A 00 00 00 ED FF FF FF

The module returns response: 08 00 0E 00 01 00 E8 FF XX XX YY YY ZZ ZZ

<command>: 0x0008

<length>: 0x000E

<result>: 0x00001, success!

<head_checksum>: 0x FFE8

<data>: 0x000X000Y. X presents TCP state: X=1 presents TCP is listening and X=2 presents TCP is connected; Y presents WiFi state: Y=5 presents Wi-Fi is startup (maybe not connected) and Y=0 presents Wi-Fi is stopped.

<data_checksum>: 0xZZZZ, calculated from <data>

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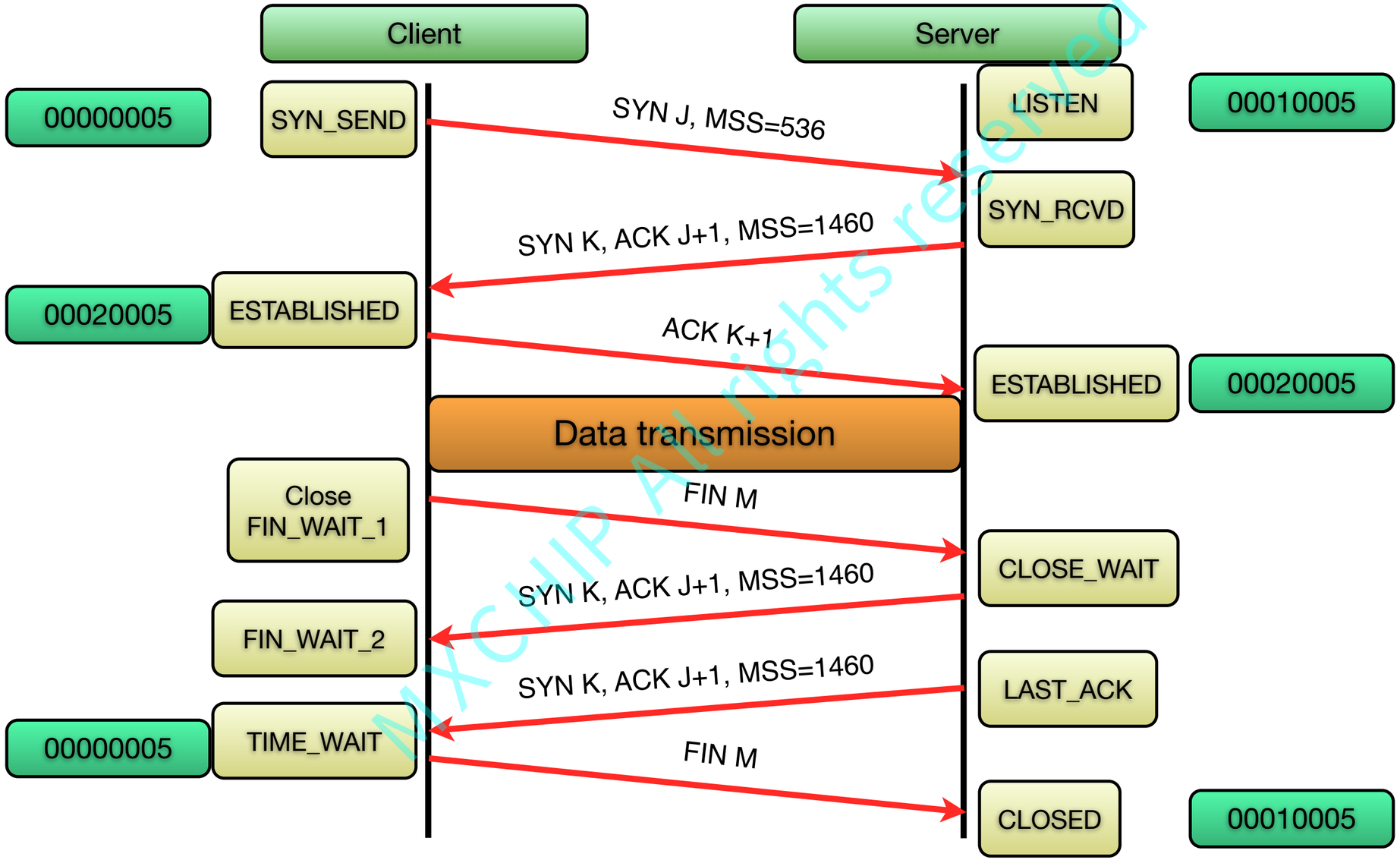
Setup And Close TCP Connection



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TCP Connection Maintenance

- Unexpected power down on TCP server/client
- Network disconnection
- Failed on network devices(Gateway, Router...)
- Uncompleted TCP close procedure

.....

TCP data transmission would be failed under above circumstances, so device should release any resource used by this TCP, mark it as closed and try to establish a new one.

Detection method:

A Failed TCP data transmission(No ACK is received after data transmission)**:** for fast detect while data is transmitting

Keep-Alive message(A simulated data transmission)**:** used while no data is transmitting on TCP conn.

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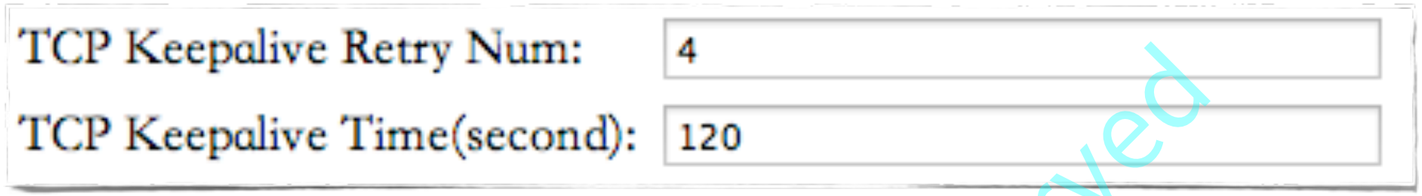
TCP Maintenance Settings On Module



- **TCP Transmit Timeout:** Wait a period time before mark the TCP as disconnected if no ACK is received.
- **TCP Keepalive Retry Num:** Number of failed TCP keepalive packages before mark the TCP as disconnected.
- **TCP Keepalive Interval Time:** Time interval between two TCP keepalive packages.

Time needed to detect a broken TCP using TCP keepalive:

- **Min:** TCP Keepalive Retry Num x TCP Keepalive Interval Time
- **Max:** (TCP Keepalive Retry Num +1) x TCP Keepalive Interval Time

Time needed to detect a broken TCP using data transition timeout:

- min(TCP Keepalive Retry Num x TCP Keepalive Interval Time, 120s)

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Others

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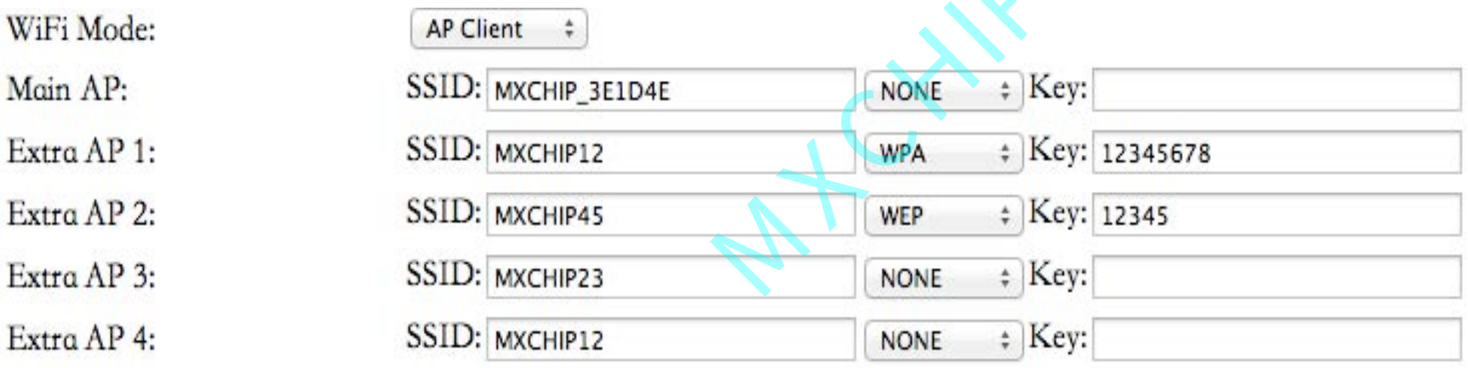
Multiple AP roaming

This function is only used in AP client mode and dual mode.

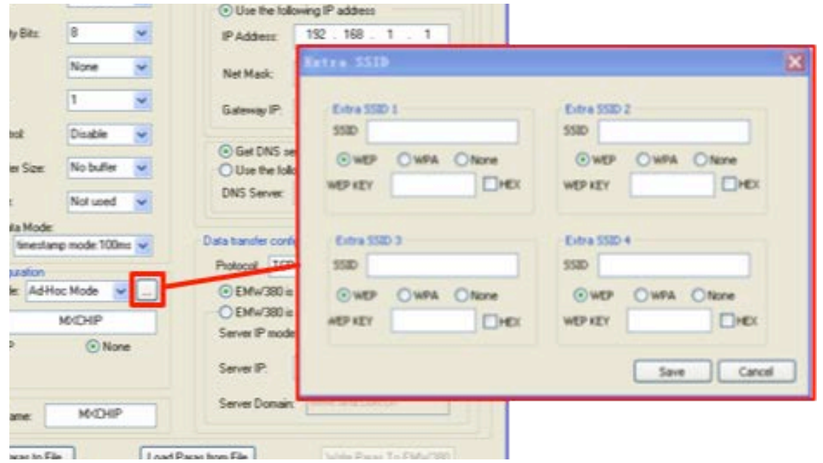
Module try to connect another AP listed in Main AP and extra AP list after current connection is lost.

- Priory: Main AP>Extra AP 1>Extra AP 2>Extra AP 3>Extra AP 4
- If serval APs share the same SSID name and security settings, treat them as one.

Use EMW Tool Box



Use EMW Tool Box



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Dual Mode

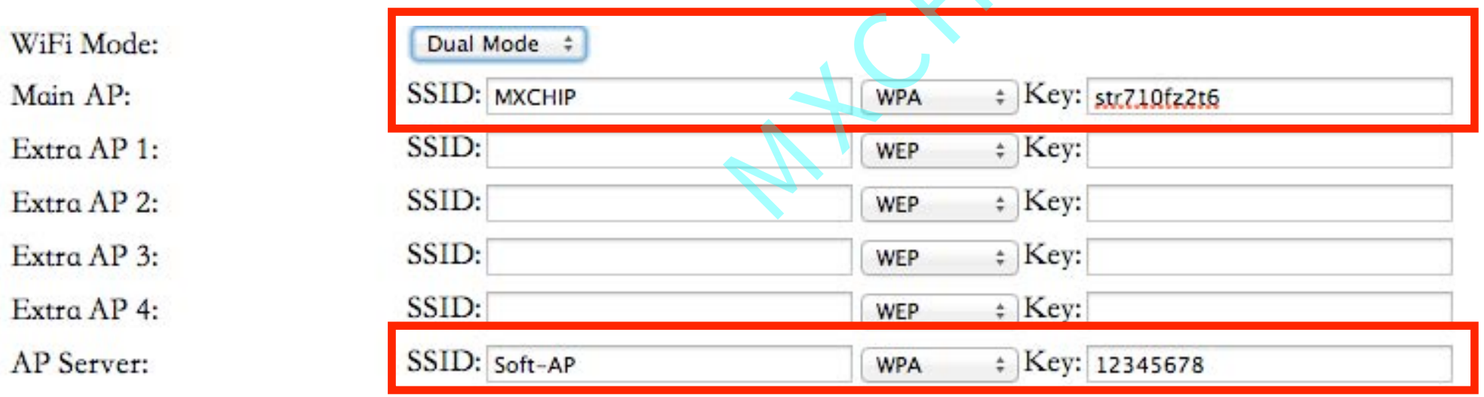
In dual mode, module establish a soft AP while in AP client mode.

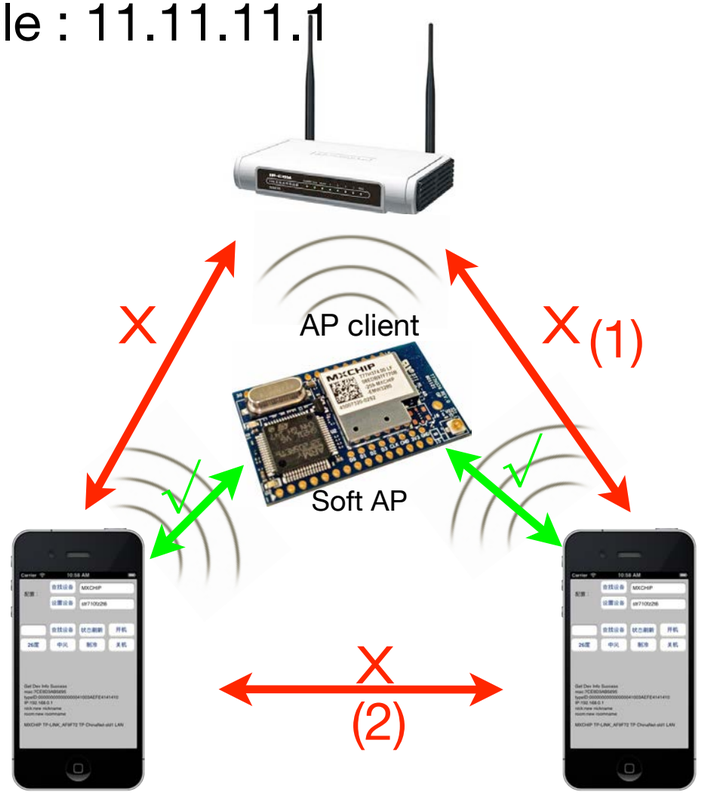
Limitation

- Soft AP conn. is only used for direct communicate with module, no router function provided between soft AP and AP client (1).
- Communication between clients under soft AP is forbidden (2).
- Module's IP address in Dual mode Soft AP is unchangeable : 11.11.11.1
- IEEE power save mode can not be used

Usage

- Provide a always-on connection to config EMW module
- Provide a always-on connection for local remote control





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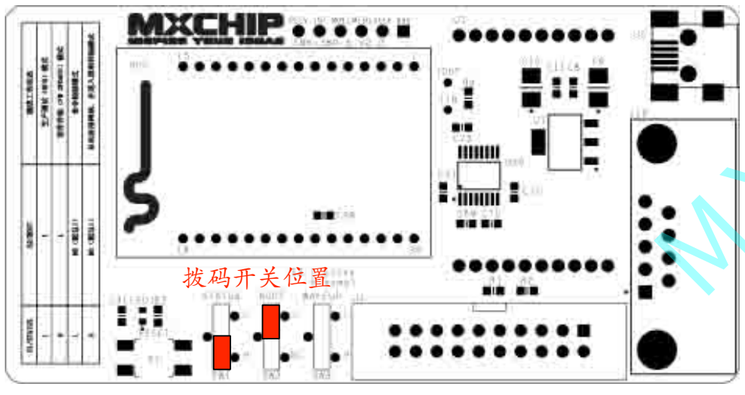
Firmware Update Mode

BOOT	STATUS	模块工作状态
0	0	MFG mode
0	1（Default）	Firmware update mode
1（Default）	0	EMSP command mode
1（Default）	1（Default）	DTU mode

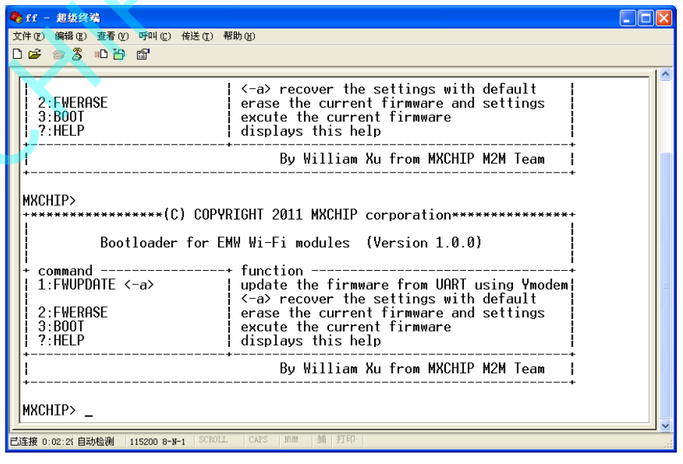
Firmware update over UART

Refer AN0002 for details. Update from web page will be released in Dec. 2012

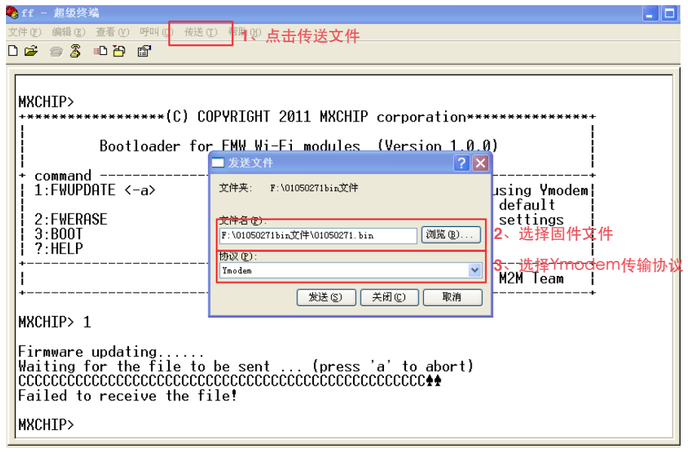
Boot module to FW update mode



UART para.: 115200/8/n/1, open update command interface with COM tools.



Input”1”, and send the bin file with Ymodem



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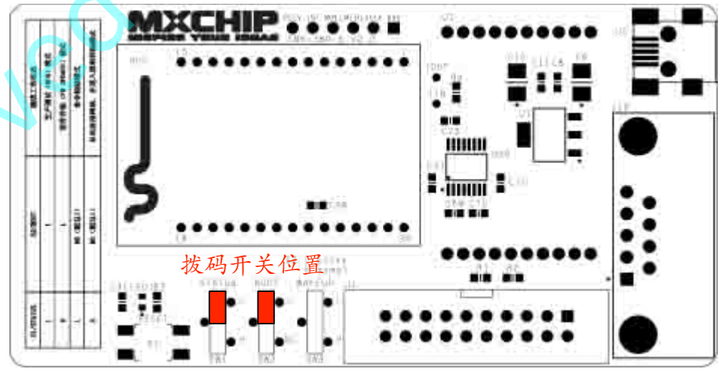
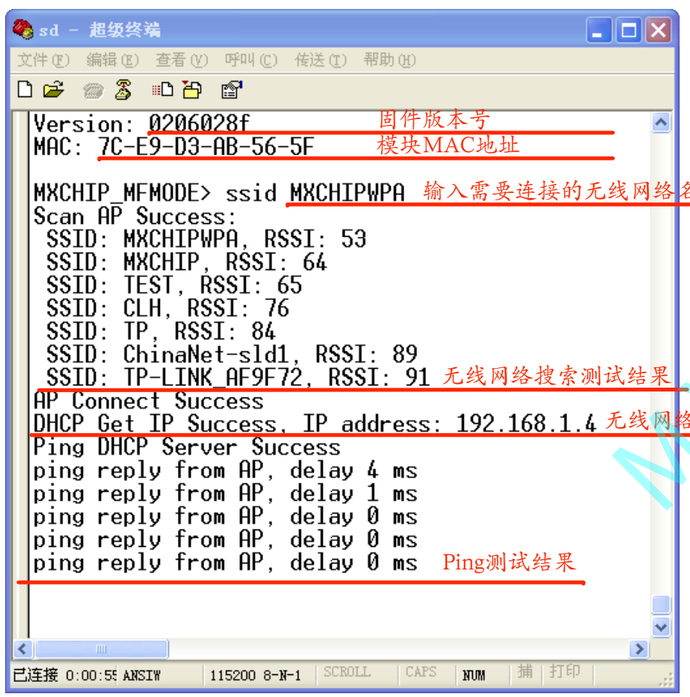
MFG mode

- Output firmware version
- Output module's MAC address
- Search AP and display AP's signal strength
- Connect a predefined AP
- DHCP test and ping AP
- Optional TCP/UDP test(define the remote device's address before test)

Boot module to FWG mode



Input test AP's SSID to start test



Extra test function on TCP/UDP data transmission

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THE END

Make wireless connections
Simple

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Thank you!