

# EC2x Wi-Fi

# Application Note

**LTE Module Series**

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# About the Document

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Revision	Date	Author	Description
1.0	2017-12-20	Duke XIN/ Adolph WANG	Initial

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# 1 4G+Wi-Fi Solution

## 1.1. Introduction

The rapid development of LTE and IoT (Internet of Thing) accelerates the integration of 4G and Wi-Fi technology, many companies turn to convert the operator's 4G signals to Wi-Fi signals so that the smartphone, tablet and laptop users can enjoy free Wi-Fi access to share local resources and communicate with several terminals via high-speed network.

Therefore, Quectel provides a 4G+Wi-Fi one-stop solution based on its own EC2x<sup>1)</sup> LTE wireless modules and FC20 Wi-Fi module. This solution is realized through converting 4G signals into Wi-Fi signals to create Wi-Fi hotspots.

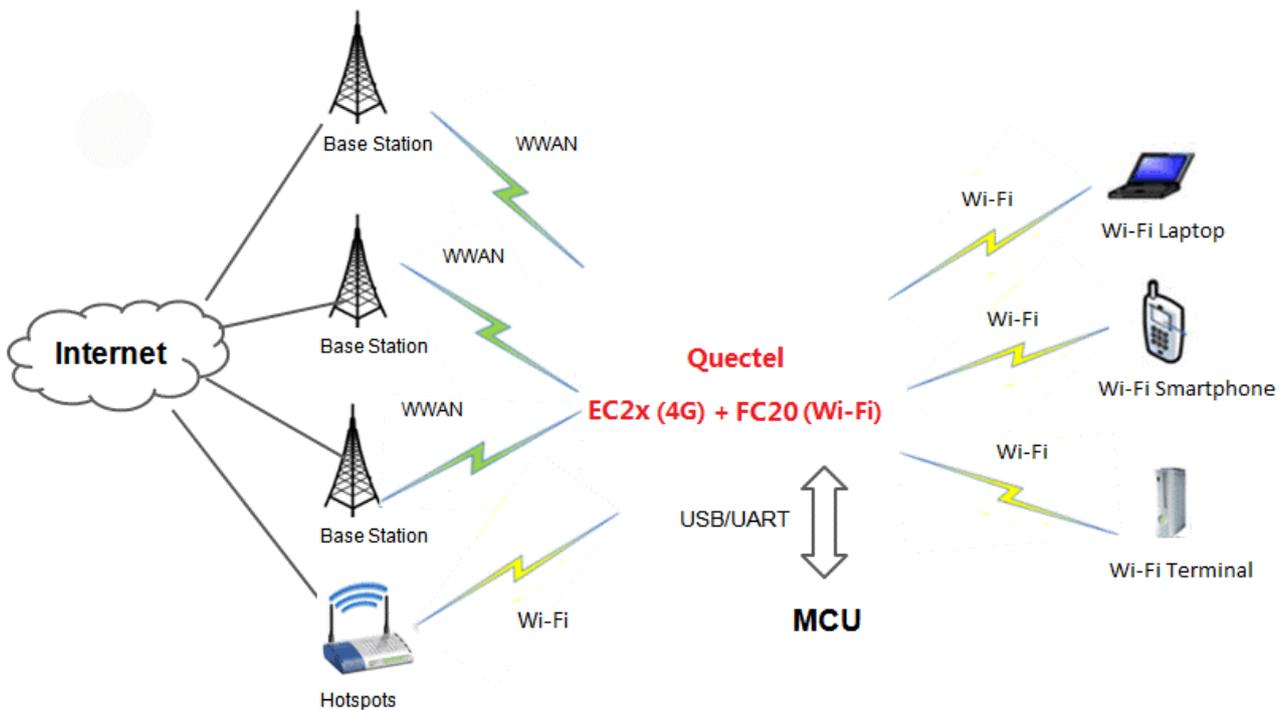


Figure 1: Software Workflow 4G+Wi-Fi One-stop Solution

1. Client and MCU can access to 4G network through EC2x modules at the same time.
2. MCU can control Wi-Fi connection by AT commands.
3. FC20 Wi-Fi module supports AP mode and STA\* mode, when there are other Wi-Fi hotspots around, network data can be uploaded to the Internet through other Wi-Fi hotspots to save data traffic.
4. EC2x LTE modules support various connections such as USB and UART.
5. The maximum access point is 16.

## NOTES

1. <sup>1)</sup> EC2x includes Quectel EC25, EC21, EC20 R2.0 and EC20 R2.1 modules.
2. “\*” means under development.

## 1.2. FC20 Features

Table 1: FC20 Features

<b>Dimensions</b>	(16.6±0.15)mm × (13.0±0.15)mm × (2.1±0.2)mm
<b>Package</b>	LCC
<b>Frequency</b>	WLAN-2.4GHZ: 2.412GHz ~ 2.484GHz WLAN-5GHZ: 4.9GHZ ~ 5.925GHz BT*: 2.402GHz ~ 2.48GHz
<b>The Number of Pins</b>	62
<b>Supply Voltage</b>	Main: 3.3V IO: 1.8V
<b>WLAN Interface</b>	SDIO 3.0
<b>WLAN Standard</b>	802.11a/b/g/n/ac
<b>Antenna</b>	Wi-Fi & BT antenna
<b>Transmission Data</b>	433Mbps @802.11ac 150Mbps @802.11n 54Mbps @802.11a/g 11Mbps @802.11b 24Mbps @BT 4.1*
<b>AP</b>	Maximally 16

Operation Temperature -40°C ~ +85°C

**NOTE**

“\*” means under development.

### 1.3. Wi-Fi Solution Architecture

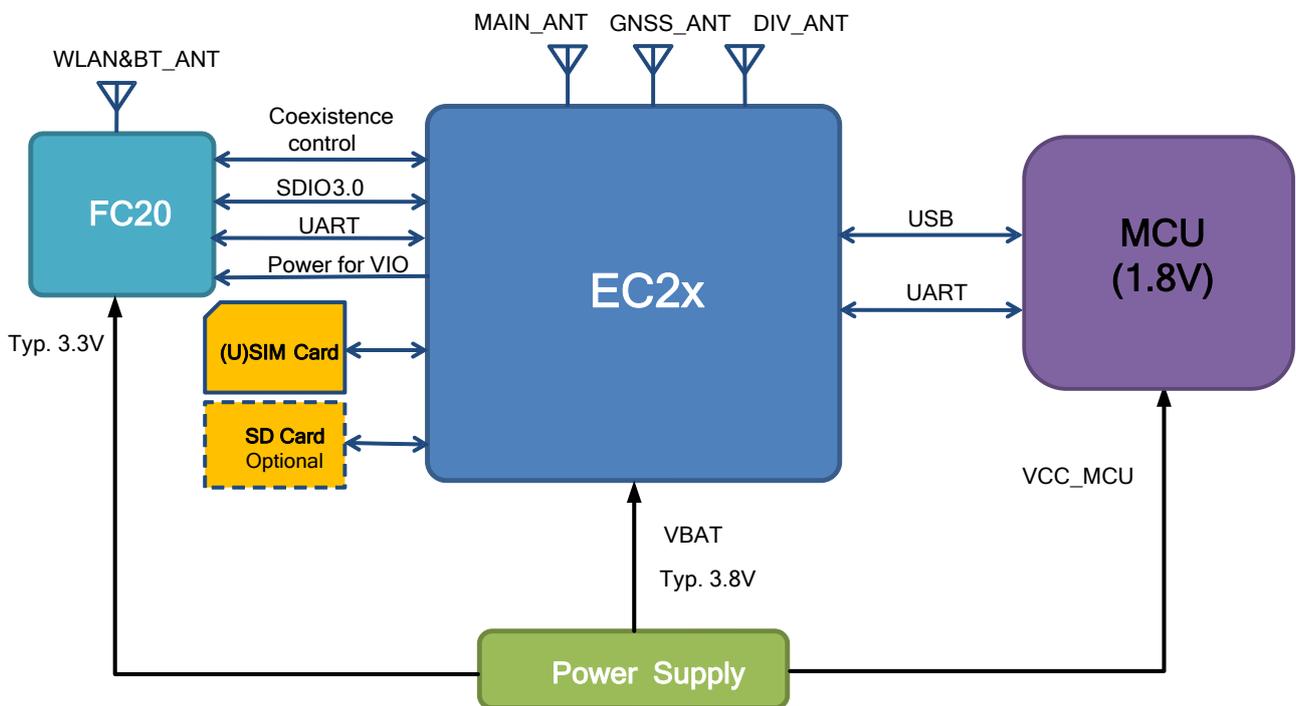


Figure 2: Wi-Fi Solution Architecture

1. EC2x modules communicate with FC20 through SDIO 3.0 interface, with maximum data rate up to 200Mb/s.
2. The communication between MCU and EC2x modules can be realized through USB or UART.
3. EC2x module can output GNSS information via USB NEMA port.
4. If the MCU voltage level is not 1.8V, then a voltage level translation circuit should be added between the module and the MCU.

## 2 Wi-Fi Related AT Commands

The following table lists the Wi-Fi related AT commands.

**Table 2: Wi-Fi Related AT Commands**

AT Commands	Description
AT+QWIFI	Enable/Disable Wi-Fi Function
AT+QWSSIDHEX	Set SSID Encoding
AT+QWSSID	Set SSID
AT+QWBCAST	Enable/Disable Broadcast
AT+QWAUTH	Set Authorization Type, Encryption Mode and Password
AT+QWMOCH	Frequency Mode and Channel Selection for 802.11 Network
AT+QWISO	Enable/Disable Isolation
AT+QWCLICNT	Query the Number of Wi-Fi Clients
AT+QWRSTD	Restore Default Settings

### 2.1. AT+QWIFI Enable/Disable Wi-Fi Function

This command is used to enable or disable Wi-Fi function.

#### AT+QWIFI Enable/Disable Wi-Fi Function

Test Command <b>AT+QWIFI=?</b>	Response <b>+QWIFI: &lt;value&gt;</b>
	<b>OK</b>
Read Command <b>AT+QWIFI?</b>	Response <b>+QWIFI: &lt;value&gt;</b>

	OK
Write Command <b>AT+QWIFI=&lt;value&gt;</b>	Response OK Or ERROR

### Parameter

<b>&lt;value&gt;</b>	The current state of Wi-Fi
0	Wi-Fi is disabled
1	Wi-Fi is enabled

### Example

```

AT+QWIFI?
+QWIFI: 0 //The Wi-Fi is currently disabled

OK
AT+QWIFI=1 //Enable Wi-Fi function
OK
    
```

## 2.2. AT+QWSSIDHEX Set SSID Encoding

This command is used to set the SSID (Service Set Identifier) encoding.

### AT+QWSSIDHEX Set SSID Encoding

Test Command <b>AT+QWSSIDHEX=?</b>	Response <b>+QWSSIDHEX: (0,1)</b>  OK
Read Command <b>AT+QWSSIDHEX?</b>	Response <b>+QWSSIDHEX: &lt;encode&gt;</b> OK
Write Command <b>AT+QWSSIDHEX=&lt;enable&gt;</b>	Response OK Or ERROR

## Parameter

<b>&lt;encode&gt;</b>	Set whether the <ssid> parameter of AT+QWSSID command is HEX number or not. <ssid> is saved separately.
<u>0</u>	Parameter of AT+QWSSID command is a string
1	Parameter of AT+QWSSID command is HEX number

## Example

```

AT+QWSSIDHEX?
+QWSSIDHEX: 0 //The current SSID is the string

AT+QWSSID?
+QWSSID: QSoftAP //The current SSID is QSoftAP

OK
AT+QWSSIDHEX=1 //Set SSID to HEX number
OK
AT+QWSSID?
+QWSSID: 5175656374656c2d57494649 //The current SSID is Quectel-WIFI for the ASCII encoding

OK

```

## 2.3. AT+QWSSID Set SSID

This command is used to set Wi-Fi SSID.

### AT+QWSSID Set SSID

Test Command <b>AT+QWSSID=?</b>	Response <b>+QWSSID: &lt;ssid&gt;</b>  <b>OK</b>
Read Command <b>AT+QWSSID?</b>	Response <b>+QWSSID: &lt;ssid&gt;</b>  <b>OK</b>
Write Command <b>AT+QWSSID=&lt;ssid&gt;</b>	Response <b>OK</b> Or <b>ERROR</b>

## Parameter

<b>&lt;ssid&gt;</b>	When AT+QWSSIDHEX=0: ASCII string with length ≤ 32 bytes, and the default value is QSoftAP. When the AT+QWSSIDHEX=1: HEX digits. The length of raw data ≤ 32 bytes after coding (such as GBK, UTF-8, etc.). This is mainly used to set SSID in Chinese.
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## Example

```

AT+QWSSIDHEX?
+QWSSIDHEX: 0

OK
AT+QWSSID?
+QWSSID: QSoftAP           //The current SSID is QSoftAP
OK
AT+QWSSID=EC25_WIFI       //Set new SSID to EC25_WIFI
OK
    
```

## 2.4. AT+QWBCAST Enable/Disable Broadcast

This command is used to enable or disable the broadcast.

### AT+QWBCAST Enable/Disable Broadcast

Test Command <b>AT+QWBCAST=?</b>	Response <b>+QWBCAST: (0,1)</b>  <b>OK</b>
Read Command <b>AT+QWBCAST?</b>	Response <b>+QWBCAST: &lt;broadcast&gt;</b>  <b>OK</b>
Write Command <b>AT+QWBCAST=&lt;broadcast&gt;</b>	Response <b>OK</b> Or <b>ERROR</b>

## Parameter

<b>&lt;broadcast&gt;</b>	Enable or disable broadcast
0	Disable broadcast
1	Enable broadcast

## Example

```

AT+QWBCAST?
+QWBCAST: 1 //The broadcast is enabled

OK
AT+QWBCAST=0 //Disable broadcast
OK
    
```

## 2.5. AT+QWAUTH Set Authorization Type, Encryption Mode and Password

This command is used to set network authorization type, encryption mode and password.

### AT+QWAUTH Set Authorization Type, Encryption Mode and Password

Test Command <b>AT+QWAUTH=?</b>	Response <b>+QWAUTH: &lt;auth&gt;</b>  <b>OK</b>
Read Command <b>AT+QWAUTH?</b>	Response <b>+QWAUTH:</b> <b>&lt;auth&gt;,&lt;encrypt&gt;[,&lt;passwordindex&gt;][,&lt;password1&gt;][,&lt;password2&gt;,&lt;password3&gt;,&lt;password4&gt;]</b>  <b>OK</b>
Write Command <b>AT+QWAUTH=</b> <b>&lt;auth&gt;,&lt;encrypt&gt;[,&lt;passwordindex&gt;]</b> <b>[,&lt;password1&gt;][,&lt;password2&gt;,&lt;password3&gt;,&lt;password4&gt;]</b>	Response <b>OK</b> Or <b>ERROR</b>

## Parameter

<b>&lt;auth&gt;</b>	Authorization type
0	Open/shared
1	Open
2	Shared
3	WPA
4	WPA2
5	WPA/WPA2
<b>&lt;encrypt&gt;</b>	Encryption mode
0	No encryption
1	WEP
2	TKIP
3	AES
4	TKIP-AES
<b>&lt;passwordindex&gt;</b>	Password string
<b>&lt;password1&gt;</b>	Password string
<b>&lt;password2&gt;</b>	Password string
<b>&lt;password3&gt;</b>	Password string
<b>&lt;password4&gt;</b>	Password string

### NOTE

The default network authorization mode is WPA2, encryption mode is AES and password is 1234567890. The setting of these parameters should comply with the following criteria:

1. If <auth> is 0 or 1, <encrypt> must be 0 or 1.
2. If <auth> is 2, <encrypt> must be 1.
3. If <auth> ≥ 3, <encrypt> must ≥ 2.
4. If <encrypt>=0, <passwordindex>, <password1>, <password2>, <password3>, <password4> are all null.
5. If <encrypt> =1:
  - 1)  $1 \leq \text{<passwordindex>} \leq 4$ ;
  - 2) <passwordindex>=1, <password1> must be in password format, <password2>, <password3>, <password4> can be set to "";
  - 3) Password format: 5 or 13 ASCII characters, 10 or 26 HEX number and ASCII characters need to add "".
6. If <encrypt> ≥2:
  - 1) <passwordindex> cannot be set.
  - 2) <password2>, <password3>, <password4> cannot be set.
  - 3) <password1> needs 8-63 ASCII characters or 64 HEX number and ASCII characters need to add "".

## Example

```

AT+QWAUTH?
+QWAUTH: 0,1,1,"11111","22222","33333","44444"

OK
AT+QWAUTH?
+QWAUTH: 5,4,"12345678"

OK
AT+QWAUTH=0,0 //Set authorization type as open/shared and encryption
                mode as null
OK
AT+QWAUTH=0,1,1,"11111","22222","","" //Set authorization type as open/shared and encryption
                mode as WEP
OK
AT+QWAUTH=2,1,2,"11111","22222","","" //Set authorization type as shared and encryption
                mode as WEP
OK
AT+QWAUTH=5,4,"12345678" //Set authorization type as WPA/WPA2 and encryption
                mode as TIKP-AES
OK
    
```

## 2.6. AT+QWMOCH Frequency Mode and Channel Selection for 802.11

### Network

This command is used to set the frequency mode and channel of 802.11 network.

#### AT+QWMOCH Frequency Mode and Channel Selection for 802.11 Network

Test Command AT+QWMOCH=?	Response +QWMOCH: (1-15),(0-13,36,40,44,48,52,56,60,64,149,153,157,161,165),( 0-19)  OK
Read Command AT+QWMOCH?	Response +QWMOCH: <mode>,<channel>  OK
Write Command AT+QWMOCH=<mode>,<channel>	Response OK

Or  
**ERROR**

## Parameter

<mode>	802.11 network frequency mode		
1	a/n		5G HT20 mode
2	b		2.4G mode
3	b/g		2.4G mode
4	b/g/n		2.4G mode
5	b/g/n		5G HT40 mode
6	a/n		5G HT40 mode
7	a		5G mode
8	g		5G mode
9	a/n		5G HT20 mode
10	ac		5G VHT40 mode
11	ac		5G VHT80 mode
12	n		2.4G HT20 mode
13	n		2.4G HT40 mode
14	n		5G HT20 mode
15	n		5G HT40 mode
<channel>	Channel selection		
0			Automatic selection
1-13			2.4G channel
36/40/44/48/52/56/60/64/149/153/157/161/165			5G channel (currently not supported)

### NOTE

<mode> and <channel> should meet the following requirements:

1. If <mode> is 1/6/7/9/10/11/14/15, <channel> must be set to 0 or 36/40/44/48/52/56/60/64/149/153/157/161/165.
2. If <mode> is 2/3/4/5/8/12/13, <channel> can be set to 0-13.
3. If <mode> is 1/6/7/9/10/11/14/15, the client device must support 5G mode.

### Example

```

AT+QWMOCH?
+QWMOCH: 4,0 //Current frequency mode is 2.4G b/g/n, automatically select channel

OK
AT+QWMOCH=3,1 //Set frequency mode to 2.4G b/g, channel 1
OK
    
```

## 2.7. AT+QWISO Enable/Disable Isolation

This command is used to enable or disable isolation.

### AT+QWISO Enable/Disable Isolation

Test Command <b>AT+QWISO=?</b>	Response <b>+QWISO: (0,1)</b>  <b>OK</b>
Read Command <b>AT+QWISO?</b>	Response <b>+QWISO: &lt;isolation&gt;</b>  <b>OK</b>
Write Command <b>AT+QWISO=&lt;isolation&gt;</b>	Response <b>OK</b> Or <b>ERROR</b>

### Parameter

<b>&lt;isolation&gt;</b>	Isolation status
0	Disabled
1	Enabled

### Example

```

AT+QWISO?
+QWISO: 0           //Currently isolation is disabled

OK
AT+QWISO=1         //Enable isolation

OK
    
```

## 2.8. AT+QWCLICNT Query the Number of Wi-Fi Clients

This command is used to query the number of clients connected to AP.

### AT+QWCLICNT Query the Number of Wi-Fi Clients

Read Command <b>AT+QWCLICNT?</b>	Response <b>+QWCLICNT: &lt;count&gt;</b>
-------------------------------------	---------------------------------------------

OK

### Parameter

<count>                      Number of clients connected to AP

### Example

```
AT+QWCLICNT?
+QWCLICNT: 2                      //Currently 2 clients are connected to AP
OK
```

## 2.9. AT+QWRSTD    Restore Default Settings

This command is used to restore Wi-Fi to default settings.

### AT+QWRSTD    Restore Default Settings

Write Command	Response
AT+QWRSTD	OK

### Example

```
AT+QWRSTD                      //Restore Wi-Fi to default settings
OK
```

# 3 Wi-Fi Related URC

## 3.1. +QWIFIND URC of Client Connection Status

After Wi-Fi is enabled (AT+QWIFI=1), if a client is connected or disconnected to AP, the URC will be reported to indicate the client's MAC address.

### +QWIFIND URC of Client Connection Status

+QWIFIND: <connect>,<mac>

#### Parameter

<connect>	Client connection/disconnection status 0 Client is disconnected to AP 1 Client is connected to AP
<mac>	MAC address of the client. Format: HEX number, such as: "0A:0B:0C:0D:0E:0F"

#### Example

```
+QWIFIND: 1,"0A:0B:0C:0D:0E:0F" //The client of which MAC address is "0A:0B:0C:0D:0E:0F" has
                                been connected to AP
+QWIFIND: 0,"0A:0B:0C:0D:0E:0F" //The client of which MAC address is "0A:0B:0C:0D:0E:0F" has
                                been disconnected
```