AG35 Wi-Fi

Application Note

LTE Module Series

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About the Document

History

Revision	Date	Author	Description
1.0	2018-01-19	Mike ZHOU/Yironny HE	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 technologies. Many companies turn to convert the operator's 4G signals into Wi-Fi signals so that the smartphone, PAD 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 automotive grade AG35 LTE wireless module and AF20 Wi-Fi module. This solution is realized through converting 4G signals into Wi-Fi signals to create Wi-Fi hotspots.

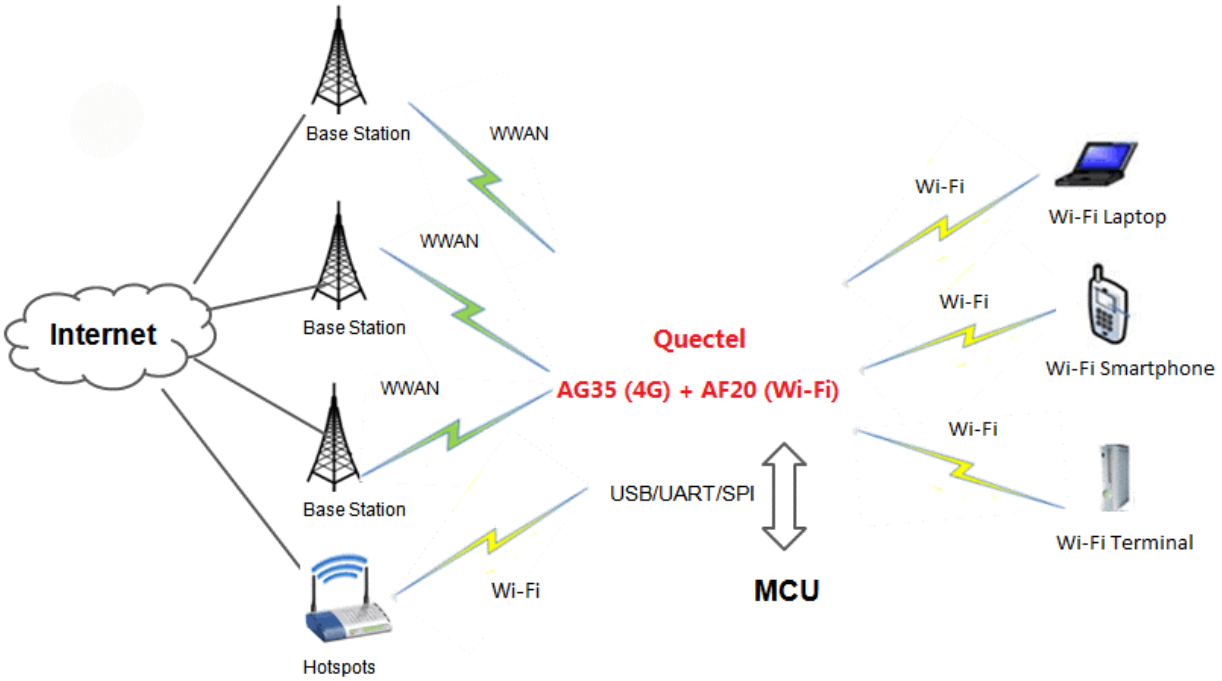

Figure 1: Software Workflow for 4G+Wi-Fi One-stop Solution

1. Client and MCU can access to 4G network through AG35 at the same time.
2. MCU can control Wi-Fi connection by AT commands.
3. AF20 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. AG35 LTE module supports various connections such as USB, UART and SPI.
5. The maximum access point is 16.

NOTE

"*" means under development.

1.2. AF20 Features

Table 1: AF20 Features

Dimensions	(17.2±0.15)mm × (15.2±0.15)mm × (2.26±0.2)mm
Package	LGA
Frequency	2.402GHz~2.482GHz (2.4G) 5.17GHz~5.915GHz (5G)
Power Supply	Main supply voltage: 3.3V I/O supply voltage: 1.8V
WLAN Interface	SDIO 3.0
BT Interface	UART and PCM
Antenna Interface	Wi-Fi & BT antenna, 50Ω
WLAN Standard	802.11a/b/g/n/ac
Transmission Data	802.11b: 1, 2, 5.5, 11Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: 6.5, 13, 19.5, 26, 39, 52, 58.5, 65Mbps 802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11ac: VHT20 (MCS0-8), VHT40 (MCS0-9), VHT80 (MCS0-9)
AP	Maximally 16
Operation Temperature	-40°C ~ +85°C

1.3. Wi-Fi Solution Architecture

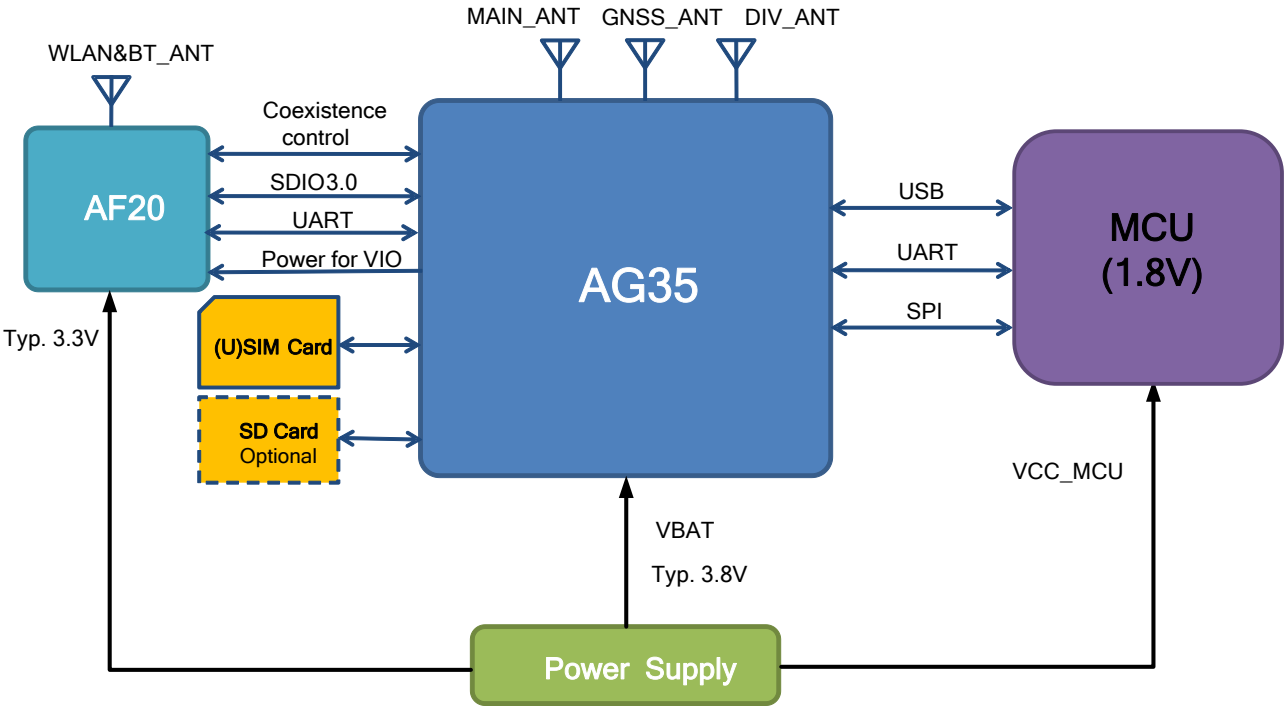

Figure 2: Wi-Fi Solution Architecture

1. AG35 communicates with AF20 through SDIO 3.0 interface, with maximum data rate up to 200Mb/s.
2. The communication between MCU and AG35 module can be realized through USB, UART or SPI.
3. AG35 module can output GNSS information via USB 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 to 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 **AT+QWIFI=?**	Response **+QWIFI: <value>** **OK**
Read Command **AT+QWIFI?**	Response **+QWIFI: <value>**

	OK
Write Command **AT+QWIFI=<value>**	Response **OK** If there is any error: **ERROR**

Parameter

<value>	The current status of Wi-Fi	
	0	Wi-Fi is disabled
	1	Wi-Fi is enabled

Example

```
AT+QWIFI?
+QWIFI: 0                    //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 **AT+QWSSIDHEX=?**	Response **+QWSSIDHEX: (0,1)** **OK**
Read Command **AT+QWSSIDHEX?**	Response **+QWSSIDHEX: <encode>** **OK**
Write Command **AT+QWSSIDHEX=<enable>**	Response **OK** If there is any error: **ERROR**

Parameter

<encode>	Set whether the <ssid> parameter of AT+QWSSID command is HEX number or not. <ssid> is saved separately. 0 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 a 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 **AT+QWSSID=?**	Response **+QWSSID: <ssid>** **OK**
Read Command **AT+QWSSID?**	Response **+QWSSID: <ssid>** **OK**
Write Command **AT+QWSSID=<ssid>**	Response **OK** If there is any error: **ERROR**

Parameter

<ssid>	When AT+QWSSIDHEX=0: ASCII string with length ≤ 32 bytes, and the default value is QSoftAP. When 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.

Example

```
AT+QWSSIDHEX?
+QWSSIDHEX: 0

OK
AT+QWSSID?
+QWSSID: QSoftAP              //The current SSID is QSoftAP
OK
AT+QWSSID=AG35_WIFI           //Set new SSID to AG35_WIFI
OK
```

2.4. AT+QWBCAST Enable/Disable Broadcast

This command is used to enable or disable broadcast.

AT+QWBCAST Enable/Disable Broadcast	
Test Command **AT+QWBCAST=?**	Response **+QWBCAST: (0,1)** **OK**
Read Command **AT+QWBCAST?**	Response **+QWBCAST: <broadcast>** **OK**
Write Command **AT+QWBCAST=<broadcast>**	Response **OK** If there is any error: **ERROR**

Parameter

<broadcast>	Enable/disable broadcast
	0 Disable broadcast
	1 Enable broadcast

Example

```
AT+QWBCAST?
+QWBCAST: 1                    //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 **AT+QWAUTH=?**	Response **+QWAUTH: <auth>** **OK**
Read Command **AT+QWAUTH?**	Response **+QWAUTH: <auth>,<encrypt>[,<passwordindex>][,<password1>][,<password2>,<password3>,<password4>]** **OK**
Write Command **AT+QWAUTH= <auth>,<encrypt>[,<passwordindex>][,<password1>][,<password2>,<password3>,<password4>]**	Response **OK** If there is any error: **ERROR**

Parameter

<auth>	Authorization type 0 Open/shared 1 Open 2 Shared 3 WPA Personal 4 WPA2 Personal 5 WPA/WPA2 Personal
<encrypt>	Encryption mode 0 No encryption 1 WEP 2 TKIP 3 AES 4 TKIP-AES
<passwordindex>	Password string
<password1>	Password string
<password2>	Password string
<password3>	Password string
<password4>	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 ≤ <passwordindex> ≤4
   2) <passwordindex>=1, <password1> must be in password format while <password2>, <password3>, <password4> can be set to ""
   3) Password format: 5 or 13 ASCII characters,10 or 26 HEX numbers 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 numbers 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**

	If there is any error: **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 selected channel

OK
AT+QWMOCH=3,1         //Set the 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 **AT+QWISO=?**	Response **+QWISO: (0,1)** **OK**
Read Command **AT+QWISO?**	Response **+QWISO: <isolation>** **OK**
Write Command **AT+QWISO=<isolation>**	Response **OK** If there is any error: **ERROR**

Parameter

<isolation>	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 **AT+QWCLICNT?**	Response **+QWCLICNT: <count>** **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 to Default Settings

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

AT+QWRSTD Restore to Default Settings	
Execution Command **AT+QWRSTD**	Response **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
```

4 Appendix A References

Table 3: Related Documents

SN	Document Name	Remark
[1]	Quectel_AG35_Hardware_Design	AG35 Hardware Design
[2]	Quectel_AF20_Hardware_Design	AF20 Hardware Design

Table 4: Terms and Abbreviations

Abbreviation	Description
AES	Advanced Encryption Standard
AP	Access Point
ASCII	American Standard Code for Information Interchange
GNSS	Global Navigation Satellite System
I/O	Input/Output
LGA	Land Grid Array
LTE	Long Term Evolution
MAC	Media Access Control
MCU	Microprogrammed Control Unit
SDIO	Secure Digital Input Output
SPI	Serial Peripheral Interface
STA	Station
SSID	Service Set Identifier

TKIP	Temporal Key Integrity Protocol
UART	Universal Asynchronous Receiver-Transmitter
URC	Unsolicited Result Codes
USB	Universal Serial Bus
WEP	Wired Equivalent Privacy
WPA	Wi-Fi Protected Access