MIG02C40F, BLE 5.3/Thread to WiFi 6 Matter Gateway

Ver 0.90 May 2023

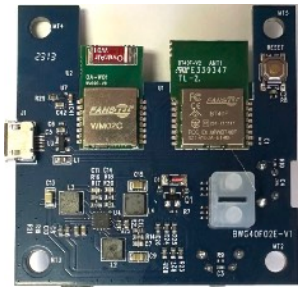
OpenSource with Market Ready Enclosure

Matter IoT Gateways (MIG) are in market ready enclosure and pre-certified. OpenSource codes are available to expedite your application firmware and software development. A matter gateway can be used as a:

- Bluetooth 5.3 to WiFi 6 gateway to route data between Bluetooth devices and cloud servers.
- Matter IoT gateway to route data between Matter (Thread/802.15.4) devices and cloud servers. The Bluetooth interface can be used for provisioning and operation supports.
- Bridge between a Matter network to a Bluetooth network, and with a cloud connection.

MIG02C40F, Dual Band Matter IoT Gateway

WM02C supports WiFi 6 in both 2.4 GHz and 5 GHz frequency bands. The dual core Cortex M33 MCU in BT40F BLE 5.3 module has enough processing power for Bluetooth mesh, Thread mesh, or to bridge a Thread network to a Bluetooth network. An embedded 4 MB flash memory provides local storage.



MIG02C40NE, Long Range Thread

Using BT40NE with +19.1 dBm TX power, MG02C40NE can support long range Matter applications.The dual core Cortex M33 MCU can support Bluetooth mesh, Thread mesh, or bridge between a Bluetooth network and a Thread network.

Remote LE Audio Broadcasting Dongle

BU40NE uses a BT40NE with dual core Cortex M33 to process audio signals and +19.1 dBm TX power. A 2-meters cable allows wall mounting to reduce obstruction and maximize LE audio broadcasting range.

BWG02C840F, Bluetooth to WiFi 6 Gateway

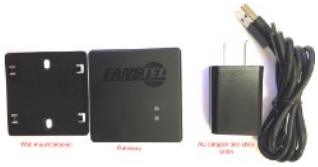
This is a low cost Bluetooth to WiFi 6 gateway. WM02C supports WiFi 6. nRF52840 in BT840F does not have enough processing power for Matter applications.

OpenSource Development

OpenSource codes for connecting to Fanstel development server are available. They can be used as base to develop interface with other servers.
Link to download additional document and source codes:
http://www.fanstel.com/download-opensource/

The following hardware is required to development firmware for Matter gateway.

- An nRF5340DK for MIG02C40C, MIG02C40NE, BU40NE.
- An nRF52840DK for BWG02C840F
- The 10-pin flat cable included in any Fanstel EV boards or programming kit.



Miscellaneous

- Size: 60x60x22mm
- Desk and wall mountable
- Power supply and USB cable included
- 2 LED indicators defined by user

Gateway Summaries

Gateway	MIG02C40F	MIG02C40NE	BU40NE	BWG02C840F
WiFi module	WM02C	WM02C	None	WM02C
BLE module/TX power	BT40F/+3.4 dBm	BT40NE/+19.1 dBm	BT40NE/+19.1 dBm	BT840F/+8.5 dBm
Bluetooth antenna	PCB	PCB and u.FL+ANT000	PCB and u.FL+ANT000	PCB
Max module range	700 M est. at 1Mbps	>4500M at 125 Kbps	>4500M at 125 Kbps	1000 M at 1Mbps
Processor	Dualcore Cortex M33	Dualcore Cortex M33	Dualcore Cortex M33	Cortex M4F
External flash	4MB	16 MB	0 MB	0 MB
FCC ID				
ISED				
CE, RCM				
TELEC				
QDID				

Table Of Contents

1. Introduction

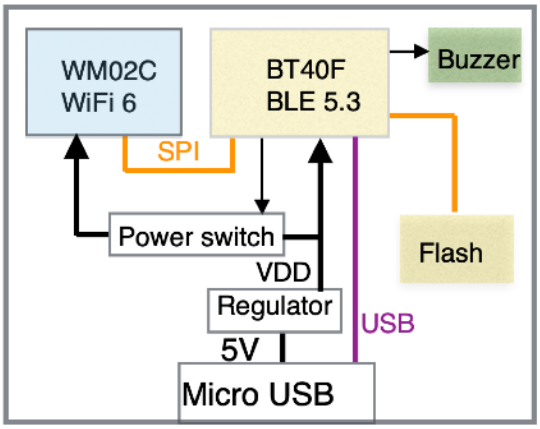
Matter IoT Gateways (MIG) are in market ready enclosure and pre-certified. OpenSource codes are available to expedite your application firmware and software development. A matter gateway can be used as a:

- Bluetooth 5.3 to WiFi 6 gateway to route data between Bluetooth devices and cloud servers.
- Matter IoT gateway to route data between Matter (Thread/802.15.4) devices and cloud servers. The Bluetooth interface can be used for provisioning and operation supports.
- Bridge between a Matter network to a Bluetooth network, and with a cloud connection.

2. Hardware Descriptions

Block Diagram of Matter IoT Gateway

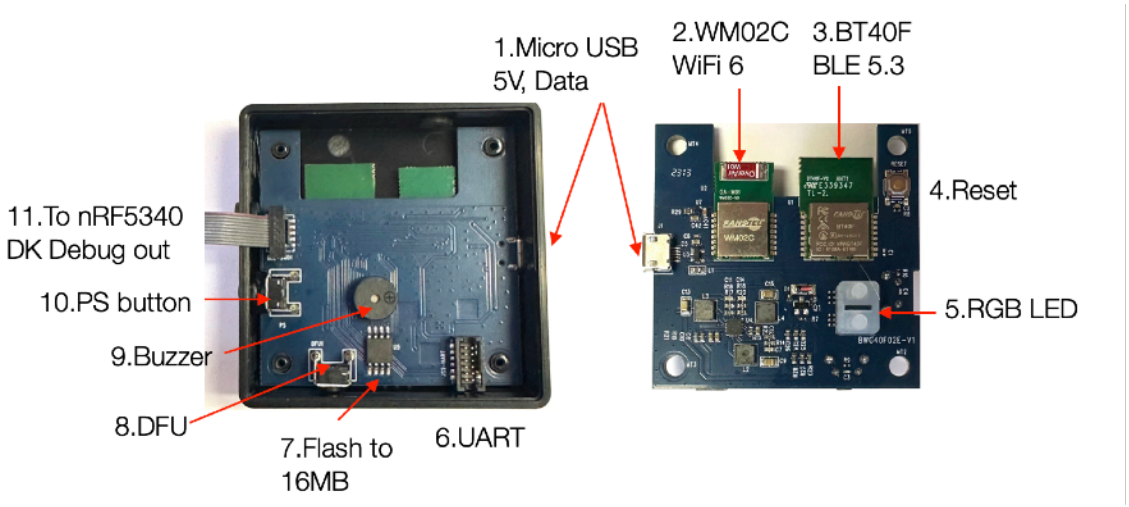
A block diagram of the Matter IoT Gateway is shown below.



- nRF5340 module, BT40F supports both Bluetooth and 802.15.4 radio protocols. It uses AT commands over SPI interface to manage WiFi 6 module.
- WM02C is an nRF7002 WiFi 6 module supporting both 2.4 GHz and 5 GHz bands.
- Gateway is powered by 5V DC from the micro USB connector. If a USB cable is plugged into a USB host, data pins are connected to the nRF5340 USB interface.
- nRF5340 can control a power switch to delay powering up of WM02C module.
- A external flash memory is connected to a second SPI interface of nRF5340.
- A buzzer is available to implement audible alerting. An user can disable the audio alerting by pressing a button.

Gateway Hardware Description

Photos of both sides of PCBA are shown below. Key components are described below by the sequence numbers.



1. Micro USB connector.
2. WiFi 6 module, WM02C as shown. Other WM modules can be used.
3. Bluetooth/802.15.4 module, BT40F. An BT40NE (nRF5340+nRF21540) can be used to support long range 802.15.4/Bluetooth.
4. Reset button.
5. RGB LED. Two Red-Green-Blue LEDs defined by firmware.
6. UART. Connect to nRF5340 UART port.
7. External flash memory. 0, 4MB, or 16MB.
8. DFU button for gateway firmware upgrade.
9. Buzzer for audio alerting. It can be controlled by a cloud server.
10. PS button. It can be defined by firmware for an end user to disable audio alerting.
11. To connect to nRF5340 DK with a 10-pin flat cable (not included)

MIG02C40F

- WM02C WiFi 6 module with nRF7002, supporting both 2.4 GHz and 5 GHz bands.
- BT40F, nRF5340 module with dual core Cortex M33, up to 128 MHz
- An AC adapter with USB cable

MIG02C40NE

- WM02C WiFi 6 module with nRF7002, supporting both 2.4 GHz and 5 GHz bands.
- BT40NE, nRF5340 + nRF21540 PA module with dual core Cortex M33, up to 128 MHz.
- BT40NE has a high performance PCB antenna and an u.FL connect for an external antenna.
- An AC adapter with USB cable

BU40NE

- BT40NE, nRF5340 + nRF21540 PA module with dual core Cortex M33, up to 128 MHz.
- BT40NE has a high performance PCB antenna and an u.FL connect for an external antenna.
- An USB cable for plugging into an USB host port.

MIG02C840F

- WM02C WiFi 6 module with nRF7002, supporting both 2.4 GHz and 5 GHz bands.
- BT840F, nRF52840 module with Cortex M4F, 64 MHz
- An AC adapter with USB cable

3. Firmware Development

Hardware Required for Firmware Development

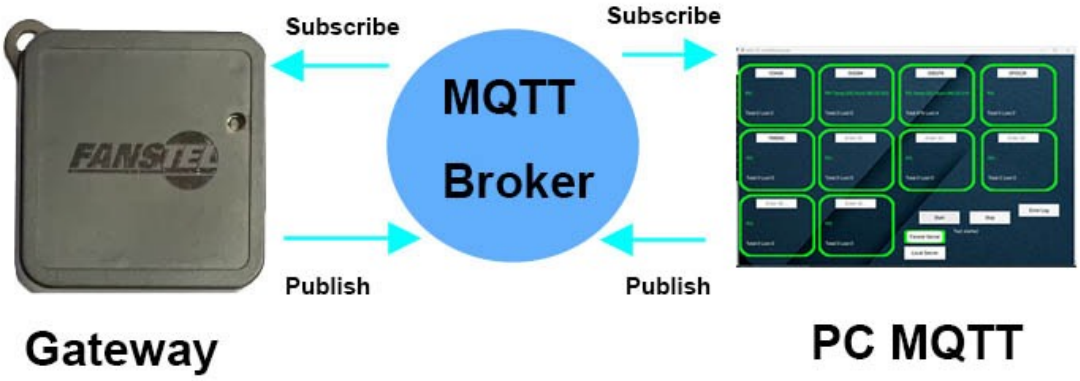
The following are required to develop firmware for gateway WiFi and Bluetooth modules.

- nRF5340 DK.
- A 10-pin flat cable included in any Fanstel EV board or PK board.

Preloaded Codes

The MIG02C40F is preloaded with MQTT over WiFi demo code.

An MQTT client on the other side can subscribe to the topic that the gateway publishes to. It publishes to the topic the gateway is subscribed, and be able to remotely monitor data. The following diagram is an overview of the communication flow.



Provision the nRF7002 DK to your access point/router

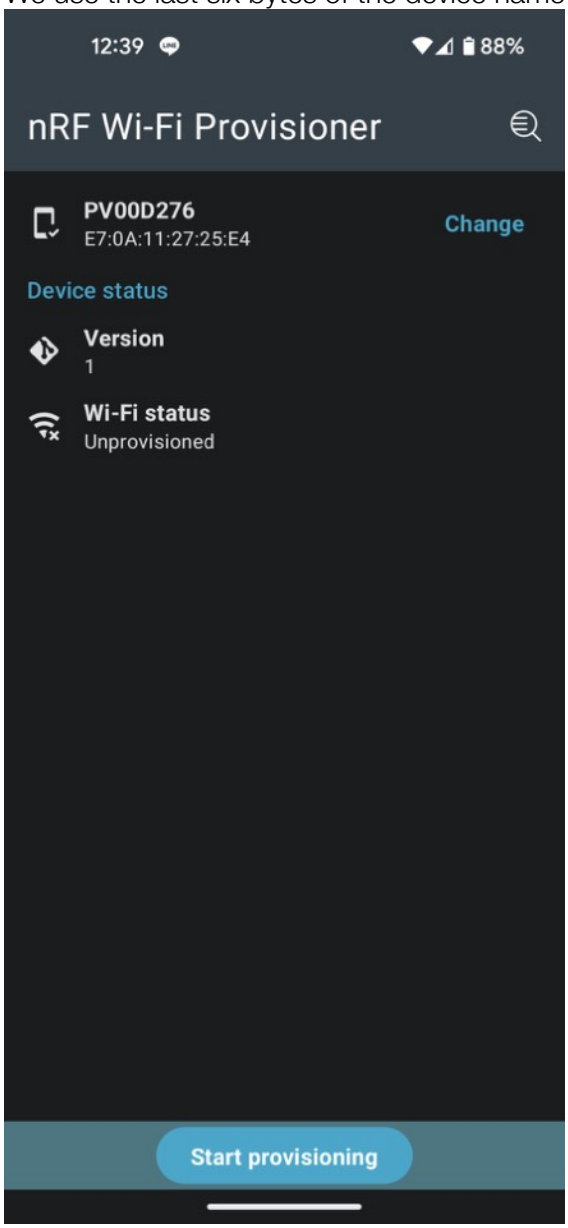
You need to do this step only once.

The first time you operate the gateway, you need to provision it to your access point/router. In other words, you need to provide the credentials of your Wi-Fi network to the gateway. For that, we will use the nRF Wi-Fi Provisioner mobile application (Android and iOS). The nRF Wi-Fi Provisioner mobile application uses Bluetooth LE to communicate with the gateway. It will display the available Wi-Fi networks and give the option to connect to them. It also allows you to un-provision or re-provision your development kit to a different Wi-Fi network. The nRF5340 SoC on the gateway will act as a Bluetooth LE peripheral and your smartphone or tablet will act as a Bluetooth LE central.

1. Install the nRF Wi-Fi Provisioner mobile app on your smartphone or tablet.
Search for nRF Wi-Fi Provisioner in the Google Play Store or Apple App Store. Download and install the app.

2. Open the nRF Wi-Fi Provisioner mobile app on your smartphone or tablet and press Start.

We use the last six bytes of the device name as the ID. In the screenshot below, the ID is "00D276".



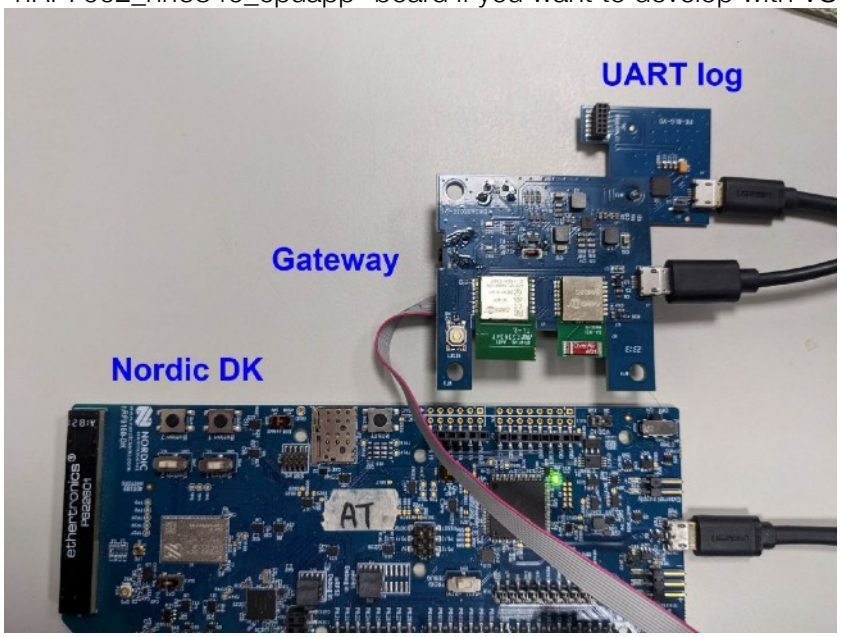
Once the gateway is connected to the internet, it will be connected to the Fanstel MQTT broker. Please enter the ID to match the gateway you have. The gateway will send data to the MQTT brok

er every five seconds. The PC MQTT tool will subscribe to and display the data.

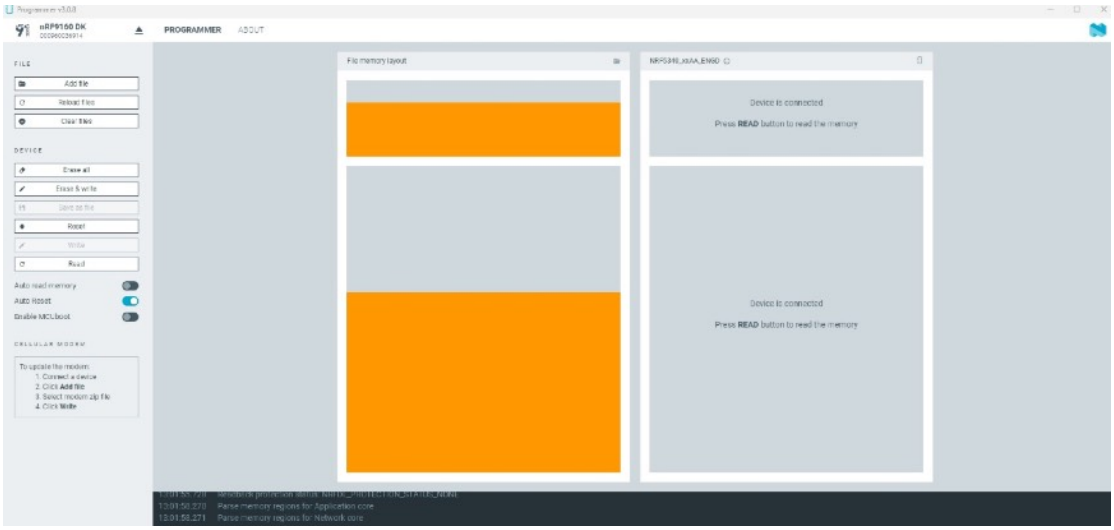
The demo codes **MQTT over WiFi on the nRF7002 DK** are available on Github.
https://github.com/AliNordic/mqtt_over_wifi_nrf7002DK

Programming the codes

To program/debug the gateway, please connect the Nordic DK **debug out** to the WM and gateway debug in. The following Nordic DK boards are supported: PCA10095, PCA10143, and PCA10090. Please select the "nRF7002_nrf5340_cpuapp" board if you want to develop with VS code.

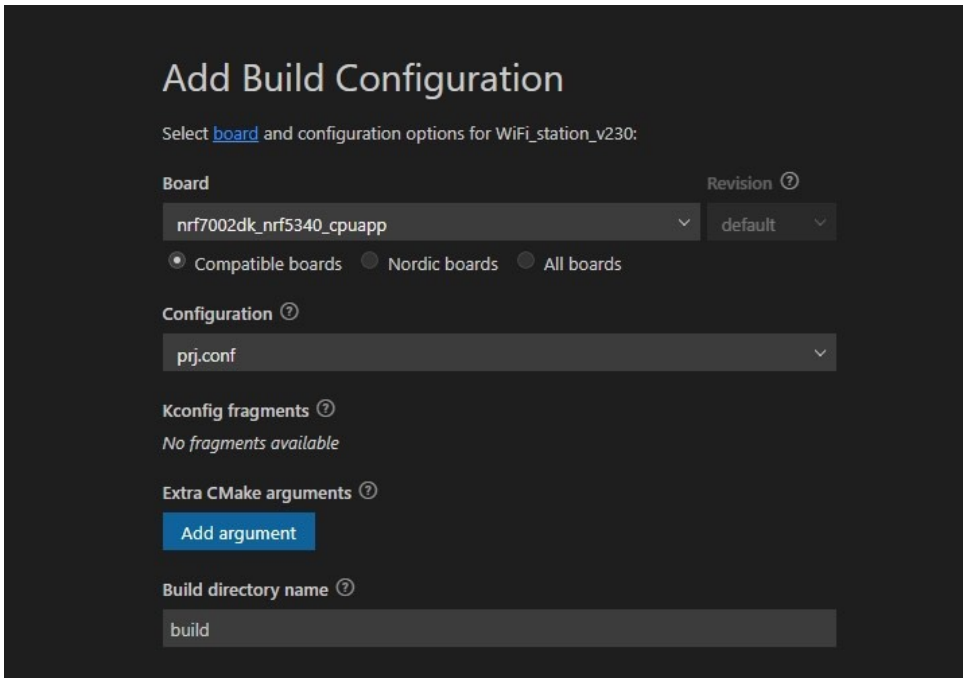


Use nRF Connect for desktop/programmer to programming the code.



The connection between the nRF5340 and nRF7002 is the same as that in the PCA10143 nRF7002 DK. The default connection is as follows:
GPIO 12 7002 Bucken
GPIO 13 qspi io0
GPIO 14 qspi io1
GPIO 15 qspi io2
GPIO 16 qspi io3
GPIO 17 qspi sck
GPIO 18 qspi csn
GPIO 19 uart0 rts
GPIO 20 uart0 tx
GPIO 21 uart0 cts
GPIO 22 uart0 rx
GPIO 23 host ireq
GPIO 24 radio grant
GPIO 28 radio req
GPIO 29 radio swctrl1
GPIO 30 radio status0
GPIO 31 7002 iovdd-ctrl
GPIO 106 led0
GPIO 110 radio btrf-switch

You can create a new project from Nordic's default WiFi example projects, such as WiFi_shell or WiFi_station, to try out the integration. If you need to set up the hardware peripherals, please configure the board using a .overlay file.



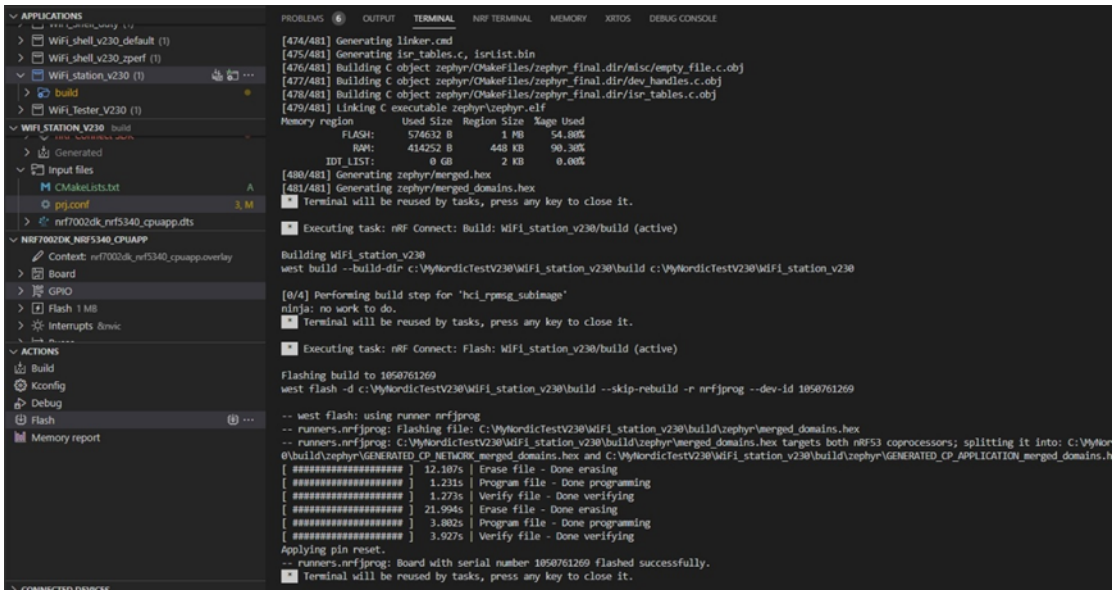
The following is an example for setup the nRF7002_nrf5340_cpuapp.overlay file.

```
&pinctrl {

    myuart0_default: uart0_default {
        group1 {
            psels = <NRF_PSEL(UART_TX, 0, 20)>,
                <NRF_PSEL(UART_RTS, 0, 19)>;
        };
        group2 {
            psels = <NRF_PSEL(UART_RX, 0, 22)>,
                <NRF_PSEL(UART_CTS, 0, 21)>;
            bias-pull-up;
        };
    };

    myuart0_sleep: uart0_sleep {
        group1 {
            psels = <NRF_PSEL(UART_TX, 0, 20)>,
                <NRF_PSEL(UART_RTS, 0,  19)>,
                <NRF_PSEL(UART_RX, 0, 22)>,
                <NRF_PSEL(UART_CTS, 0,  21)>;
            low-power-enable;
        };
    };

};
&uart0 {

    status = "okay";
    current-speed = <115200>;
```

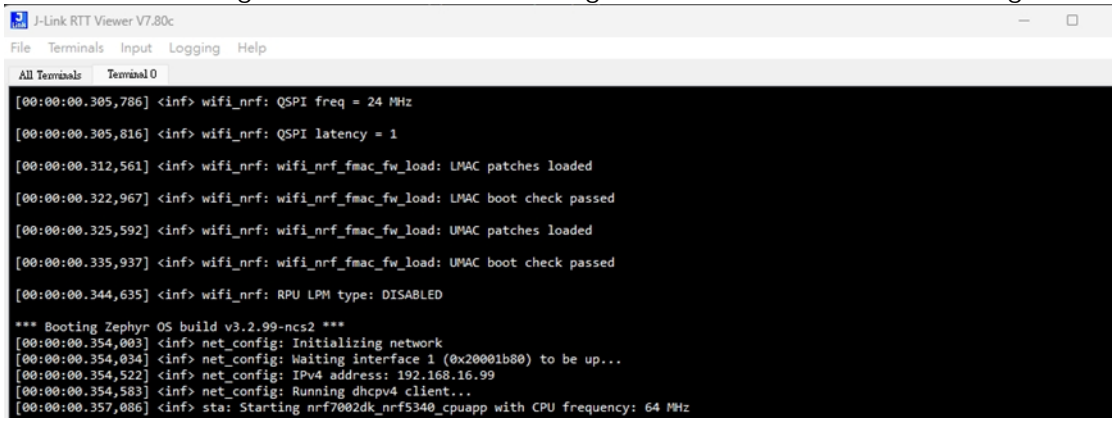
```
    pinctrl-0 = <&myuart0_default>;
    pinctrl-1 = <&myuart0_sleep>;
    pinctrl-names = "default", "sleep";
};
&uart1 {
    status = "disabled";

};
 &spi4 {
    status = "disabled";

};
 &pwm0 {
    status = "disabled";

};
&i2c1{
    status = "disabled";
};

&led1{
    status = "disabled";
};
&button0{
    status = "disabled";
};
&button1{
    status = "disabled";
};
```

After finish setup, build and flash the code.

The code is running.



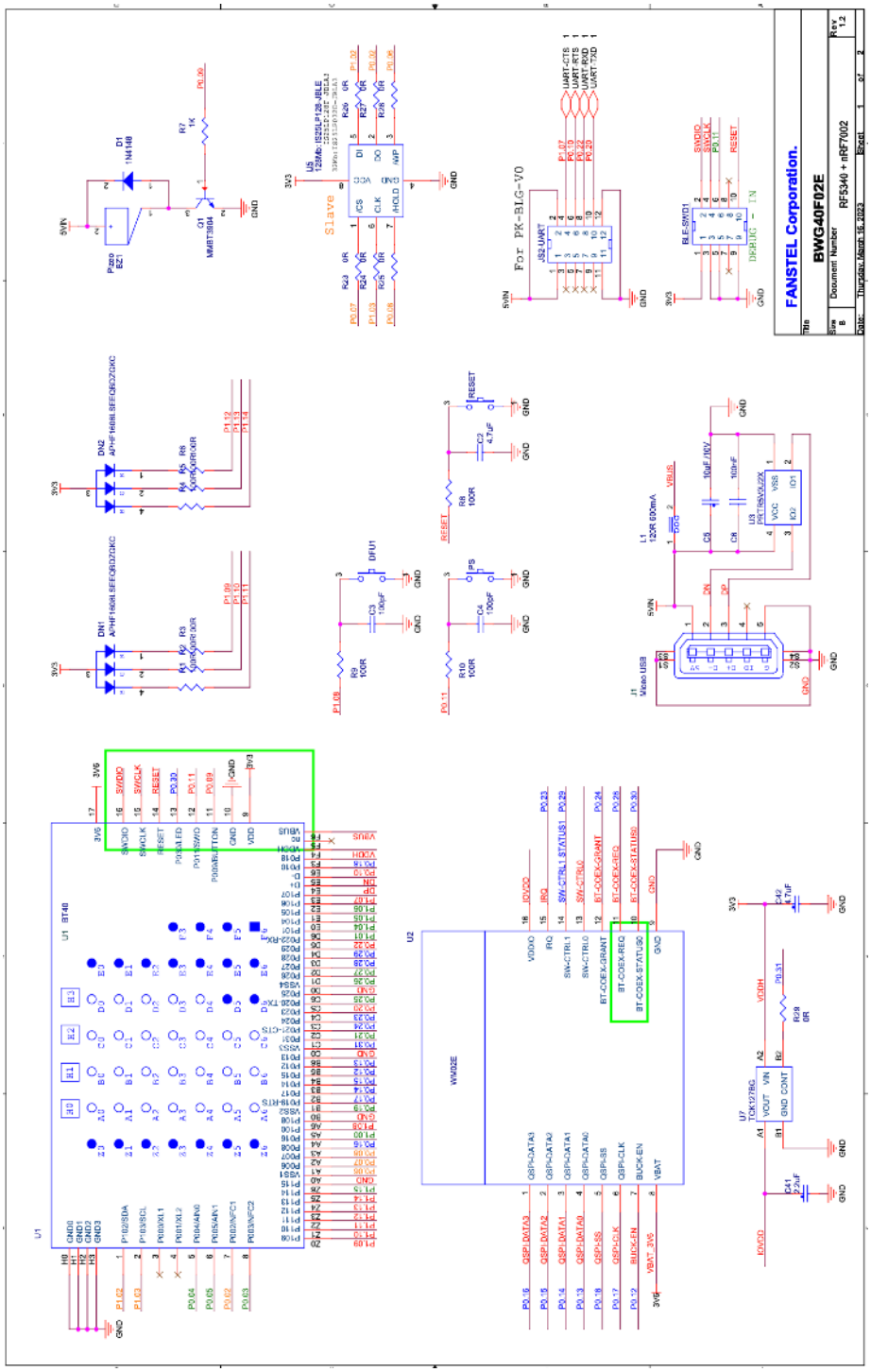
Use RTT Viewer log or UART to monitor the log to make sure the code is running normally.



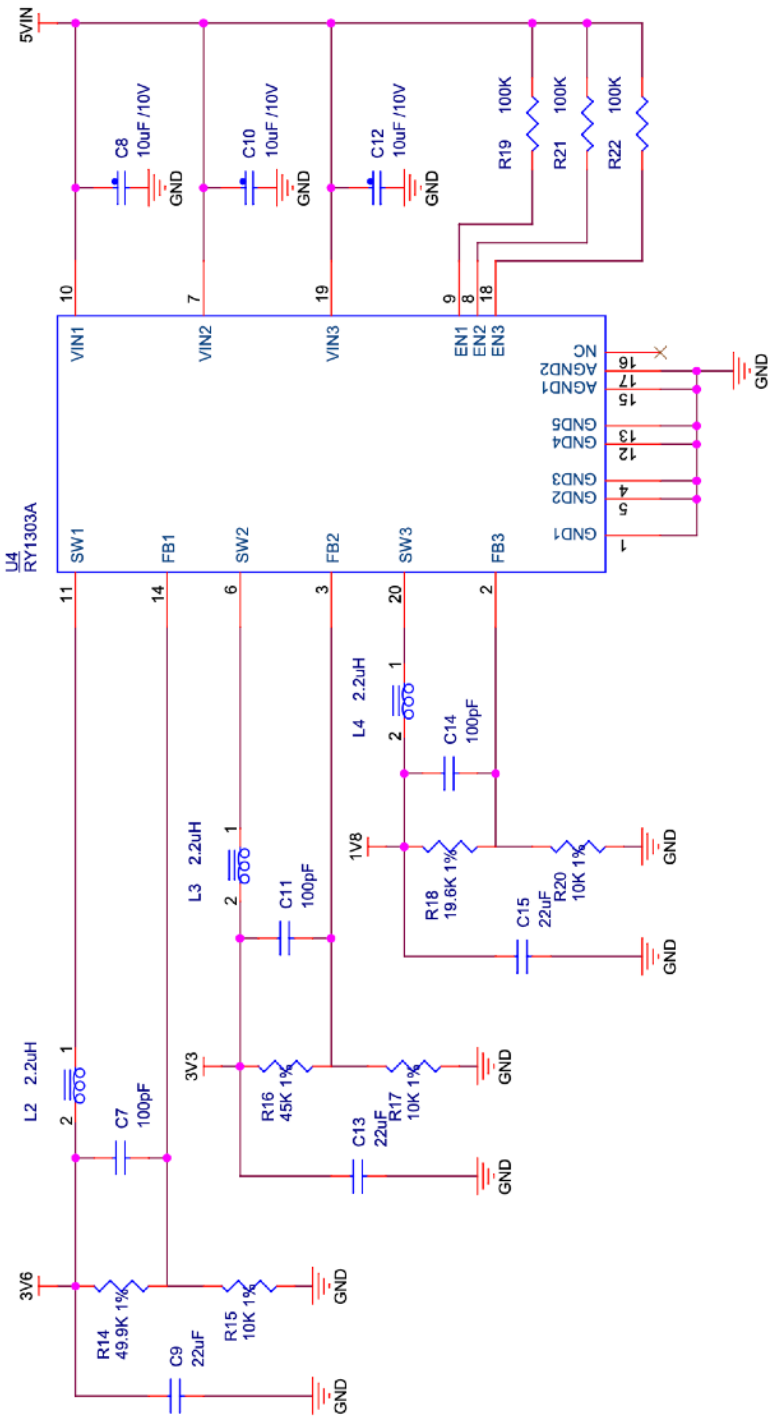
Control nRF21540 Power Amplifier in BT40NE

MIG02C40F Schematics

The main schematics of MIG02C40F.



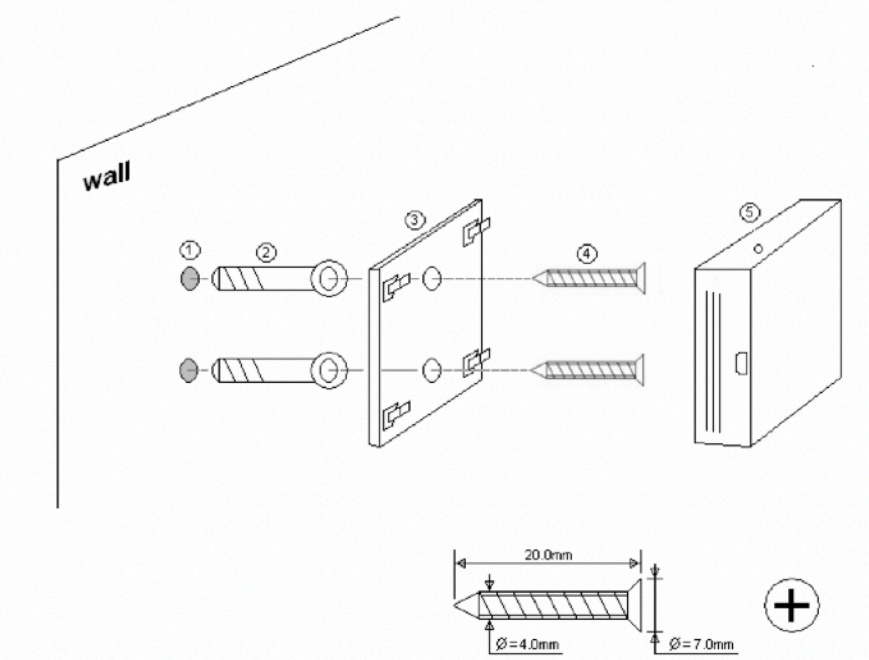
The power supply schematics.



4. Wall Mounting

Wall mounting diagram is shown below. Self-tapping screws and expanded rubber are not included.

- Use wall mount bracket and a pencil to mark location of mounting holes on wall.
- Drill holes.
- Insert expanded rubbers into holes
- Use self-tapping screws to screw wall mount bracket on wall.
- Mount gateway or sensor on wall mount bracket.



1	hole	Ø = 6 mm , L = 3 0 mm
2	Expanded rubber	Ø = 6 mm , L = 2 5 mm
3	Wall stand	
4	Self-tapping screws	Ø = 4 mm , L = 2 0 mm
5	Sensor box	

Revision History

• May 2023, Ver. 0.90: Initial draft copy release

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