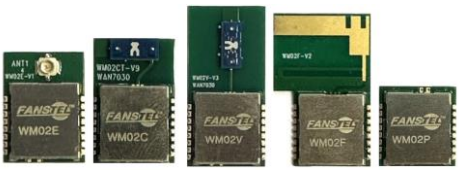
WM02C Compact, WiFi 6 Companion Modules

Ver 0.97, Aug. 2024

WM02C Series module is a powerful, highly flexible, ultra low power WiFi 6 module using Nordic nRF7002 SoC. With an integrated PCB trace antenna, a chip antenna, an u.FL, or pads for an external antenna, it allows faster time to market with reduced development cost.

A series of nRF5340 or nRF52840 modules can manage WiFi 6 modules through SPI interface. Many Fanstel modules are certified for both BLE and Thread, ideal for Matter applications.



Specifications:

- Nordic nRF7002 SoC.
- Low-power and secure Wi-Fi for the IoT
- Ideal coexistence with Bluetooth LE
- Supports IEEE 802.11 a/b/g/n/ac/ax
- Supports Target Wake Time (TWT), Orthogonal Frequency Division Multiple Access (OFDMA, Downlink and Uplink), BSS coloring
- WiFi CERTIFIED 6™, WiFi CERTIFIED™ a/b/g/n/ac, WiFi Enhanced Open™.
- Supports WPA3™, WPA2™, WPA™ - Personal and Enterprise, Protected Management Frames.
- Supports WMM®, WMM-Power Save, WiFi Agile Multiband™, WiFi Direct®.
- 2.4 GHz and 5 GHz dual-band or 2.4 GHz only
- Adjustable TX power from +5 to +19 dBm.
- Power consumption:
    - 165 mA @+15 dBm TX, 2.4 GHz, MCS7, Vbat=3.6V; 56 mA RX.
    - 244 mA @+15 dBm, 5 GHz, MCS7, Vbat=3.6V; 58 mA RX.
- SPI / QSPI
- Wi-Fi 6 Station (STA)
- 1 Spatial Stream (SS)
- 20 MHz channel bandwidth
- 64 QAM (MCS7), 86 Mbps PHY throughput
- Co-existence interfaces
- 16 castellated pins.
- Integrated shield to resist EMI
- 40 MHz crystal embedded.
- Operation voltage: 2.9V to 3.4V
- Operation temperature: -40°C to +85°C
- FCC ID:
- ISED ID:
- CE:
- Japan:
- Australia RCM:
- Taiwan NCC:

Bluetooth Host Modules

Matter applications, Certified for BLE and Thread.

- nRF5340: BT40/BT40E/BT40F; BT40N/BT40NE(with nRF21540 PA).
- nRF52840: BT840/BT840E/BT840F; BT840N/BT840NE (with nRF21540 PA).

Certified for BLE only

- nRF5340: BC40P/BC40C/BC40M.
- nRF52840: BC840/BC840M/BC840E; BM840/BM840P; BT840X/BT840XE (with SKY66112 PA)

Model Summaries

module	WM02C	WM02V	WM02E	WM02P	WM02F
SoC	nRF7002	nRF7002	nRF7002	nRF7002	nRF7002
WiFI 6 frequencies	2.4GHz + 5GHz	2.4GHz+5GHz	2.4GHz+5GHz	2.4GHz+5GHz	2.4GHz+5GHz
Size, mm	12x19.1x2.0	12x25.3x2.0	12x16.8x2.0	12x12.9x2.0	12 (15.1) x24.3x2.0
BT Antenna	Chip	Chip	u.FL	Pads	High performance PCB
2.4GHz range, iPhone 14	549 meters	505 meters	550 meters		493 meters
5GHz range, iPhone 14	413 meters	498 meters	510 meters		375 meters
Availability	Production		Production	Production	Production

Table Of Contents

1. Introduction

WM02C, WM02E, WM02F, WM02P, and WM02V companion module uses a Nordic nRF7002 SoC. It supports 802.11 a/b/g/n/ac/ax in the 2.4 GHz and 5 GHz bands. All companion modules are referred as WM02C in this product specifications.

Nordic application examples use an nRF52840 or an nRF5340 SoC to manage nRF7002. Fanstel offers many nRF52840 and nRF5340 modules.

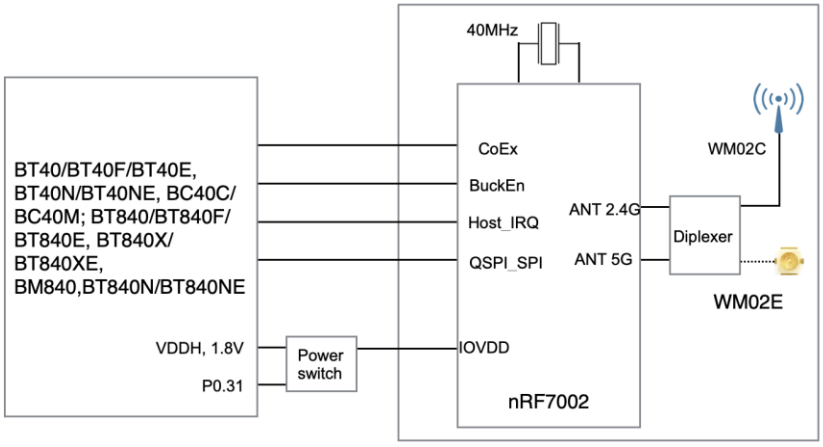
For matter application, the following modules are certified for both BLE and Thread.

- BT840, BT840E, BT840F, nRF52840 modules certified for BLE and Thread.
- BT40, BT40E, BT40F, nRF5340 modules certified for BLE and Thread.
- BT840N, BT840NE, nRF52840+nRF21540 modules certified for BLE and Thread
- BT40N, BT40NE, nRF5340+nRF21540 modules certified for BLE and Thread.

The following modules can manage WM02C in WiFi 6 applications. They are certified for BLE. Fanstel has no plan for Thread certification.

- BC40C, BC40M, BC40P, compact nRF5340 modules.
- BC840, BC840M, BC804E, compact nRF52840 modules.
- BM840, BM840P, the lowest cost nRF52840 modules.
- BT840X, BT840XE, nRF51840 + SKY66112 PA modules.

WM02C Block Diagram



The block diagram of WM02C and WM02E is below.

WM02C WiFi 6 Module

- Uses an nRF7002.
- Supports 802.11 a/b/g/n/ac/ax.
- Both 2.4 GHz and 5GHz bands.
- 16 castellated pins
- Integrated horizontal chip antenna
- Size: 12.0x19.1x2.0mm.

WM02V WiFi 6 Module

- Uses an nRF7002.
- Supports 802.11 a/b/g/n/ac/ax.
- Both 2.4 GHz and 5GHz bands.
- 16 castellated pins
- Integrated vertical chip antenna
- Size: 12.0x25.3x2.0mm

WM02E WiFi 6 Module

- Uses an nRF7002.
- Supports 802.11 a/b/g/n/ac/ax.
- Both 2.4GHz and 5GHz bands.
- 16 castellated pins
- An u.FL connector for external antenna.
- Size: 12.0x16.8x2.0mm

WM02F WiFi 6 Module

- Uses an nRF7002.
- Supports 802.11 a/b/g/n/ac/ax.
- Both 2.4GHz and 5GHz bands.
- 16 castellated pins
- A high performance PCB antenna
- Size: 12.0 (15.1 in antenna area) x24.3x2.0mm

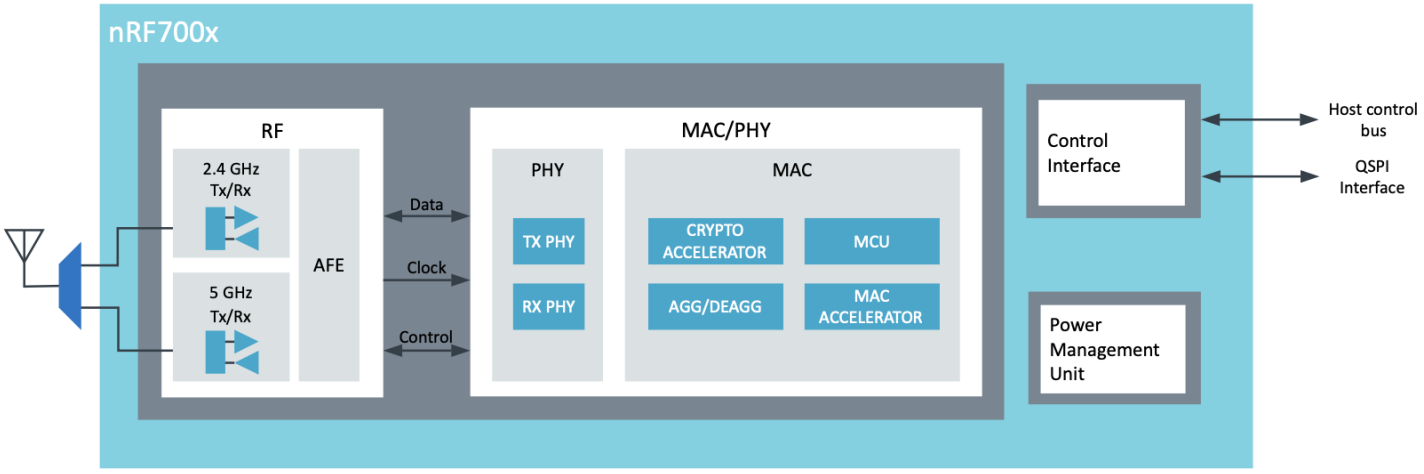
WM02P WiFi 6 Module

- Uses an nRF7002.
- Supports 802.11 a/b/g/n/ac/ax.
- Both 2.4GHz and 5GHz bands.
- 16 castellated pins
- Pads for connection to an antenna on the host board.
- Size: 12.0x12.9x2.0mm

2. Hardware Specifications and Designs

Brief description of nR7002 SoC is provided. For full description of the SoC, please download from Nordic Semiconductor website.
https://www.nordicsemi.com/Products/nRF7002

Block Diagram of nRF7002



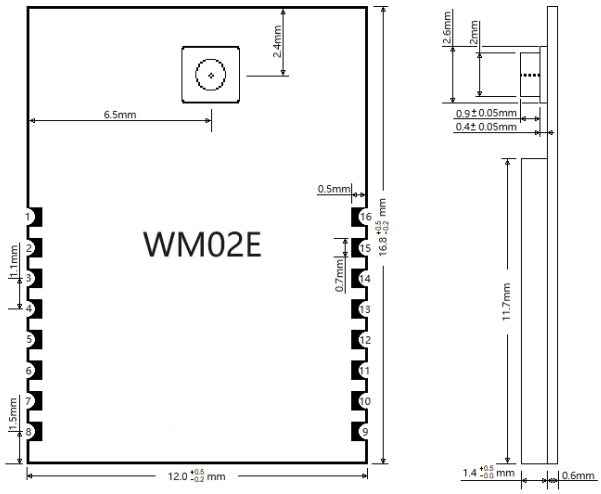
The following is a block diagram of Nordic nRF7002 WiFi 6 SoC.

Low-power, advanced security, seamless coexistence

The nRF7002 is a companion IC, providing seamless Wi-Fi connectivity and Wi-Fi-based locationing (SSID sniffing of local Wi-Fi hubs). It is designed to be used alongside Nordic's existing nRF52® and nRF53® Series Bluetooth Systems-on-Chip (SoCs), and nRF91® Series cellular IoT Systems-in-Package (SiPs). The nRF7002 can also be used in conjunction with non-Nordic host devices.
The nRF7002 is the first device in our portfolio of unique Wi-Fi products that will combine seamlessly with Nordic's existing ultra-low power technologies. Nordic brings their decades of ultra-low-power wireless IoT and silicon design expertise to Wi-Fi. With Wi-Fi 6 we bring added benefits to IoT applications including further efficiency gains that support long-life, battery-powered Wi-Fi operation.
With Wi-Fi 6 we will support all wireless protocols used in Matter, Bluetooth LE for commissioning, Thread for low power mesh, and Wi-Fi for high-throughput. Matter is a protocol championed by Apple, Amazon, Google, Nordic Semiconductor, Samsung, and hundreds of other companies in consumer IoT.

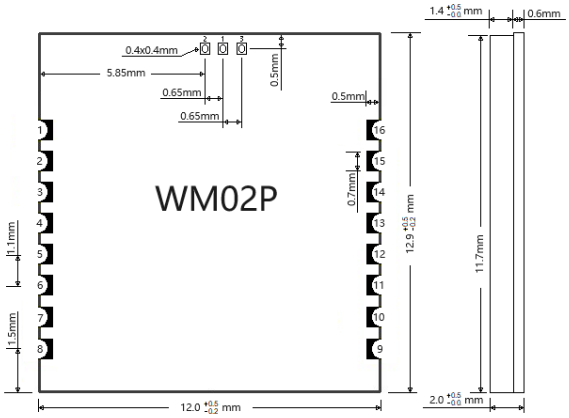
Mechanical Drawings

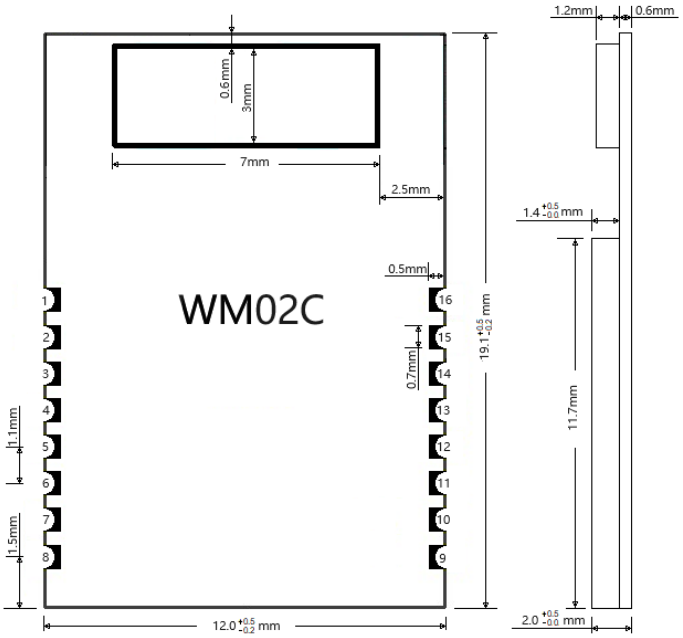
The followings are mechanical drawings of WM02E. Size is 12x16.8x2.0 mm. It has 16 castellated pins. Top view of module is



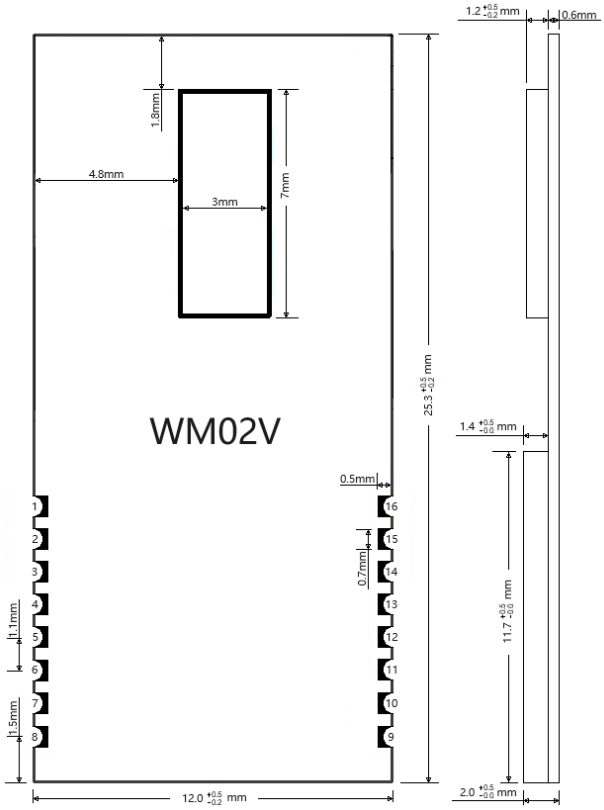
below.

The mechanical drawings of WM02P, top view.



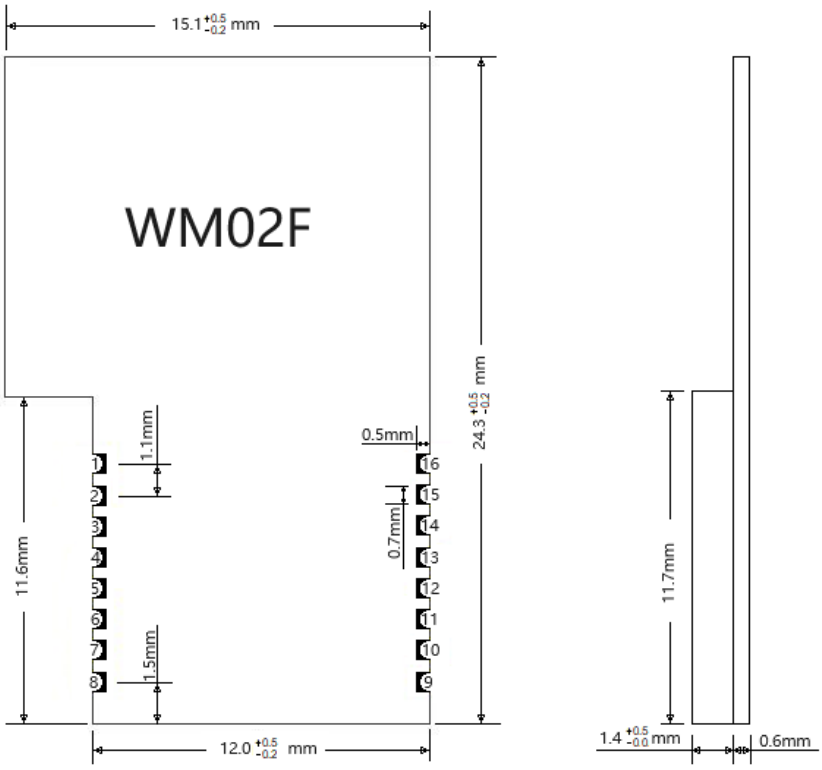


Mechanical drawings of WM02C, top view.



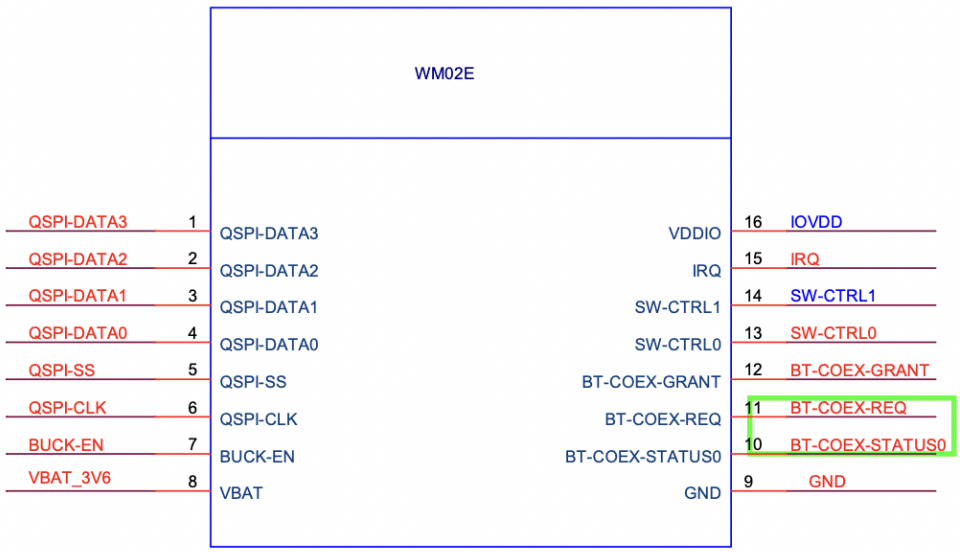
Mechanical drawings of WM02V, top view.

Mechanical drawings of WM02F, top view.



Pin Assignments of WM02C

The followings are WM02C pin assignment. Pin functions are in a table in next section. Please refer to Nordic nRF7002



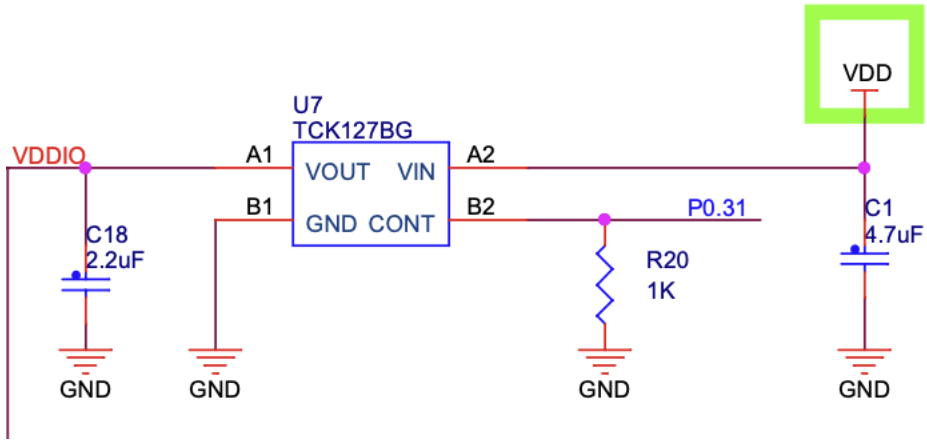
Product Specifications for detailed descriptions and features supported.
Short Range (SR) device in the following table is a Bluetooth/Thread (BT) device or an nR5340/nRF52840 module in the Fanstel applications.

WM02C	nRF7002	WM02C	
pin#	pin#	pin name	Descriptions
1	40	QSPI-Data3	QSPI Data 3
2	39	QSPI-Data2	QSPI Data 2
3	38	QSPI-Data1	QSPI Data 1
4	37	QSPI-Data0	QSPI Data 0
5	36	QSPI-SS	GPIO, digital
6	35	QSPI-CLK	GPIO, digital
7	30	BuckEn	GPIO, digital
8	13	Vbat	VDD power supply voltage, 2.9 to 3.6 V, typically 3.3V.
9	47	GND	Ground
10	41	BT-CoEx-Status0	Indicates if the SR transaction is TX or RX.
11	42	BT-CoEx-REQ	SR device requesting a TX/RX transaction
12	43	BT-CoEx-Grant	Indicates that the SR device is granted access for this transaction.
13	44	SW-CTRL0	Used for antenna switch control in shared antenna mode.
14	45	SW-CTRL1	In 4-wire mode, this carries the SR 1 bit priority signal. In 3-wire shared antenna mode, this can be optionally used as antenna switch control.
15	46	IRQ	Host processor interrupt request.
16	48	IOVDD	VDD power supply for GPIO pins.

Pin Function

Powering Up Sequence

Fanstel combo modules and evaluation boards use a Toshiba power switch in the following circuitry to control powering up sequence.



Please refer to the EV board schematics for connection between WM02C and its host BT40F.

Power Consumption Measurements

Measurement results for production version to be provided.

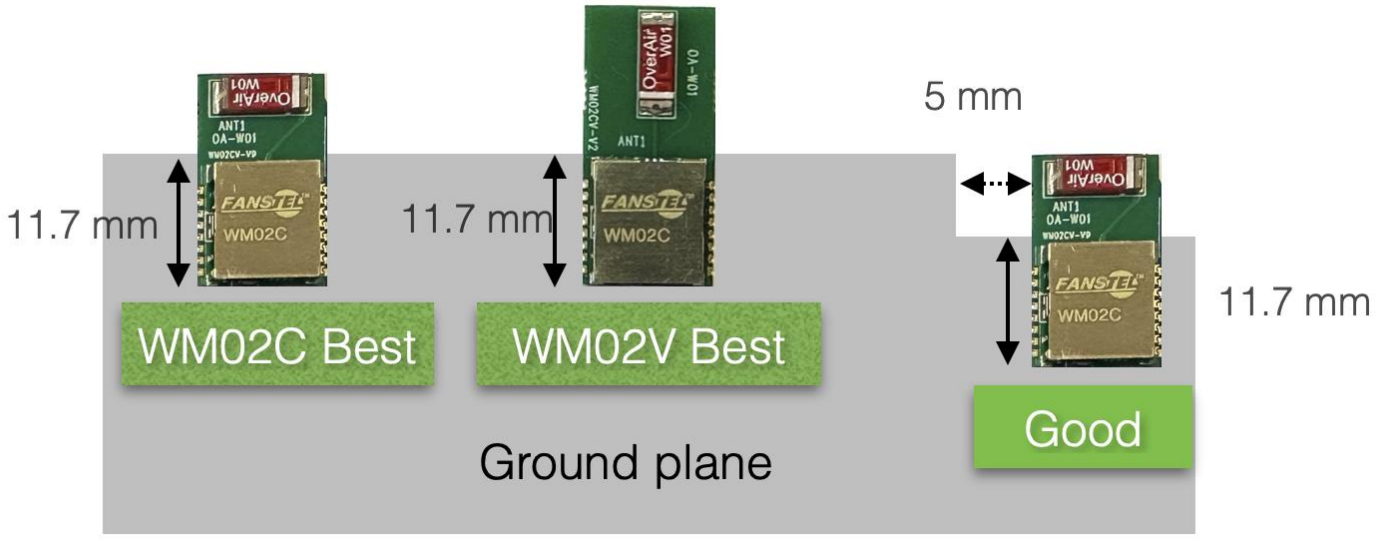
The following power consumption measurement using engineering version nRF7002 silicon. Power consumption measurements will be updated upon passing certification testing.

	WiFi idle	WiFi scanning	WiFi connected, PS on	WiFi connected, PS off
nRF7002 DK	AVG 15.23 uA	AVG 35.79 mA	AVG 5.20 mA	AVG 55.44 mA
EVB WM02C-VB	AVG 15.62 uA	AVG 24.90 mA	AVG 3.24 mA	AVG 53.72 mA

The worst case power consumption is when WiFi connected with Power Saving OFF. The peak current consumption measurement is below, 270 mA. Fanstel uses a 3.3V, 300 mA voltage regulator in the EV boards and open source Matter gateway BWG840F02E.

Mounting WM02C Modules on the Host PCB

- WM02C, WM02V, and WM02F modules with an integrated antenna shall follow mounting guidelines in this section.
- No mounting restriction for WM02E with an u.FL connector.
- WM02P has pad connection for an antenna on the host board. WM02P shall be mounted at a location allowing antenna to have minimum interference with other components or signal traces.



The length of the RFI shield is 11.7mm. The RFI shield area is the main body of module. The rest of the module is called antenna area.

- The main body area can be on a host board ground plane. The antenna area must be extended outside of the host board or in an area without ground or signal trace.
- The length of WM02C antenna area is 7.4mm.
- The length of WM02V antenna area is 13.6mm.
- The length of WM02F antenna area is 12.6mm.
- We don't recommend mounting WM02C/V module in the middle of a host PCB.

For the best WiFi range performance, keep all external metal at least 30mm from the antenna area.

Host Board Layout

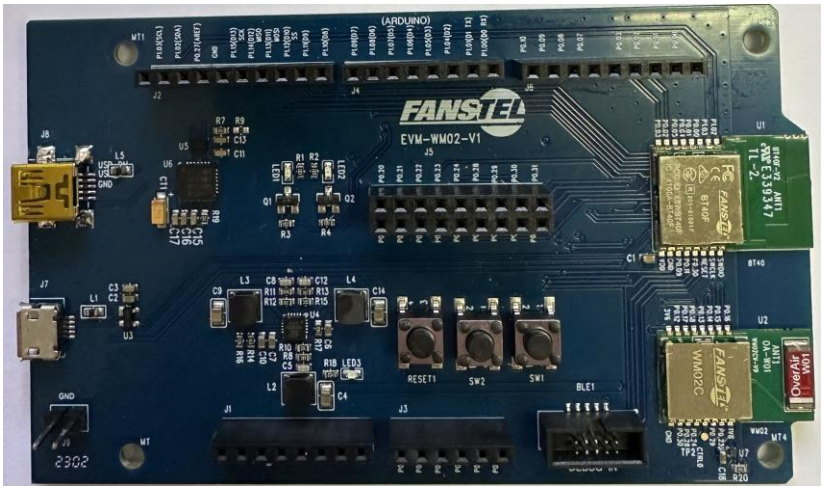
Library components for some PCB layout software are available. Or, it can be extracted from EV-WM02C evaluation board Gerber files. Gerber files can be downloaded from:
https://www.fanstel.com/nrf54-70-document

3. Firmware Development

WM02C Evaluation Board

An evaluation board consists of the followings:

- Mini USB cable
- Evaluation board with a BT40F module as the host MCU.

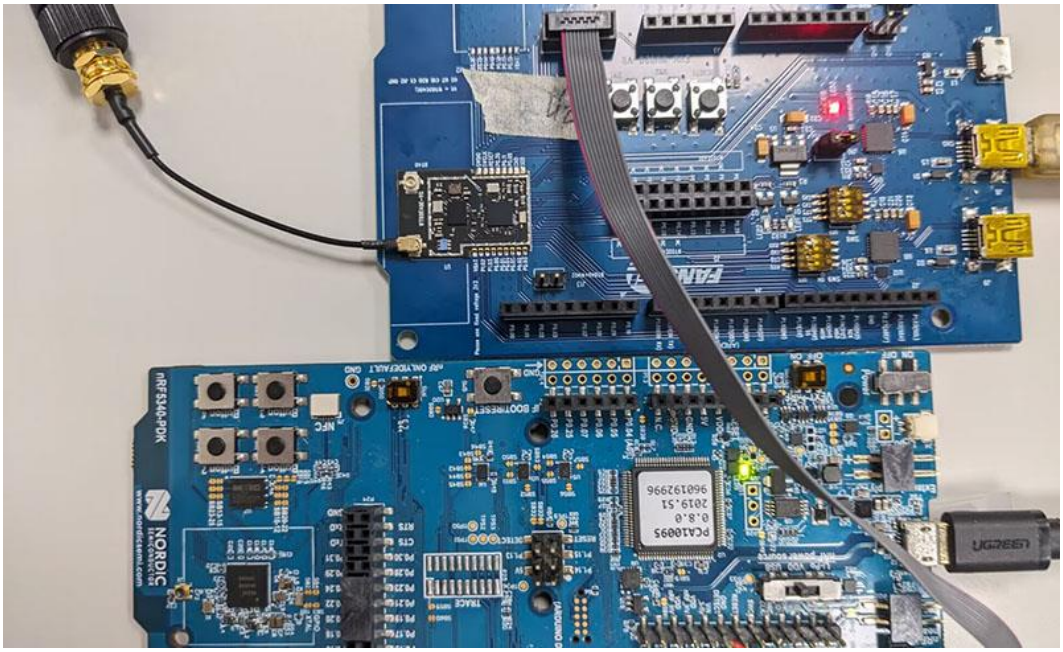


- 10-conductor cable for connection to Nordic nRF5340 DK(DK is not included)

Nordic Development Tools

To be updated.

A Nordic nRF5340-DK is recommended for programming this evaluation board. Nordic development tools can be downloaded from Nordic website.



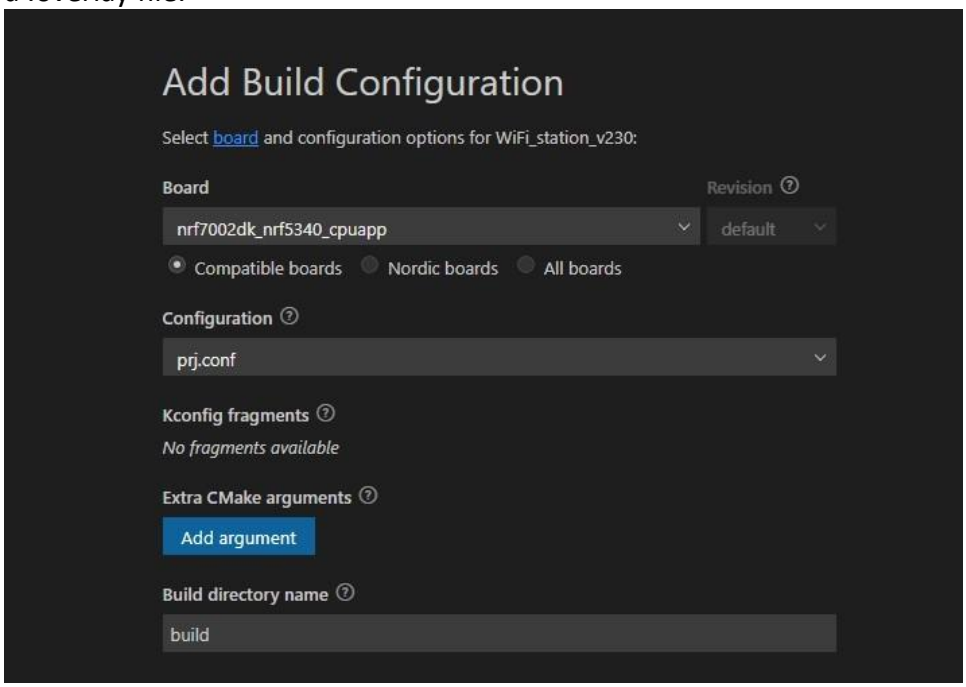
To program the BT40F module on the evaluation board:

Use VS code, nRF Connect for desktop programmer or nrfjprog tool, either one can programming the code.

The connection between the nRF5340 and nRF7002 is the same as 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.



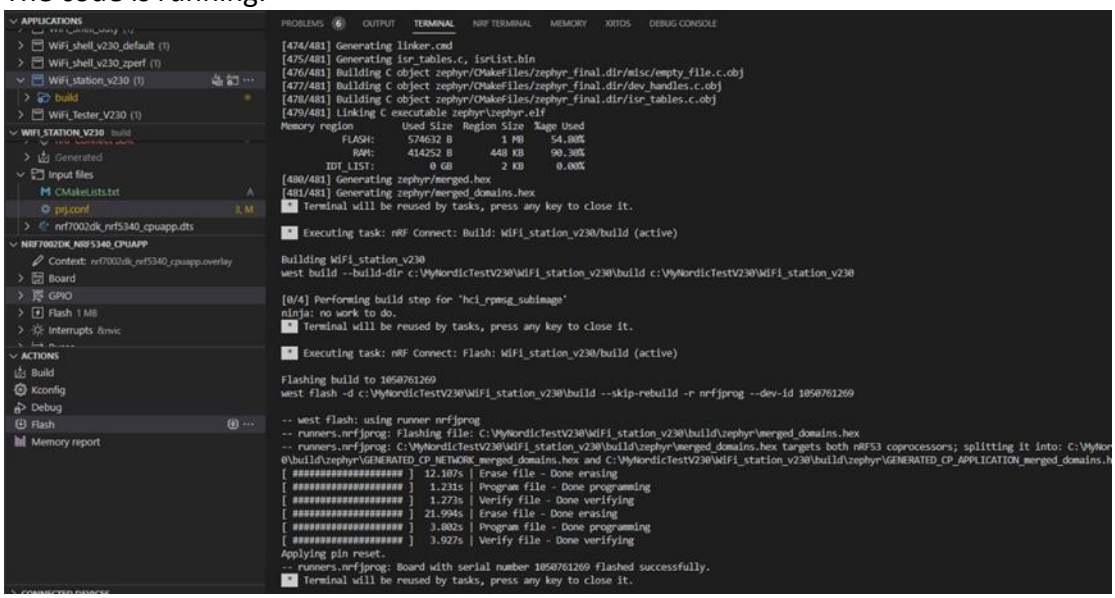
The following is an example for setup the nRF7002_nrf5340_cpuapp.overlay file.

```
&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)>;
```

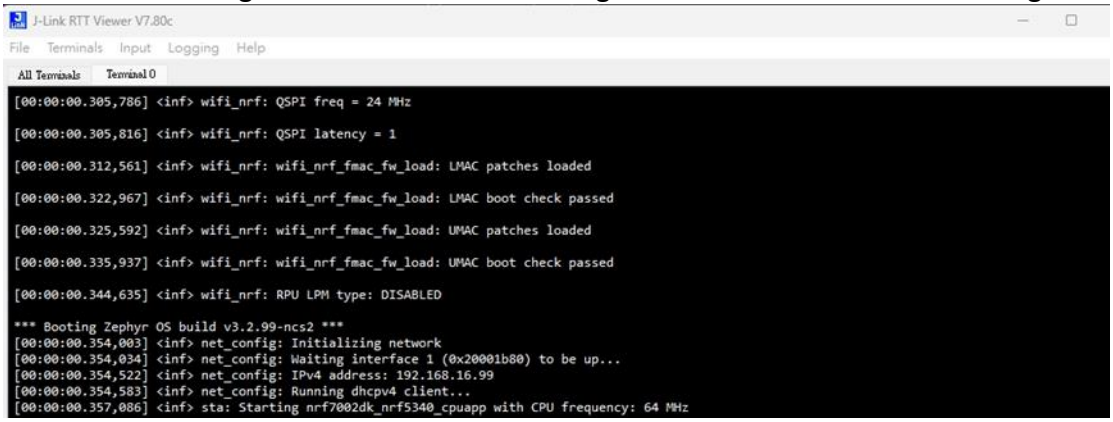
```
            bias-pull-up;
        };
    };

    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.



Download and set up on your Windows PC or MAC, nRF command line tool 10.24.2 or newer.
https://www.nordicsemi.com/Products/Development-tools/nRF-Command-Line-Tools/Download

- Download and set up on your Windows PC or MAC, nRF Connect desktop 5.0.0 or newer.
https://www.nordicsemi.com/Products/Development-tools/nRF-Connect-for-Desktop/Download

- Connect EV-WM02C to the **Debug out** connector of a Nordic nRF5340-DK.

- Use ***nRF Connect*** to program BT40F module on the EV board.

Codes for Evaluation Boards.

The codes preloaded into BT40F module to manage WM02C module on the evaluation board can be downloaded.

MAC addresses

Each WM2C module is programmed with two MAC addresses. The procedure to read these MAC addresses to be provided.

The MAC address are pre-programmed into the One Time Programmable(OTP) memory.

The address can be read by Nordic Wi-Fi radio test project command:

```
uart:~$ wifi_radio_ficr_prog otp_read_params
OTP Region is open for R/W

REGION_PROTECT0 = 0x50fa50fa
REGION_PROTECT1 = 0x50fa50fa
REGION_PROTECT2 = 0x50fa50fa
REGION_PROTECT3 = 0x50fa50fa

MAC0: Reg0 = 0x00071800
MAC0: Reg1 = 0x00007105
MAC0 Addr  = 00:18:07:00:05:71

MAC1 : Reg0 = 0x00071800
MAC1 : Reg1 = 0x00007106
MAC1 Addr   = 00:18:07:00:06:71

CALIB_XO = 0xff

CALIB_PDADJMCS7 = 0xffffffff

CALIB_PDADJMCS0 = 0xffffffff

CALIB_MAXPOW2G4 = 0xffffffff

CALIB_MAXPOW5G0MCS7 = 0xffffffff

CALIB_MAXPOW5G0MCS0 = 0xffffffff

CALIB_RXGAINOFFSET = 0xffffffff

CALIB_TXPOWBACKOFFT = 0xffffffff

CALIB_TXPOWBACKOFFV = 0xffffffff

REGION_DEFAULTS = 0xfffffff9
```

“wifi_radio_ficr_prog_read_params”

Setting Regional Transmission Parameters

WiFi transmission power and band edge specifications are region specific. The following parameters are used to pass certification testing. They shall be set as the transmission parameters.

To be provided.

USA, Canada, and Taiwan

wifi_radio_test_set_ant_gain 0

802.11b:wifi_radio_test_set_edge_bo 5

802.11g:wifi_radio_test_set_edge_bo 4

802.11n20:wifi_radio_test_set_edge_bo 4

802.11HE20:wifi_radio_test_set_edge_bo 6

The command wifi_radio_test_set_edge_bo will set all upper, lower edge gain to the specific value.

Europe, UK, and Australia

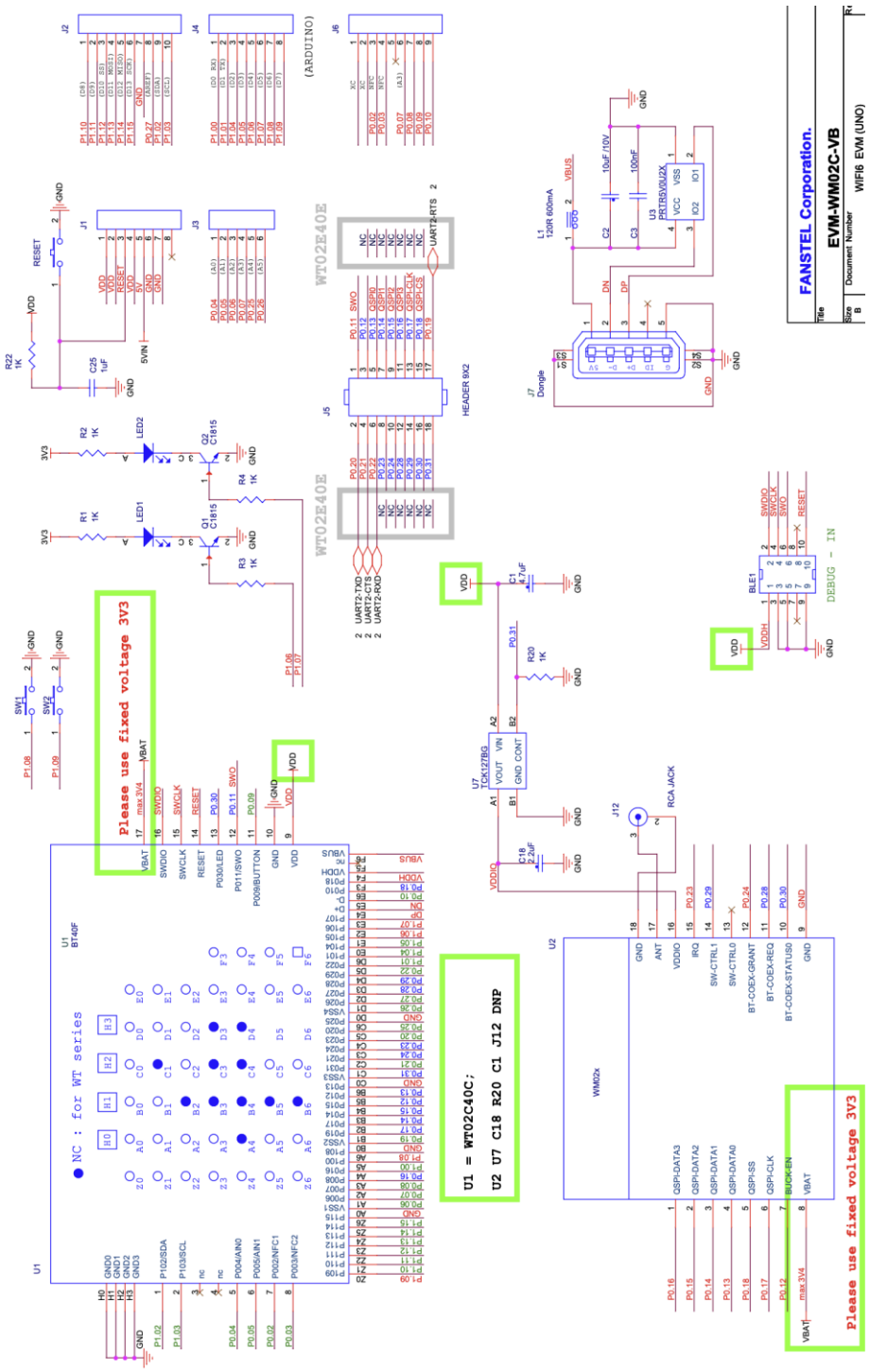
Japan TELEC

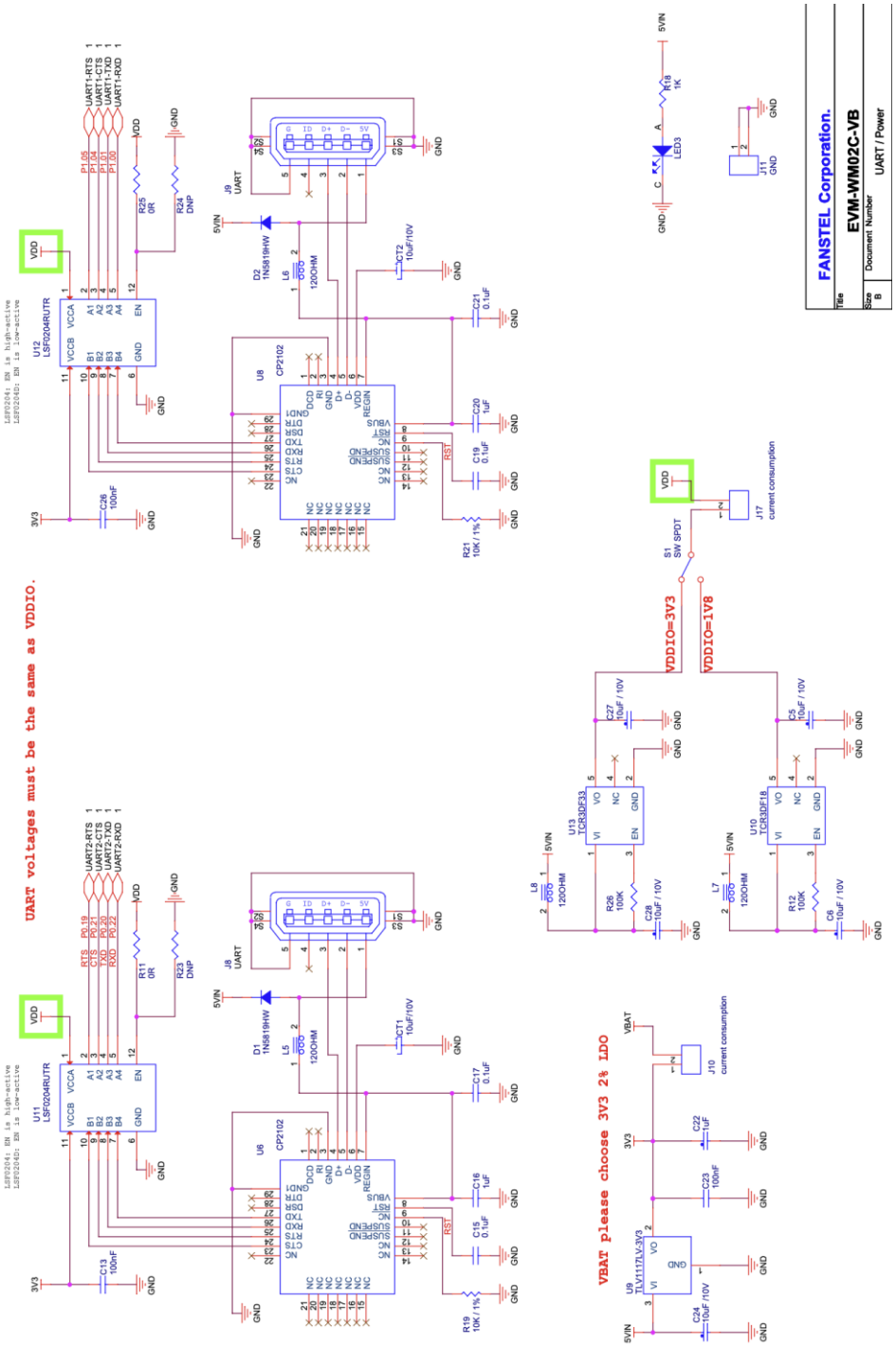
Evaluation Board Schematics

WM02C VB Evaluation Board for Production Version Modules

EV-WM02C schematics, EV-WM02C Gerber, and EV-WM02P Gerber files can be download. The schematics and Gerber can be as a reference design, ground plane design, and signal routing guides of a host board using WM02C series module.

- A BT40/BT40F, nRF5340 module is mounted at the U1 location.
- The WiFi 6 module under evaluation, is mounted at the U2 location.
- A Toshiba power switch TCK127BG (U7) is used for power up sequencing.




FANSTEL Corporation.
EVM-WM02C-VB
UART / Power
UART voltages must be the same as VDDIO.
VDDIO=3V3
VDDIO=1V8
VBAT please choose 3V3 2% LDO
current consumption

4. WiFi Range Measurements

Description of measurement site, measurement methods, and range raw data between an iPhone 14 and a WiFI 6 module are available at:
https://www.fanstel.com/wifirange

Preliminary Measurement Results

- A WiFi module engineering sample is used to measure range with an iPhone 14.
- The WiFi module antenna is 2 meters above ground, pointing to the sky.
- A tester holds the iPhone 14, about 1.5 meters above ground.
- 12 measurements for each frequency band: Antenna facing iPhone for the first measurement, antenna rotates clockwise by 30 degrees after each measurement.
- Nordic SDK 2.5.0 is used in these measurement. Default parameters are used.

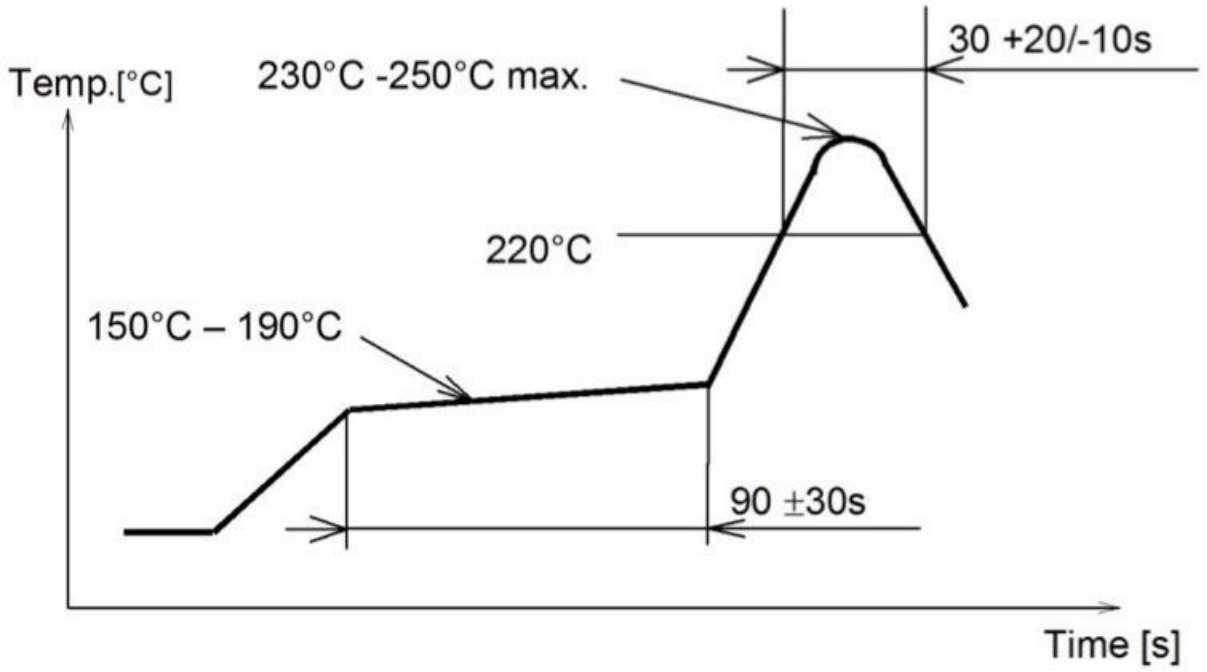
Module	Freq.	WiFi												
Module orientati		0	30	60	90	120	150	180	210	240	270	300	330	Average
WM02F	5.745G	360	370	350	350	370	380	380	370	375	380	400	420	375
WM02F	2.437G	500	480	450	470	480	490	490	500	510	515	520	510	493
WM02V	5.745G	500	490	420	470	490	500	490	500	510	540	530	530	498
WM02V	2.437G	510	510	500	490	520	530	550	550	560	560	300	480	505
WM02C	5.745G	640	300	480	490	490	500	200	200	270	370	370	640	413
WM02C	2.437G	520	550	570	590	580	570	560	560	550	550	490	500	549
WM02E	5.745G	510												510
WM02E	2.437G	550												550

Deployment Recommendations

- To have the best WiFi data reception, direct line of sight between 2 devices should be away from ground or wall.
- If one device must be installed closer to ground or a wall, install other devices far away from a wall or ground.
- Indoor condition is different for different building. We suggest testing WiFi data reception in the building with the worst case condition.

5. Production

Soldering Temperature-Time Profile for Re-Flow Soldering



Maximum number of cycles for re-flow is 2. No opposite side re-flow is allowed due to module weight.

Cautions, Design Notes, and Installation Notes

Failure to follow the guidelines set forth in this document may result in degrading of the product s functions and damage to the product.

Design Notes

(1) Follow the conditions written in this specification, especially the control signals of this module.

(2) The supply voltage has to be free of AC ripple voltage (for example from a battery or a low noise regulator output). For noisy supply voltages, provide a decoupling circuit (for example a ferrite in series connection and a bypass capacitor to ground of at least 47uF directly at the module).

(3) This product should not be mechanically stressed when installed.

(4) Keep this product away from heat. Heat is the major cause of decreasing the life of these products.

(5) Avoid assembly and use of the target equipment in conditions where the products' temperature may exceed the maximum tolerance.

(6) The supply voltage should not be exceedingly high or reversed. It should not carry noise and/or spikes.

(7) this product away from other high frequency circuits.

Notes on Antenna and PCB Layout

(1) Don t use a module with internal antenna inside a metal case.

(2) For PCB layout:

- Avoid running any signal line below module whenever possible,
- No ground plane below antenna,
- If possible, cut-off the portion of main board PCB below antenna.

Installation Notes

(1) Reflow soldering is possible twice based on the time-temperature profile in this data sheets. Set up the temperature at the soldering portion of this product according to this reflow profile.

(2) Carefully position the products so that their heat will not burn into printed circuit boards or affect the other components that are susceptible to heat.

(3) Carefully locate these products so that their temperatures will not increase due to the effects of heat generated by neighboring components.

(4) If a vinyl-covered wire comes into contact with the products, then the cover will melt and generate toxic gas, damaging the insulation. Never allow contact between the cover and these products to occur.

(5) This product should not be mechanically stressed or vibrated when reflowed.

(6) If you want to repair your board by hand soldering, please keep the conditions of this chapter.

(7) Do not wash this product.

(8) Refer to the recommended pattern when designing a board.

(9) Pressing on parts of the metal cover or fastening objects to the metal will cause damage to the unit.

(10) For more details on LGA (Land Grid Array) soldering processes refer to the application note.

Usage Condition Notes

(1) Take measures to protect the unit against static electricity. If pulses or other transient loads (a large load applied in a short time) are applied to the products, check and evaluate their operation before assembly on the final products.

(2) Do not use dropped products.

(3) Do not touch, damage or soil the pins.

(4) Follow the recommended condition ratings about the power supply applied to this product.

(5) Electrode peeling strength: Do not add pressure of more than 4.9N when soldered on PCB

(6) Pressing on parts of the metal cover or fastening objects to the metal cover will cause damage.

(7) These products are intended for general purpose and standard use in general electronic equipment, such as home appliances, office equipment, information and communication equipment.

Storage Notes

(1)The module should not be stressed mechanically during storage.

(2)Do not store these products in the following conditions or the performance characteristics of the product, such as RF performance will be adversely affected:

- Storage in salty air or in an environment with a high concentration of corrosive gas.
- Storage in direct sunlight
- Storage in an environment where the temperature may be outside the range specified.
- Storage of the products for more than one year after the date of delivery storage period.

(3) Keep this product away from water, poisonous gas and corrosive gas.

(4) This product should not be stressed or shocked when transported.

(5) Follow the specification when stacking packed crates (max. 10).

Safety Conditions

These specifications are intended to preserve the quality assurance of products and individual components. Before use, check and evaluate the operation when mounted on your products. Abide by these specifications, without deviation when using the products. These products may short-circuit. If electrical shocks, smoke, fire, and/or accidents involving human life are anticipated when a short circuit occurs, then provide the following failsafe functions, as a minimum.

(1)Ensure the safety of the whole system by installing a protection circuit and a protection device.

(2)Ensure the safety of the whole system by installing a redundant circuit or another system to prevent a dual fault causing an unsafe status.

Other Cautions

(1)This specification sheet is copyrighted. Reproduction of this data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices.

(2)Do not use the products for other purposes than those listed.

(3)Be sure to provide an appropriate failsafe function on your product to prevent an additional damage that may be caused by the abnormal function or the failure of the product.

(4)This product has been manufactured without any ozone chemical controlled under the Montreal Protocol.

(5)These products are not intended for other uses, other than under the special conditions shown below. Before using these products under such special conditions, check their performance and

reliability under the said special conditions carefully to determine whether or not they can be used in such a manner.

- In liquid, such as water, salt water, oil, alkali, or organic solvent, or in places where liquid may splash.
- In direct sunlight, outdoors, or in a dusty environment
- In an environment where condensation occurs.
- In an environment with a high concentration of harmful gas.

(6) If an abnormal voltage is applied due to a problem occurring in other components or circuits, replace these products with new products because they may not be able to provide normal performance even if their electronic characteristics and appearances appear satisfactory.

(7) When you have any question or uncertainty, contact Fanstel.

Packaging

Production modules are delivered in reel, 1000 modules in each reel.

FCC LABEL

The Original Equipment Manufacturer (OEM) must ensure that the OEM modular transmitter must be labeled with its own FCC ID number. This includes a clearly visible label on the outside of the final product enclosure that displays the contents shown below. If the FCC ID is not visible when the equipment is installed inside another device, then the outside of the device into which the equipment is installed must also display a label referring to the enclosed equipment

The end product with this module may subject to perform FCC part 15 unintentional emission test requirement and be properly authorized.

This device is intended for OEM integrator only.

Revision History

- Jan. 2023, Ver. 0.90: Initial draft release.
- Feb. 2023, Ver. 0.91: Update block diagram and EV board schematics.
- Mar. 2023, Ver. 0.92: Update module names and add preliminary WiFi range measurement results.
- July 2023, Ver. 0.93: update WiFi range measurements for new chip antenna.
- Oct. 2023, Ver.0.94: Update mechanical drawings.
- May 2024, Ver.0.95: Update mechanical drawings and WiFi ranges measurement results with SDK 2.5.0.
- June 2024, Ver.0.96: Update for production version information.
- Aug. 2024, Ver. 0.97: Update mechanical drawings.

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Federal Communications Commission (FCC) Statement

15.21
You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

15.105(b)
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.
-Increase the separation between the equipment and receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1) this device may not cause harmful interference, and

2) this device must accept any interference received, including interference that may cause undesired operation of the device.

FCC RF Radiation Exposure Statement
1) This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
2) This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.
This equipment should be installed.
Note: The end product shall has the words "Contains Transmitter Module FCC ID: X8WWM02C".

Canada, Industry Canada (IC)
This Class B digital apparatus complies with Canadian ICES-003
Cet appareil numérique de classe B est conforme à la norme NMB-003.
This device complies with Industry Canada licence-exempt RSS standard(s). *Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the*
Le present appareil est conforme aux CNR d'Industrie Canada applicables auxappareils radio exempts de licence.L'exploitation est autorisée aux deux conditions suivantes:
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage adioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Conformité des appareils de radiocommunication aux limites d'exposition humaine aux radiofréquences (CNR-102)

L'ordinateur utilise des antennes intégrales à faible gain qui n'émettent pas un champ électromagnétique supérieur aux normes imposées par Santé Canada pour la population. Consultez le Code de sécurité 6 sur le site Internet de Santé Canada à l'adresse suivante : http://www.hc-sc.gc.ca/

L'énergie émise par les antennes reliées aux cartes sans fil respecte la limite d'exposition aux radiofréquences telle que définie par Industrie Canada dans la clause 4.1 du document CNR-102, version 4.

Caution: Exposure to Radio Frequency Radiation.

To comply with RSS 102 RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.

Pour se conformer aux exigences de conformité CNR 102 RF exposition, une distance de séparation d'au moins 20 cm doit être maintenue entre l'antenne de cet appareil et toutes les personnes.

(Modular approval) End Product Labeling:

The final end product must be labeled in a visible area with the following: “Contains IC: 4100A-WM02C”.

Le produit final doit être étiqueté dans une zone visible avec ce qui suit “Contient IC : 4100A-WM02C “

NCC 警語:

取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻器材之使用不得影響飛航安全及干擾合法通信;經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前述合法通信，指依電信管理法規定作業之無線電通信。低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。