



FPM20 Microprocessor and Communication Module

DATA SHEET

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GENERAL DESCRIPTION

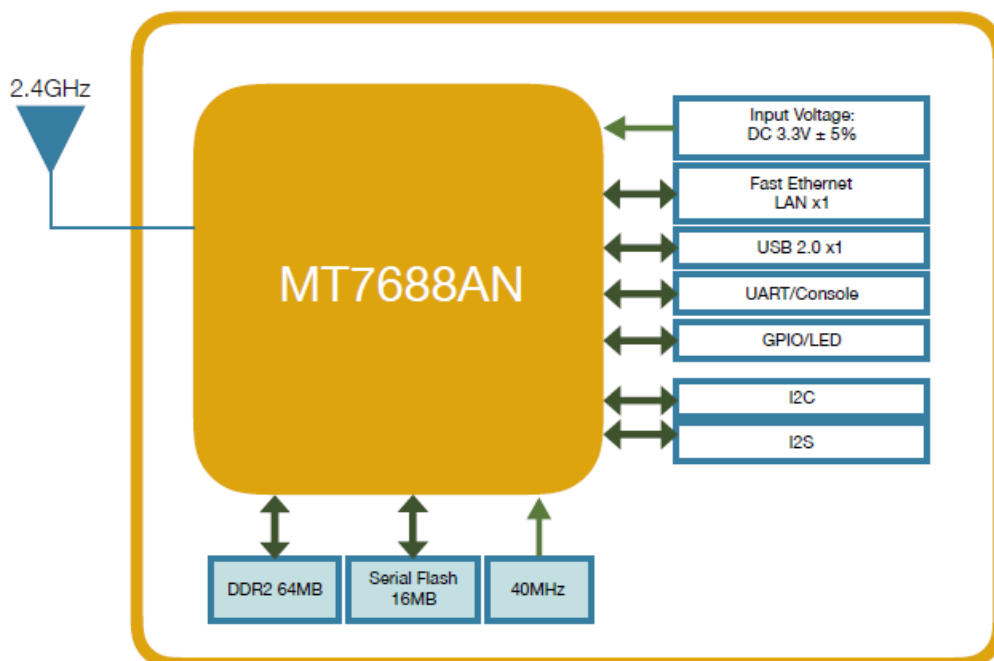
Model Name

The module will be referred to as “FPM20”.

Features

- Based on MediaTek MT7688 system-on-a-chip (SoC) platform
- Embedded MIPS24KEc (575/580 MHz) with 64 KB I-Cache and 32 KB D-cache
- 16MB serial flash and 64MB DDR2 DRAM
- 1-port 10/100 FE PHY
- 16 Multiple BSSID
- AES128/256-CBC
- WEP64/128/, TKIP, AES, WPA, WPA2, WAPI
- WPS: PBC, PIN
- Small size: 34mm*28mm

Block Diagram

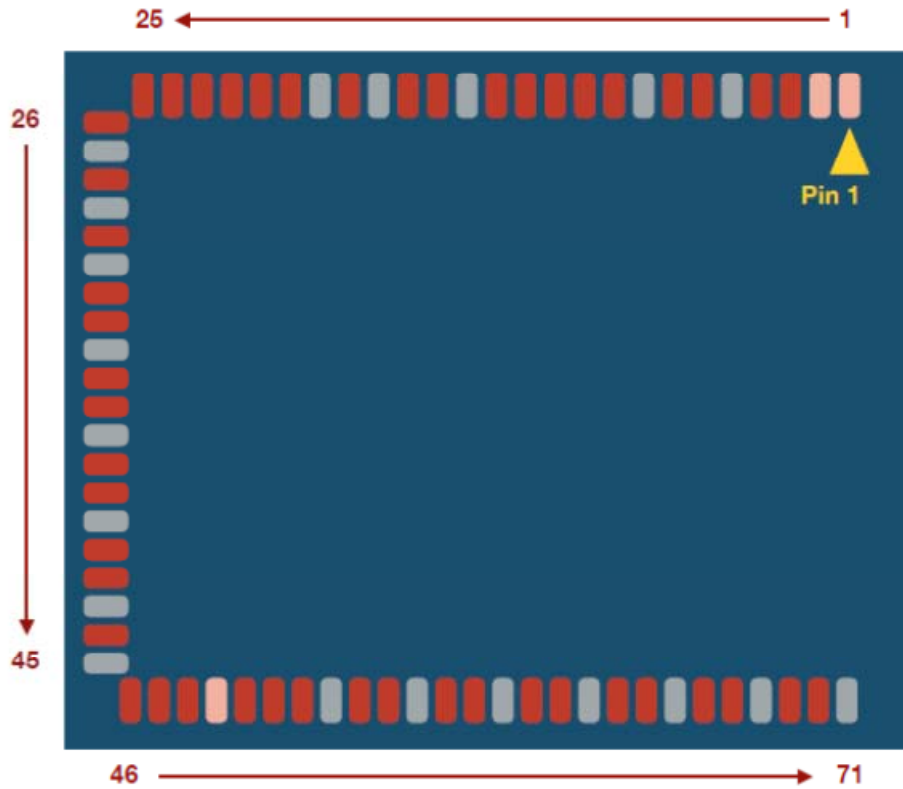


HARDWARE SPECIFICATION

General Specifications

Form Factor	Stamp Hole
Host Interfaces	USB 2.0, FAST Ethernet, I2S, I2C, UART, GPOI
Chipset	CPU: MediaTek MT7688AN
	Serial Flash: 16Mbytes
	SDRAM DDR2: 64Mbytes
Network Standard	IEEE 802.11 b/g/n
Modulation Techniques	NPSK, QPSK, CCK, 16QAM, 64QAM, 256QAM
Modulation Technology	CCK, OFDM, DSSS, MIMO (1T1R)
Supported Data Rate	IEEE 802.11b Standard Mode: 1, 2, 5.5, 11 Mbps IEEE 802.11g Standard Mode: 6, 9, 12, 18, 24, 36, 48, 54 Mbps IEEE 802.11n MCS0-MCS15 PHY rate up to 300Mbps
Network Architectures	Bridge Mode, AP Client
Antenna Type	External antenna for Wi-Fi transmit and receive Antenna port impedance: 50 ohm
Operating Frequency	802.11b/g/n: 2.412GHz — 2.462GHz
Operating Channel	802.11b/g/n: CH1 to CH11 1-11ch for North America
Security	WEP 64/128, WPA, WPA2, TKIP, CKIP, AES, CCMP, WAPI
Temperatures (ambient)	Operates from 0 to 55°C Storage from -10 to 85°C
Humidity (non-condensing)	Operating humidity: 10 ~ 90% RH Storage humidity: 10 ~ 95% RH
OS Compatibility	Linux
PCB Dimension	34mm × 28mm

Pin Definition



Pin Assignment

Pin	Assignment	GPIO	Used	Type	Description
1	3.3V		YES	P	3.3V power supply
2	3.3V		YES	P	3.3V power supply
3	NC		NO	NC	Not connected
4	REF_CLK		YES	O	Reference clock output
5	GND		YES	G	Ground
6	WPS_RST_PBC		YES	O	Watchdog timeout reset
7	EPHY_LED4_N_JTRST_N		YES	I/O	10/100 PHY port #4 activity LED, JTAG_TRST_N

Pin	Assignment	GPIO	Used	Type	Description
8	GND		YES	G	Ground
9	EPHY_LED3_N_JTCLK		YES	I/O	10/100 PHY port #3 activity LED, JTAG_CLK
10	EPHY_LED2_N_JTMS		YES	I/O	10/100 PHY port #2 activity LED, JTAG_TMS
11	EPHY_LED1_N_JTDI		YES	I/O	10/100 PHY port #1 activity LED, JTAG_TDI
12	EPHY_LED0_N_JTDO		YES	I/O	10/100 PHY port #0 activity LED, JTAG_TDO
13	WLED_N		YES	O	WLAN activity LED
14	GND		YES	G	Ground
15	UART_TXD1	45	YES	O	UART1 lite TXD
16	UART_RXD1	46	YES	I	UART1 lite RXD
17	GND		YES	G	Ground
18	I2C_SCLK	4	YES	I/O	I2C clock
19	GND		YES	G	Ground
20	I2C_SD	5	YES	I/O	I2C data
21	I2S_WS	2	YES	O	I2S word select
22	I2S_DI	0	YES	O	I2S data input
23	NC		NO	NC	Not connected
24	3.3V		YES	P	3.3V power supply
25	3.3V		YES	P	3.3V power supply
26	ANT0		YES	I/O	RF0 input/output
27	GND		YES	G	Ground
28	I2S_DO	1	YES	I/O	I2S data output
29	GND		YES	G	Ground
30	I2S_CLK	3	YES	I/O	I2S clock
31	GND		YES	G	Ground
32	UART_TXD0	12	YES	O	UART0 lite TXD
33	UART_RXD0	13	YES	I	UART0 lite RXD

Pin	Assignment	GPIO	Used	Type	Description
34	GND		YES	G	Ground
35	RXIP0		YES	A	10/100 PHY port#0 RXP
36	RXIN0		YES	A	10/100 PHY port#0 RXN
37	GND		YES	G	Ground
38	TXIP0		YES	A	10/100 PHY port#0 TXP
39	TXIN0		YES	A	10/100 PHY port#0 TXN
40	GND		YES	G	Ground
41	SPIS_CS/TXOP1	14	YES	A	SPI Bus Chip select & 10/100 PHY port#1 TXP
42	SPIS_CLK/TXON1	15	YES	A	SPI Bus clock & 10/100 PHY port#1 TXN
43	GND		YES	G	Ground
44	ANT1		NO	I/O	RF1 input/output
45	GND		YES	G	Ground
46	SPIS_MISO/RXIP1/UART-TXD2	16	YES	A	SPI Bus Master Input/Slave Output & 10/100 PHY port#1 RXP
47	SPIS_MOSI/RXIN1/UART-RXD2	17	YES	A	SPI Bus Master Output/Slave Input & 10/100 PHY port#1 RXN
48	NC		NO	NC	Not connected
49	3.3V		YES	P	3.3V power supply
50	NC		NO	NC	Not connected
51	PWM_CH0/RXIP2	18	YES	A	PWM_CH0 mode & 10/100 PHY port #2 RXP
52	PWM_CH1/RXIN2	19	YES	A	PWM_CH1 mode & 10/100 PHY port #2 RXN
53	GND		YES	G	Ground
54	UART_TXD2/PWM_CH2/ TXOP2	20	YES	A	PWM_CH2 mode & 10/100 PHY port #2 TXP
55	UART_RXD2/PWM_CH3/ TXON2	21	YES	A	PWM_CH3 mode & 10/100 PHY port #2 TXN
56	GND		YES	G	Ground
57	SD_WP/TXOP3	22	YES	A	SDIO_WP & 10/100 PHY port #3 TXP

Pin	Assignment	GPIO	Used	Type	Description
58	SD_CD/TXON3	23	YES	A	SDIO_CD & 10/100 PHY port #3 TXN
59	GND		YES	G	Ground
60	SD_D1/RXIP3	24	YES	A	SDIO_D1 & 10/100 PHY port #3 RXP
61	SD_D0/RXIN3	25	YES	A	SDIO_D0 & 10/100 PHY port #3 RXN
62	GND		YES	G	Ground
63	SD_CLK/RXIP4	26	YES	A	SDIO_CLK & 10/100 PHY port #4 RXP
64	SD_CMD/RXIN4	27	YES	A	SDIO_CMD & 10/100 PHY port #4 RXN
65	GND		YES	G	Ground
66	SD_D3/TXOP4	28	YES	A	SDIO_D3 & 10/100 PHY port #4 TXP
67	SD_D2/TXON4	29	YES	A	SDIO_D2 & 10/100 PHY port #4 TXN
68	GND		YES	G	Ground
69	USB_D+		YES	I/O	USB port 0 data pin data+
70	USB_D-		YES	I/O	USB port 0 data pin data-
71	GND		YES	G	Ground

Notes:

1. RF antenna connects should use a specific connector or be directly soldered. Refer to Module Engineering Suggestions in this document.

Electronic Specification

Symbol	Parameter	Min	Typical	Max	Unit	Note
Ts	Storage Temperature	-10		+85	°C	Condition at 3.3V, 25°C
Tw	Working Temperature	0	+25	+55	°C	

Power Consumption

Vcc	Supplied Voltage		3.3		V	
Pt(Tx)	WLAN Current Consumption in Transmit Mode					TX Mode
	CCK 1Mbps		408		mA	
	CCK 11Mbps		363		mA	
	OFDM 6Mbps		279		mA	
	OFDM 54 Mbps		215		mA	
	HT20 MCS0		290		mA	
	HT20 MCS7		230		mA	
	HT40 MCS0		224		mA	
	HT40 MCS7		260		mA	
Pt(Rx)	WLAN Current Consumption in Receive Mode					RX Mode
	2.4G OFDM 54Mbps		179		mA	
	2.4G HT20 MCS7		179		mA	
	2.4G HT40 MCS15		181		mA	

Radio Specification

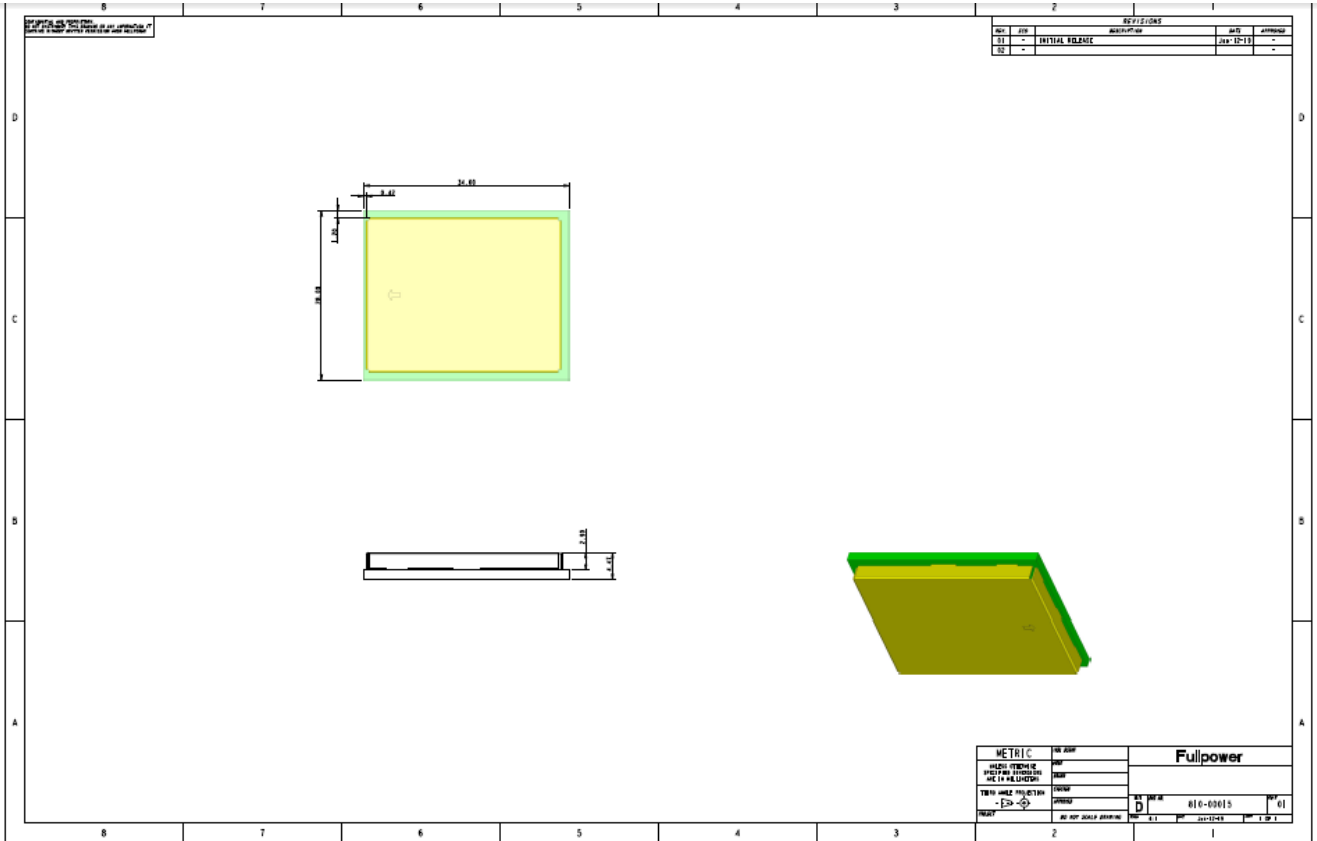
Condition: Vcc=3.3VDC, Temp=25°C

Parameter	Min	Typical	Max	Unit
11b				
Frequency range	2412		2472	MHz
Channel	1		13	
Tx power @11Mbps		18		dBm
<u>Tx SpectrumMask</u>				
Transmitted spectral for frequency at $fc \pm 11\text{MHz}$ to $fc \pm 22\text{MHz}$			-30	dBr
Transmitted spectral for frequency at $fc \pm 22\text{MHz}$ to $fc \pm 33\text{MHz}$			-50	dBr
Rx sensitivity @ 11b 11Mbps PER < 8%		-76		dB
11g				
Frequency range	2412		2472	MHz
Channel	1		13	
Tx power @54Mbps		16		dBm
<u>Tx SpectrumMask</u>				
Transmitted spectral at 11MHz frequency offset			-20	dBr
Transmitted spectral at 20MHz frequency offset			-28	dBr
Transmitted spectral at 30MHz frequency offset			-45	dBr
Rx sensitivity @ 11g 54Mbps PER < 10%		-65		dB
11n HT20 2.4GHz				
Frequency range	2412		2472	MHz
Channel	1		13	
Tx power @MCS7		16		dBm
<u>Tx Spectrum Mask</u>				

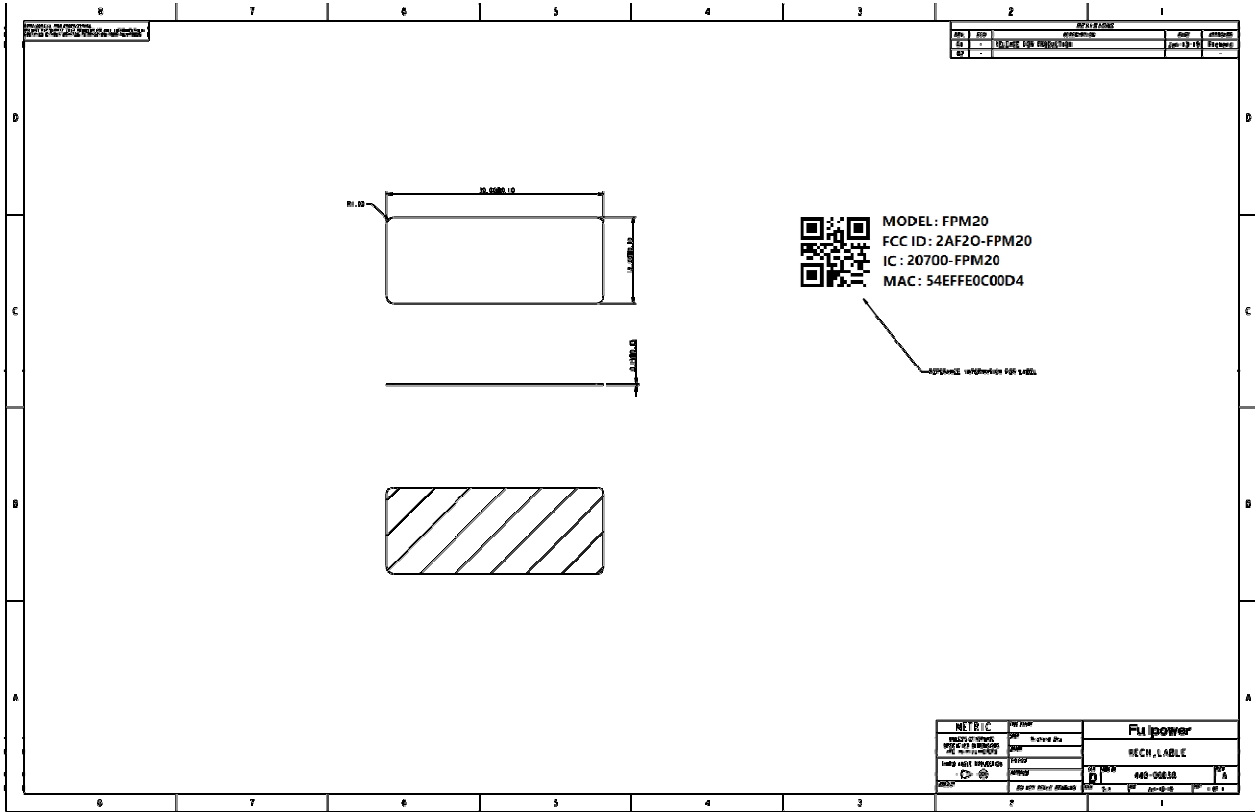
Parameter	Min	Typical	Max	Unit
Transmitted spectral at 11MHz frequency offset			-20	dBr
Transmitted spectral at 20MHz frequency offset			-28	dBr
Transmitted spectral at 30MHz frequency offset			-45	dBr
Rx sensitivity @ 11n 130Mbps PER < 10%		-64		dB
11n HT40 2.4GHz				
Frequency range	2422		2462	MHz
Channel	3		11	
Tx power @MCS7		15		dBm
<u>Tx Spectrum Mask</u>				
Transmitted spectral at 21MHz frequency offset			-20	dBr
Transmitted spectral at 40MHz frequency offset			-28	dBr
Transmitted spectral at 60MHz frequency offset			-45	dBr
Rx sensitivity @ 11n 270Mbps PER < 10%		-64		dB

MECHANICAL AND LABEL SPECIFICATIONS

Mechanical Drawing



Label Drawing



PRODUCT PHOTO AND CERTIFICATION

Product Photo



Certification List

- FCC: 47 CFR FCC Part 15.247
- Industry Canada: RSS-247 Issue 1 and RSS-Gen Issue 4

MODULE ENGINEERING SUGGESTIONS

Recommended RF Switches and Connectors

Type: RF Switch/Connector

Description: SWITCH SMD RF 50 OHMS IMPEDANCE DC TO 11GHz

MFG P/N: Murata MM8030-2610RJ3

Distributor P/N: Digi-Key 490-5907-2-ND

Type: RF SMA Connector

Description: CONN PTH SMA 5-PIN RF 50 OHMS R/A

MFG P/N: Molex 731000114

Distributor P/N: Digi-Key WM5525-ND

Antenna Information and Layout

Antenna design and RF layout are critical in a wireless system that transmits and receives electromagnetic radiation in free space.

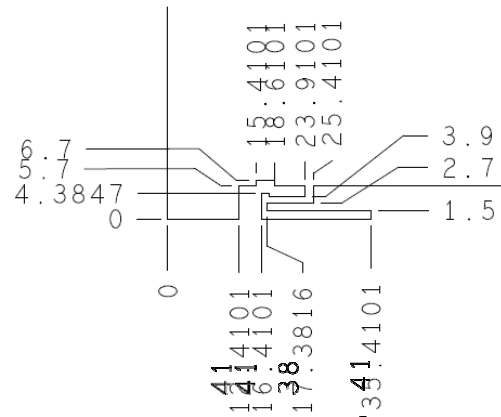
Other important general layout considerations for RF trace, power supply decoupling, via holes, PCB stackup, antenna and grounding are critical. The RF layout together with the radio matching network needs to be properly designed to ensure that most of the power from the radio reaches the antenna and vice versa.

PCB Antenna: This is a trace drawn on the PCB. This trace is a Planar Inverted-F Antenna (PIFA) which consists of a monopole antenna running parallel to a ground plane and grounded at one end. The antenna is fed from an intermediate point a distance from the grounded end. A PCB antenna requires more PCB area, but is cheaper. It has easy manufacturability and has great wireless range.

Antenna tuning ensures that the antenna impedance is matched to 50 Ω looking towards the antenna. Radio tuning ensures that the impedance looks 50 Ω , looking towards the chip, when the chip is in the receive mode.

The antenna Gain: 2dBi

Antenna manufacturer: Fullpower Technologies, Inc.



PLANAR INVERTED-F ANTENNA (PIFA)

Parameters Layers

Padstack layers

Single layer mode

Layer	Regular Pad	Thermal Relief	ti P
Bgn TOP	Oblong 1.0000 X 2.0000	Oblong 1.5000	Oblong 1.5000
-> SOLDERMASK_TOP	Oblong 1.1000 X 2.1000	N/A	N/A
SOLDERMASK_BOTTOM	Null	N/A	N/A
PASTEMASK_TOP	Oblong 1.0000 X 2.0000	N/A	N/A
PASTEMASK_BOTTOM	Null	N/A	N/A
FILMMASK_TOP	Null	N/A	N/A
FILMMASK_BOTTOM	Null	N/A	N/A

Views

Type: Single

XSection Top

Regular Pad

Geometry: Oblong

Shape: [] ...

Flash: [] ...

Width: 1.0000

Height: 2.0000

Offset X: 0.0000

Offset Y: 0.0000

Thermal Relief

Geometry: Oblong

Shape: [] ...

Flash: [] ...

Width: 1.5000

Height: 2.5000

Offset X: 0.0000

Offset Y: 0.0000

Anti Pad

Geometry: Oblong

Shape: [] ...

Flash: [] ...

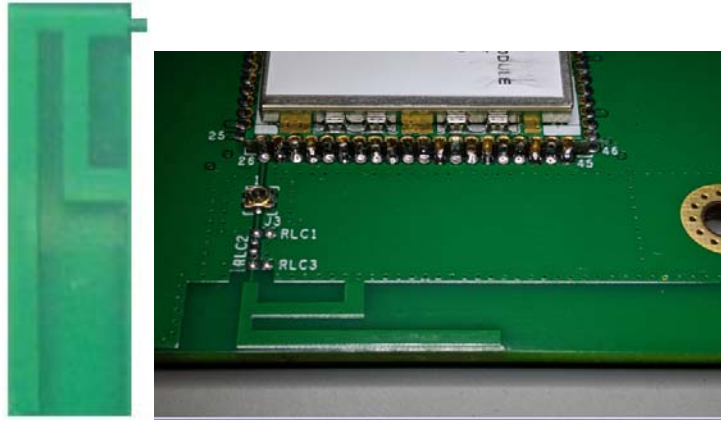
Width: 1.5000

Height: 2.5000

Offset X: 0.0000

Offset Y: 0.0000

Current layer: TOP



ANT List

No.	Type	Bands	Ant Gain(dBi)
1	PCB antenna	2.4GHz-2.5GHz	2.0

Product Label Suggestion

Any product that includes the FPM20 should include the following information on the label:

Contains transmitter module FCC ID: 2AF2O-FPM20, IC: 20700-FPM20

User Documentation Suggestion (Regulatory Statement of Compliance)

The following statements of compliance are suggested for end user documentation.

FCC Statement of Compliance

This equipment complies with Part 15 of the FCC Rules. Operation of this equipment is subject to the following two conditions: (1) the equipment may not cause harmful interference, and (2) the equipment must accept any interference that might cause undesired operation.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipmen

Note: 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.

Industry Canada Statement of Compliance

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 device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils 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 radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement

This radio module must not be installed to co-locate and operate simultaneously with other radios in a host system, additional testing and equipment authorization may be required to operate simultaneously with other radios.

The module is designed to comply with the FCC andISED statement . FCC ID:2AF2O-FPM20, IC: 20700-FPM20. The host system using this module, should have a label indicating it contains the module's FCC ID: 2AF2O-FPM20. And should also contain IC: 20700-FPM20

Exposure to Radio Frequency Energy

This equipment complies with radiation exposure limits set forth in the FCC's OET Bulletin 65 and Industry Canada's RSS-102 standard for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm (about 8 inches) between the radiator and your body. This equipment must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM statement

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 be subject to perform FCC part 15 unintentional emission test requirements and be properly authorized.

This device is intended for OEM integrator only

The requirement for KDB 996369 D03:

1. List of applicable FCC rules

FCC Part 15. 247.

No.	Description
1	Peak Output Power
2	6dB and 99% Occupied Bandwidth
3	Conducted Band Edges and Spurious Emission
4	Power spectral density (PSD)
5	Conducted Emission
6	Radiated Band Edges and Spurious Emission

2. Summarize the specific operational use conditions

This device is intended for OEM integrators only. Please see the full grant of equipment document for restrictions.

3. Limited module procedures

The module is a Limited module, the modular have it's own RF shielding, minimum signaling amplitude, buffered modulation/data inputs, and power supply regulation($3.3V \pm 5\%$) and all these information please see the Hardware Specification and Electronic Specification.

4. Trace antenna designs

The module uses the PCB antenna, please see above antenna designs information.

5. RF exposure considerations

The host device manufacturer should confirm that a separation distance of 20 cm or more should be maintained between the antenna of this host device and persons during the host device operation.

6. Antennas

The device itself has no antenna, customer can use the antenna as above trace antenna list type Or other antenna gain of the final device or host device cannot be greater than 18dBi

7. Label and compliance information

If this certified module is installed inside the host device, then the outside of the host must be labeled with "Contains FCC ID: 2AF2O-FPM20 and IC: 20700-FPM20".

8. Information on test modes and additional testing requirements

The host manufacturer can use the software of SecureCRT Tool to make to make the wifi transmit continuously.

9. Additional testing, Part 15 Subpart B disclaimer

The module only complies with the FCC Part 15.247. If the module is installed in the host device, the host manufacturer is responsible for the compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. For example, if the host manufacturer markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the host manufacturer shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

RoHS Information

This product, as well as its components, are in conformity with the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

REVISION HISTORY

Date	Who	Notes
June 14, 2019	Louis Bouchard	Initial draft