WAC-2241-M2

IEEE 802.11 ac/a/b/g/n/ WLAN + Bluetooth 4.1

M.2 2230 Combo Module

Datasheet

Version 0.5

B4

Revision History

Document Release	Date	Modification	Initials	Approved
Version 0.1	2014/08/04	Initial Release	Chao Lee	Chihhao Liao
Version 0.2	2014/08/27	Update mechanical drawing	Kevin Lin	Chihhao Liao
Version 0.3	2015/3/31	Update mechanical drawing	Yvonne Chen	Patrick Lin
Version 0.4	2015/4/17	Update power specifications	Chao Lee	Chihhao Liao
Version 0.5	2015/5/21	Update BT power specifications	Chao Lee	Chihhao Liao

1. Introduction

Gemicom Technology, Inc. introduces the pioneering IEEE 802.11 ac/a/b/g/n WIFI with Bluetooth 4.1 class I M.2 combo module --- **WAC-2241-M2.**   This module is a highly integrated wireless local area network (WLAN) solution to let users enjoy the digital content through the latest wireless technology without using the extra cables and cords.   It is fully compliant to Bluetooth 4.1 and v2.1 and supports EDR of 2Mbps and 3Mbps for data and audio communications.   It enables a **high performance, cost effective, low power, compact solution**.

Compliant with the IEEE 802.11a/b/g/n/ac standard, this module uses Direct Sequence Spread Spectrum **(DSSS)**, Orthogonal Frequency Division Multiplexing **(OFDM), BPSK, QPSK, CCK** and **QAM** baseband modulation technologies.

Compare to 802.11n technology, 802.11ac standard makes big improvement on speed and range.
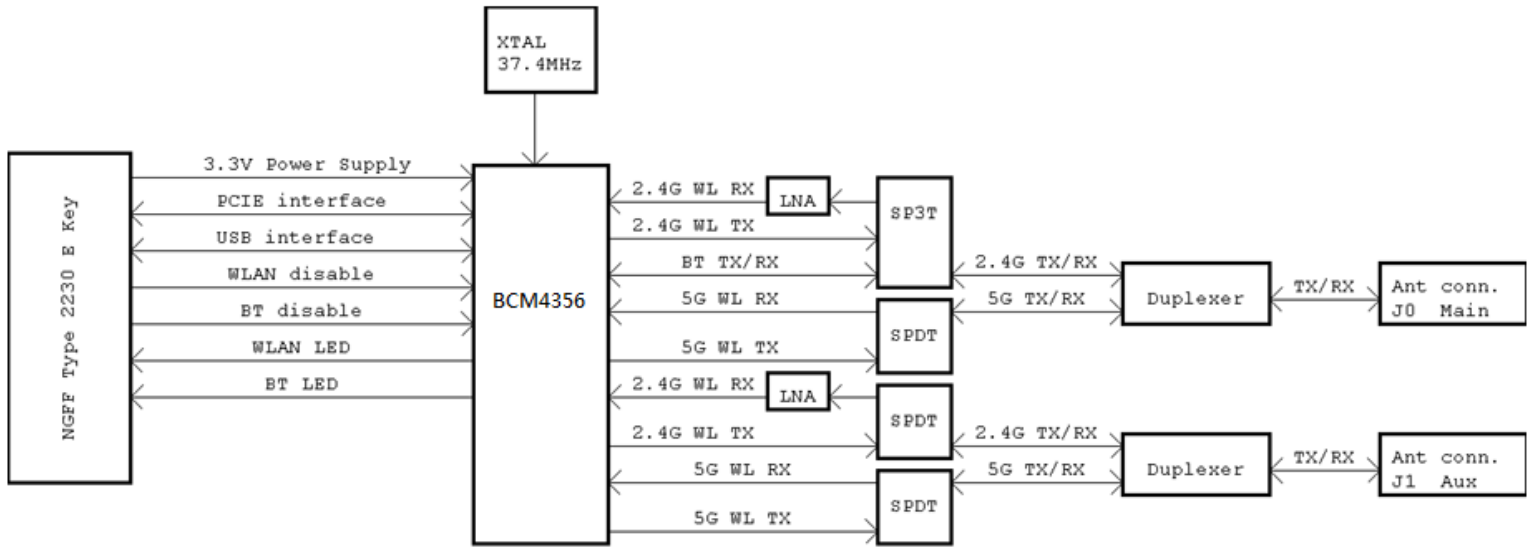
Faster Speed: WLAN up to 867Mbps data rate.

This module adopts Broadcom dual-band WLAN & Bluetooth **BCM4356** single chip solution. All the other components are implemented by all means to reach the mechanical specification required.

2. Features

◆ Wireless connection up to 867 Mbps for Wi-Fi

◆ 2 antennas to support 2(Transmit) × 2(Receive) diversity technology and Bluetooth

◆ WCS (Wireless Coexistence System)

◆ Low power consumption and high performance

◆ Enhanced wireless security

◆ Fully qualified Bluetooth BT4.1

◆ Enhanced Data Rate(EDR) compliant for both 2Mbps and 3Mbps supported

◆ Fully speed operation with Piconet and Scatternet support

◆ Electrical compliant to USB1.1 & 2.0

3. Block Diagram

4. General Specifications

Model Name	WAC-2241-M2
Product Description	IEEE 802.11 a/b/g/n/ac Wi-Fi with Bluetooth 4.1 class I M.2 Combo Module
Bluetooth Standard	Bluetooth4.1
Host Interface	Wi-Fi : PCI-E , BT : USB
Major Chipset	Broadcom BCM4356
Wi-Fi VID/PID	14E4/43EC
Wi-Fi SSVID/SSPID	1A3B/221A
BT VID/PID	13D3 /3488
Dimension	22mm x 30mm x 2.2mm (Tolerance remarked in mechanical drawing)
Weight	2.4g
Antenna	I-PEX MHF4 Connector Receptacle (20449) 1.main(J0):WiFi TX/RX , BT TX/RX 2.aux(J1): WiFi TX/RX
Operating Conditions	
Voltage	power supply for host:3.3V+-5%
Operating Temperature	Operating: 0~80℃
Storage temperature	Storage: -20~85℃
Electrical Specifications	

Frequency Range	Wi-Fi: 2.4 GHz ISM Bands 2.412-2.472 GHz, 2.484 GHz /
	      5.15-5.25 GHz (FCC UNII-low band) for US/Canada, Japan and Europe
	      5.25-5.35 GHz (FCC UNII-middle band) for US/Canada and Europe
	      5.47-5.725 GHz for Europe
	      5.725-5.825 GHz (FCC UNII-high band) for US/Canada
	BT: 2402MHz~2483MHz

Modulation	Wi-Fi:
	  802.11 ac/a/b/g/n: OFDM
	  802.11b: CCK(11, 5.5Mbps), DQPSK(2Mbps), BPSK(1Mbps)
	BT:
	  Header GFSK
	  Payload 2M: 4-DQPSK
	  Payload 3M: 8DPSK

Output Power	Wi-Fi: nvram_p201
	  802.11a: 16+/-2dBm (54Mbps)
	  802.11b: 18+/-1.5dBm (11Mbps)
	  802.11g: 16+/-1.5dBm (54Mbps)
	  802.11n @2.4GHz: 15+/-1.5dBm (HT20 MCS7)

|	
	802.11n @2.4GHz: 15+/-1.5dBm (HT40 MCS7) **802.11n @5GHz: 15+/-2dBm (HT20 MCS7)** **802.11n @5GHz: 14.5+/-2dBm (HT40 MCS7)** **802.11ac @5GHz: 14+/-2dBm (HT80 MCS9)** **BT: 0 ≤ Output Power ≤ +10 dBm (Conductive)**

Receive Sensitivity	**Wi-Fi:**
	  802.11a: -65 dBm
	  802.11b: -76 dBm
	  802.11g: -65 dBm
	  802.11n@2.4GHz: HT20 MCS7 -64 dBm
	  802.11n @2.4GHz: HT40 MCS7 -61 dBm
	  802.11n@5GHz: HT20 MCS7 -64 dBm
	  802.11n @5GHz: HT40 MCS7 -61 dBm
	  802.11ac @5GHz: VHT80 MCS9 -51 dBm
	
	BT: BER < 0.1% (Anritsu 8852B Tx -70 dBm)

Operating Range	**Wi-Fi: Open Space: ~300M / Indoor:~100M** **(The transmission speed may vary according to the environment)** **BT: 10m~20m (depending on environment and NB model)**
Regulatory	**Follow BCM94356z regulatory list**

4-1. Absolute Maximum Ratings

Symbol	Parameter	Max. Rating	Unit
V_{dd33}	Maximum I/O supply voltage	+3.9V	V

4-2. Recommended Operating Conditions

Symbol	Parameter	Rating	Unit
V_{dd33}	I/O voltage	**3~3.63**	V

4-3. Power UP Sequencing

PCI EXPRESS CARD ELECTROMECHANICAL SPECIFICATION, REV. 2.0
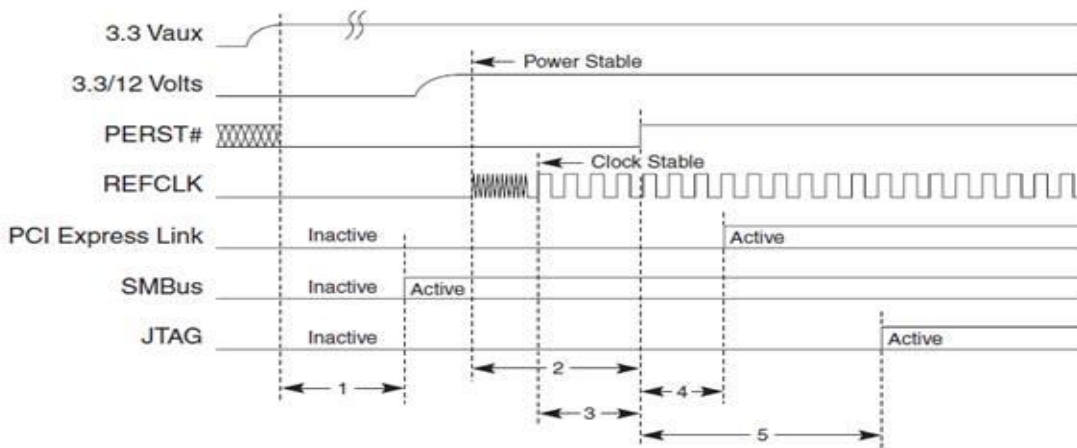
1. 3.3Vaux stable to SMBus driven (optional). If no 3.3Vaux on platform, the delay is from +3.3V stable
2. Minimum time from power rails within specified tolerance to PERST# inactive (T$_{PVPERL}$)
3. Minimum clock valid to PERST# inactive (T$_{PERST-CLK}$)
4. Minimum PERST# inactive to PCI Express link out of electrical idle
5. Minimum PERST# inactive to JTAG driven (optional)

OM14742B

Figure 2-10: Power Up

Table 2-4: Power Sequencing and Reset Signal Timings

Symbol	Parameter	Min	Max	Units	Notes	Figure
T$_{PVPERL}$	Power stable to PERST# inactive	100		ms	1	Figure 2-10
T$_{PERST-CLK}$	REFCLK stable before PERST# inactive	100		µs	2	Figure 2-10
T$_{PERST}$	PERST# active time	100		µs		Figure 2-11
T$_{FAIL}$	Power level invalid to PERST# active		500	ns	3	Figure 2-13
T$_{WKRF}$	WAKE# rise – fall time		100	ns	4	Figure 2-14

4-4. Power Consumption

WIRELESS

Test Bed		DELL Vostro 3560				
Test OS		Windows 8.1 Professional x64				
Test AP		Netgear R6300				
Driver Version		1.315.28_Winblue_WHCK_CS_x64_Driver_20150203				
Test Voltage		3.3V				
Item		2.4G	5G	2.4G	5G	Note
		Disable ASPM		L1 Mode		
No connect AP	AVG	27.6mA		10.4mA		
	MAX	146.1mA		129.2mA		
	MIN	25.8mA		8.6mA		
Connect AP	AVG	33.3mA	34.7mA	16.7mA	29.5mA	
	MAX	154.0mA	232.5mA	127.6mA	237.5mA	
	MIN	26.0mA	26.1mA	8.5mA	8.8mA	
WLAN RF OFF(airplane mode)		26.4mA		9.2mA		
Transmit by HT40/VHT80		503.9mA	650.1mA	478.1mA	642.8mA	
Receiver by HT40/VHT80		237.2mA	380.9mA	227.1mA	375.3mA	

1. The power consumption data were measured when NB operated in DC (battery) mode.
2. WLAN RF off mode in windows 8.1 under entering Airplane mode for testing.
3. Bluetooth function is disabled.

BLUETOOTH

Test Bed		DELL Vostro 3560	
Test OS		Windows 8.1 Professional x64	
Driver Version		BTW12.0.1.450_Win8.1_USB	
Test Voltage		3.3V	
Item		Current value	Note
No connect BT device	AVG	9.4mA	
	MAX	12.8mA	
	MIN	8.7mA	
connect BT device	AVG	11.2mA	
	MAX	16.7mA	
	MIN	10.4mA	
BT RF OFF		9.2mA	
Transmit by EDR 2.1		24.5mA	
Receiver by EDR 2.1		19.9mA	

1. The power consumption data were measured when NB operated in DC (battery) mode.
2. Wifi function is disabled.

5. Connector Pin-out Definitions (2230 NGFF Notch E)

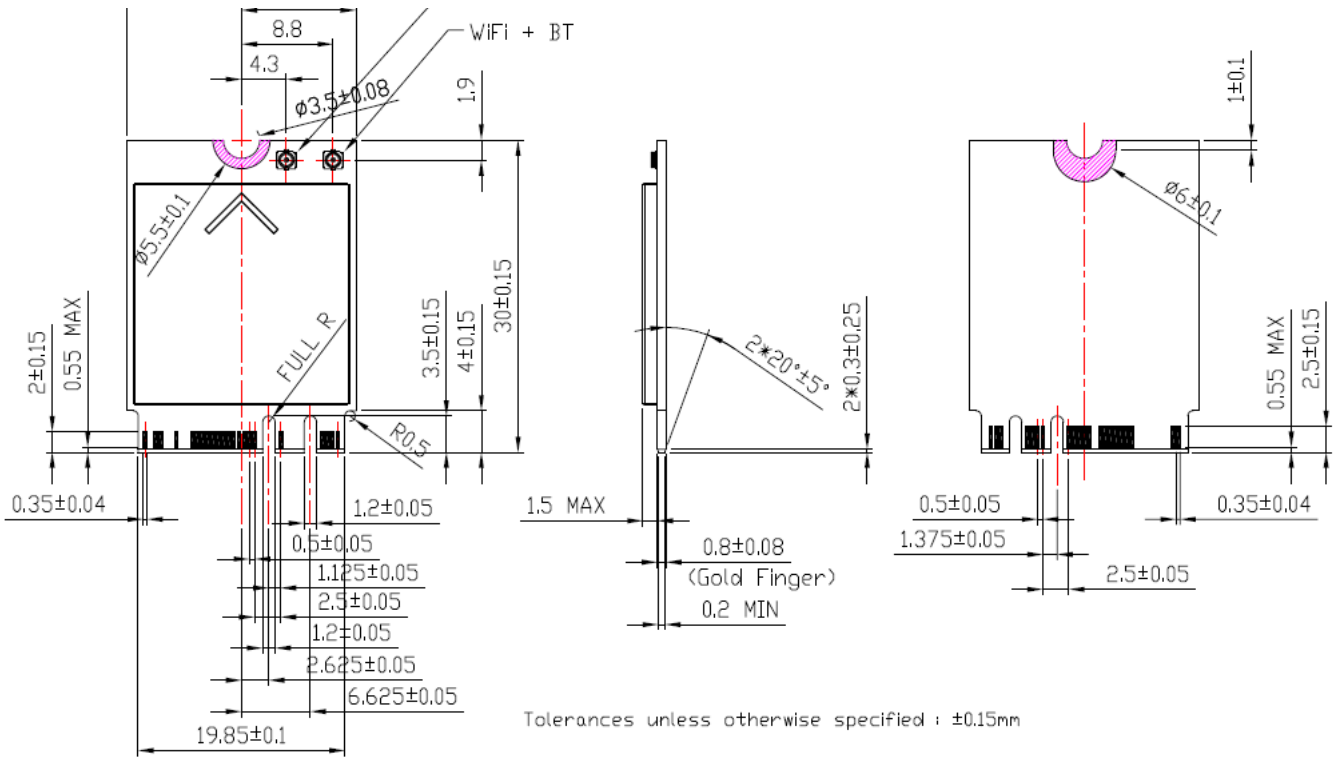| Pin No.	Definition	Basic Description	Type	Voltage
1	GND	Ground.	GND	
2	3.3V	3.3V power supply.	VCC	3.3V
3	USB_D+	USB (Host) data negative. Negative terminal of the USB transceiver.	Input/Output	
4	3.3V	3.3V power supply.	VCC	3.3V
5	USB_D-	USB (Host) data positive. Positive terminal of the USB transceiver.	Input/Output	
6	LED1#	WLAN LED, Active low.	Output	3.3V
7	GND	Ground.	GND	
8	PCM_CLK	PCM Clock/I2S Continuous serial clock. (in this project is not used, please let it open)	Input/Output	1.8V
9	SDIO_CLK	SDIO 3.0 Clock. (in this project is not used, please let it open)	Input	1.8V
10	PCM_SYNC	PCM Synchronous dada sync/I2S Word select . (in this project is not used, please let it open)	Input/Output	1.8V
11	SDIO_CMD	SDIO Command interface. (in this project is not used, please let it open)	Input/Output	1.8V
12	PCM_OUT	PCM Synchronous data output/I2S Serial Data OUT. (in this project is not used, please let it open)	Output	1.8V
13	SDIO_DATA0	4 lines for SDIO Data exchange. (in this project is not used, please let it open)	Input/Output	1.8V
14	PCM_IN	PCM Synchronous data input/I2S Serial Data IN. (in this project is not used, please let it open)	Input	1.8V
15	SDIO_DATA1	4 lines for SDIO Data exchange. (in this project is not used, please let it open)	Input/Output	1.8V
16	LED2#	BT LED, Active low.	Output	3.3V
17	SDIO_DATA2	4 lines for SDIO Data exchange. (in this project is not used, please let it open)	Input/Output	1.8V
18	GND	Ground.	GND	
19	SDIO_DATA3	4 lines for SDIO Data exchange. (in this project is not used, please let it open)	Input/Output	1.8V
20	BT_HOST_WAKE_L	BT Wake, Active low(after SW download). (in this project is not used, please let it open)	Output	3.3V
21	SDIO_WAKE_L	SDIO Wake, Active low. (in this project is not used, please let it open)	Output	1.8V
22	UART_TX	UART Transmit data. (in this project is not used, please let it open)	Output	1.8V
23	SDIO Reset_L (WL_REG_ON)	This signal is used by the PMU to power up the WLAN section. Active low. (in this project is not used, please let it open)	Input	1.8V
32	UART_RX	UART Receive data. (in this project is not used, please let it open)	Input	1.8V
33	GND	Ground.	GND	
34	UART_RTS	UART Ready To Send. (in this project is not used, please let it open)	Output	1.8V
35	PERP0	Differential receiver.	Input	
36	UART_CTS	UART Clear To Send. (in this project is not used, please let it open)	Input	1.8V
37	PERN0	Differential receiver.	Input	

38	RESERVED1	JTAG function pin.(in this project is not used, please let it open)	Floating	
39	GND	Ground.	GND	
40	RESERVED2	JTAG function pin. (in this project is not used, please let it open)	Floating	
41	PETP0	Differential transmitter.	Output	
42	RESERVED3	No connect to gold fingers	Floating	
43	PETN0	Differential transmitter.	Output	
44	COEX3	JTAG function pin, (in this project is not used, please let it open)	Floating	
45	GND	Ground.	GND	
46	COEX2	JTAG function pin, (in this project is not used, please let it open)	Floating	
47	REFCLKP	PCIE differential clock.	Input	
48	COEX1	JTAG function pin, i(in this project is not used, please let it open)	Floating	
49	REFCLKN	PCIE differential clock.	Input	
50	SUSCLK_32KHz	Suspend Clock is a 32.768kHz clock supply input that is provided by platform to enable the add-in card to enter reduce power consumption modes.	Input	3.3V
51	GND	Ground.	GND	
52	PERST_L	PCIE system reset. Active low.	Input	3.3V
53	CLKREQ_L	PCIE clock request signal. Active low.	Output	3.3V
54	BT_DISABLE_L	BT disable, Active low.	Input	3.3V
55	PEWAKE_L	PCIE PME Wake, Open drain. Active low.	Output	3.3V
56	WL_DISABLE_L	WLAN disable , Active low.	Input	3.3V
57	GND	Ground.	GND	
58	I2C_DATA	No connect to gold fingers	Floating	
59	PERP1	No connect to gold fingers	Floating	
60	I2C_CLK	No connect to gold fingers	Floating	
61	PERN1	No connect to gold fingers	Floating	
62	I2C_IRQ	No connect to gold fingers	Floating	
63	GND	Ground.	GND	
64	RESERVED4	No connect to gold fingers	Floating	
65	PETP1	No connect to gold fingers	Floating	
66	PERST1	No connect to gold fingers	Floating	
67	PETN1	No connect to gold fingers	Floating	
68	CLKREQ1	No connect to gold fingers	Floating	
69	GND	Ground.	GND	
70	PEWAKE1	No connect to gold fingers	Floating	
71	REFCLKP1	No connect to gold fingers	Floating	

72	3.3V	3.3V power supply.	VCC	3.3V
73	REFCLKN1	No connect to gold fingers	Floating	
74	3.3V	3.3V power supply.	VCC	3.3V
75	GND	Ground.	GND	-

6. Schematics
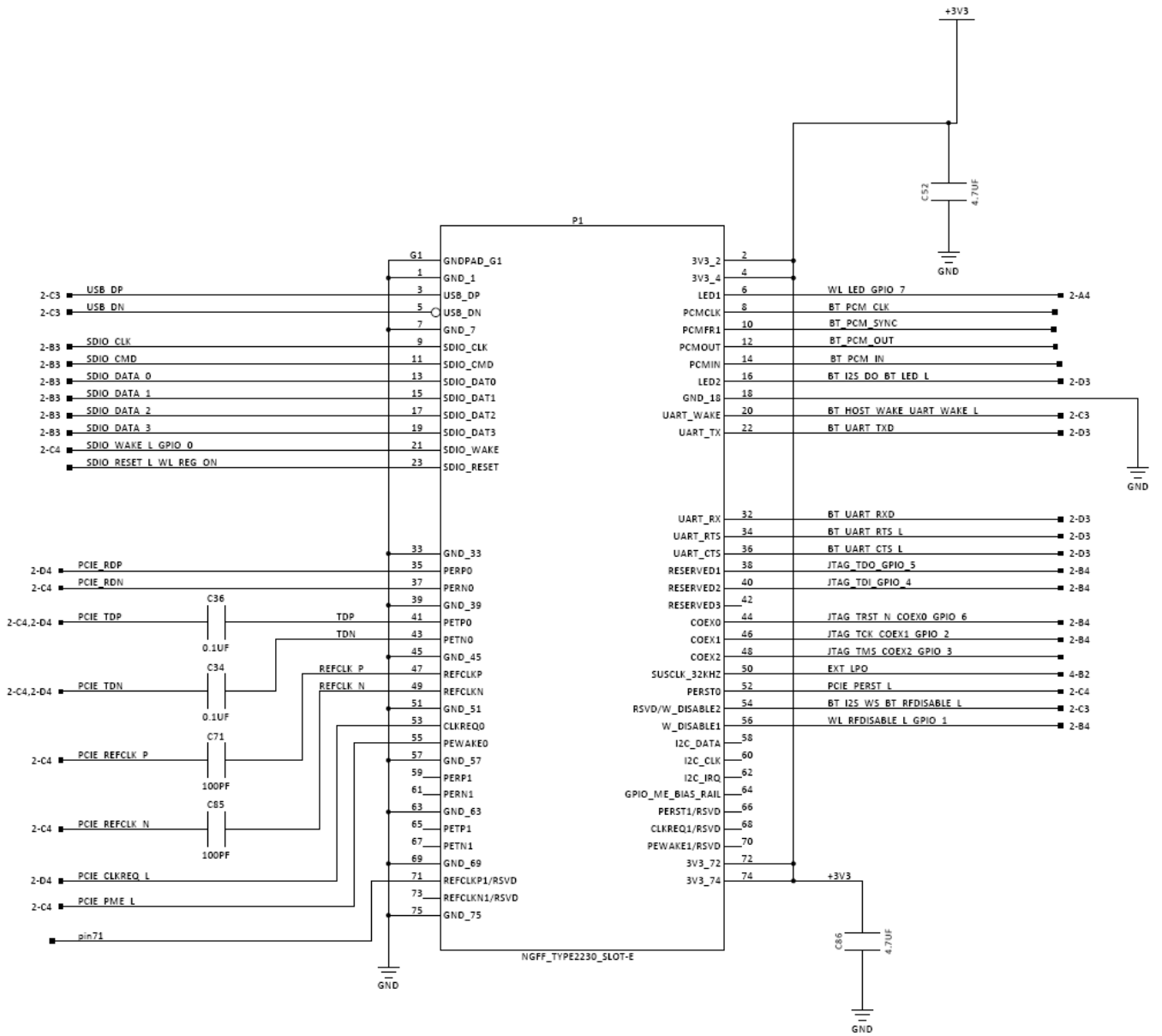
7. Mechanical Drawing

RF CONNECTOR