CyberTAN Technology, Inc.

Model Name	NM353-1
Description	802.11a/b/g/n/ac BT5.0 combo NGFF M.2 2230 card
Version	Release 1.0
Date	April 18, 2018
Author	Kello Wu

Revision History

Date	Release	Author	Description
2018/4/18	1.0	Kello Wu	First preliminary release.

Related Documents

Date	Author	Description

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1. Overview

Makers of smart phones and home appliances can easily add full IEEE 802.11ac, Bluetooth into their products with the NM353-1 combo module.　The combo module features tiny sizes and low power consumption. The NM353-1 is the perfect way to offer high-speed, worldwide wireless connectivity in any handheld or wireless-attached digital devices.

Features and Benefits

- **Single Chip Design**

 SoC minimizes component count and simplifies hardware and software design.

- **NGFF M.2 2230 standard Interface**

 The pin definition and dimension of module design follow the M.2 standard.

- **Seamless Wireless Connectivity**

 The module supports the IEEE 802.11a/b/g/n/ac standards for high speed and transparent inter-operation with most home and business WLANs and all public hot spots around the world.

- **Up-to-date, High-level Security**

 WEP, WPA, and WPA2 are supported to ensure maximum data privacy.

- **Dynamic Rate Shifting**

 Wireless transmission speed is automatically adjusted on the basis of signal strength to achieve maximum availability and link reliability.

1.1 Basic Specifications

Table 1: Basic Specifications

Standards	*WiFi:* IEEE 802.11a , IEEE 802.11b, IEEE 802.11g, Draft IEEE 802.11n, IEEE 802.11d, IEEE 802.11ac IEEE 802.11e, IEEE 802.11h, IEEE 802.11i, IEEE 802.11k, IEEE 802.11r *BT:* V2.1+EDR / BT v3.0 / BT v4.2 / BT v5.0
Bus Interface	*WiFi:* PCI–e GEN1 and SDIO 3.0 *BT:* UART and USB 2.0
Form Factor	NGFF TYPE 2230-S3-A-E
Data Rate	**802.11a:** 54, 48, 36, 24, 18, 12, 9, 6 Mbps **802.11b:** 11, 5.5, 2, 1 Mbps; **802.11g:** 54, 48, 36, 24, 18, 12, 9, 6 Mbps **802.11n:** MCS 0 to 15 for HT20MHz; MCS 0 to 15 for HT40MHz **802.11ac:** Nss2 MCS 0 to 8 for VHT20MHz; Nss2 MCS 0 to 9 for VHT40MHz; Nss2 MCS 0 to 9 for VHT80MHz;
Operating Channel	*WiFi 2.4GHz:* 11: (Ch. 1-11) – United States 13: (Ch. 1-13) – Europe 14: (Ch. 1-14) – Japan *WiFi 5GHz:* Band 1: (Ch. 36 – 48) Band 2: (Ch. 52 – 64) Band 3: (Ch. 100 – 140) Band 4: (Ch. 149 – 165) *BT 2.4GHz:* Ch. 0 ~78

Frequency Range	2.400GHz ~ 2.4835 GHz 5.15GHz ~ 5.35GHz, 5.47GHz ~ 5.85GHz		
Transmit Output Power **(Tolerance: +/- 1.5dBm)**	*802.11b (2.4GHz)* 22dBm @ All rates	*802.11g (2.4GHz)* 19dBm @ 6Mbps 17.5dBm @ 54Mbps	*802.11n (2.4GHz)* 19dBm @MCS 0 17dBm @MCS15
	802.11a (5GHz) 23dBm @ 6Mbps 19dBm @ 54Mbps *802.11n (5GHz)* 23dBm @MCS 0 18dBm @MCS 15	*802.11ac (5GHz)* 23dBm @MCS 0 16.5dBm @MCS 9	
	BT: Max +6dBm		
Receiver Sensitivity	*2.4GHz* **11b:** -90dBm typical @11Mbps **11g:** -80dBm typical @54Mbps **11n:** -75dBm typical MCS15_HT20 -95dBm typical @MCS0_HT20	*5GHz* **11a:** -80dBm typical @54Mbps **11n:** -75dBm typical @MCS15_HT20 -95dBm typical @MCS0_HT20 **11ac:** -66dBm typical @MCS9_VHT80 -89dBm typical @MCS0_VHT80	
	BT: -95dBm typical @1Mbps, BLE mode		
Operating Voltage	5V & 3.3V & 1.8V(SDIO 3.0)		
OS supported	Windows 10 / Linux/Android		
Operating Temperature	-20~+65 degree C		
Antenna connector	Hirose U.FL type or equivalent		

2. Mechanical Characteristics

2.1 Pin Definition

PIN #	Pin Name	Description	PIN #	Pin Name	Description
1	GND		2	3.3V	
3	USB_D+	USB D+ signal	4	3.3V	
5	USB_D-	USB D- signal	6	X	
7	GND		8	X	
9	SDIO CLK		10	X	
11	SDIO CMD		12	X	
13	SDIO DATA0		14	X	
15	SDIO DATA1		16	X	
17	SDIO DATA2		18	GND	
19	SDIO DATA3		20	BT_HOST_WAKE	BT Wake UP Host
21	SDIO WAKE	SDIO Wake UP Host	22	UART TX	UART serial data output
23	X		24	Notch	
25	Notch		26	Notch	
27	Notch		28	Notch	
29	Notch		30	Notch	
31	Notch		32	UART RX	UART serial data output
33	GND		34	UART RTS	UART request to send
35	PCIE_RDP	PCIe Rx Diff pair	36	UART CTS	UART clear to send
37	PCIE_RDN	PCIe Rx Diff pair	38	X	
39	GND		40	X	
41	PCIE_TDP	PCIe Tx Diff pair	42	X	
43	PCIE_TDN	PCIe Tx Diff pair	44	X	
45	GND		46	X	
47	REFCLKP	PCIe Diff Ref CLK+	48	X	
49	REFCLKN	PCIe Diff Ref CLK-	50	SUSCLK(32kHz)	Clock Ref
51	GND		52	PCIE_PERST_L	PCIe reset
53	PCIE_CLKREQ_L	Ref CLK request signal	54	BT_DEV_WAKE	Host Wake up BT device
55	PCIE_PME_L	Power management event	56	WL_DEV_WAKE	Host Wake up WiFi Device

57	GND		58	X	
59	X		60	X	
61	VDD1P8	Supply voltage for SDIO 3.0	62	X	
63	GND	Ground	64	X	
65	VDD1P8	Supply voltage for SDIO 3.0	66	BT_REG_ON	Host ON/OFF BT Power
67	VDD5_PA	Supply voltage for PA	68	WL_REG_ON	Host ON/OFF WiFi Power
69	GND	Ground	70	X	
71	VDD5_PA	Supply voltage for PA	72	3.3V	
73	VDD5_PA	Supply voltage for PA	74	3.3V	
75	GND	Ground			

2.2 Module Dimensions

Unit: mm
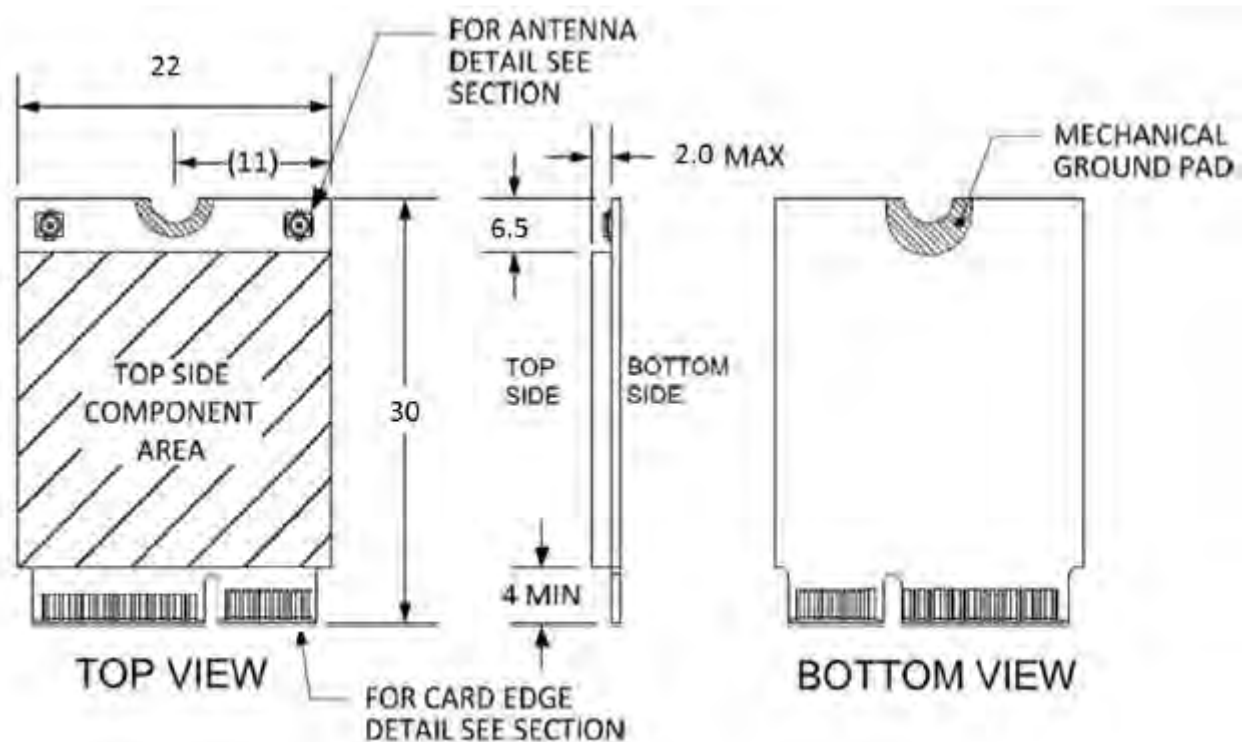
3. EMI Certification Notes

It is recommended that the module be entirely encased in metal shielding to ensure meeting FCC requirement.

4. Regulatory Information

4.1 Federal Communication Commission Interference Statement

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 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

The integrator should clarify obligations that the host/module combination complies with FCC Part 15B requirements in the Host User Guide.

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.

For product available in the USA/Canada market, only channel 1~11 can be operated. Selection of other channels is not possible.

This device and its antenna(s) must not be co-located with any other transmitters except in accordance with FCC multi-transmitter product procedures.
Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without C2PC.

This device is restricted for indoor use.

IMPORTANT NOTE:
This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated.
Additional testing and certification may be necessary when multiple modules are used.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

USERS MANUAL OF THE END PRODUCT:
In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied.

The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

If the labelling area is small than the palm of the hand, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of 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.

LABEL OF THE END PRODUCT:
The final end product must be labeled in a visible area with the following "Contains FCC ID: N89-NM3531".

If the labelling area is larger than the palm of the hand, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.

4.2 Antenna List and Requirement
   Antenna Type: Internal Dipole Antenna
   Antenna Peak Gain: 4dBi max on 5GHz
                          2.92dBi max on 2.4GHz