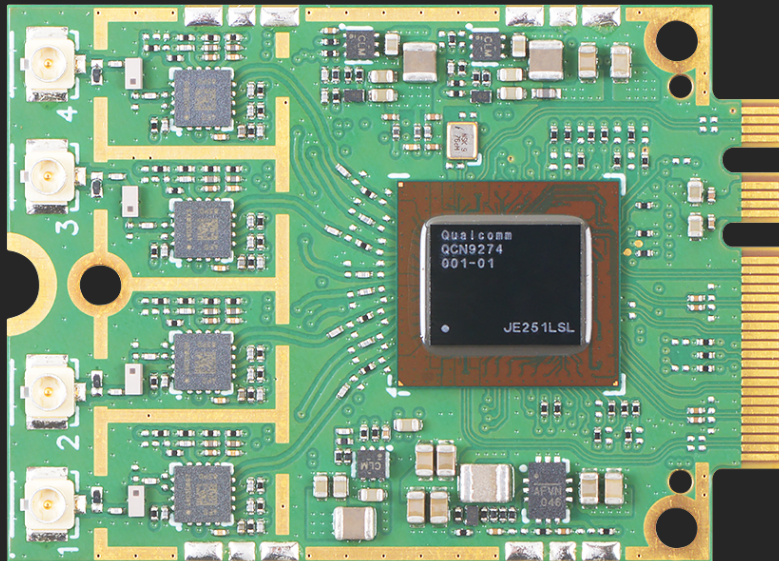




Discover the Noni, a state-of-the-art WiFi7 radio module in a compact M.2 A+E form factor. Powered by Qualcomm's QCA9274/QCA6274 chipsets, Noni operates on the IEEE 802.11be standard with speeds over 11 Gbps in 4x4 MIMO or split 2x2 + 2x2 configurations. It supports up to 320 MHz channel sizes and advanced 4K QAM modulation, enhancing efficiency and connection quality.

Noni features Multi-Link for simultaneous communication on different frequencies, improving reliability and signal strength. Its adaptive interference puncturing maintains performance in challenging environments. With dual-band capabilities in both 5GHz and 6GHz frequencies, Noni is versatile for present and future wireless needs. Embrace a new level of connectivity with Noni's WiFi7 features.

Features

- 4x4 320MHz 802.11be/ax/ac/n/a Wi-Fi 7 radio module/card;
- Wide-band: 5 GHz, 6 GHz full band support;
- PCI Express 3.0 dual-lane interface;
- Additional interfaces: GPIOs, JTAG;
- Noni module available as mini-PCIe, M.2 A+E, SOM;
- Dual-synthesizer WLAN radio up to 320MHz bandwidth support;
- Supports 5/10 MHz in 4.9 GHz (Public Safety band);
- Supports 20/40/80/160 or 240 MHz in 5 GHz;
- Supports 20/40/80/160,240 or 320 MHz in 6-7.125 GHz;
- Supports up to 1024 QAM (4SS) and 4096 QAM(2SS);
- Data rates of up to 11530 Mbps in 802.11be/ax 320 MHz channels 6GHz mode;
- Data rates of up to 8647.2 Mbps in 802.11be/ax/ac/n/a 240 MHz channels 5GHz mode;
- DL/UL MU-MIMO, up to 4 users per PPDU;
- DL/UL MU-OFDMA, up to 37 users per PPDU;
- TxBF, MU-MIMO, MU-OFDMA/TxBF, ML, STBC;
- Dynamic frequency selection (DFS) and Agile DFS; (dynamic switching between 4 and 3+1);
- Spectral Analysis (SA) and Agile Spectral Analysis (aSA); for all bands (dynamic switching between 4 and 3+1);
- PTA (3-wire) and MCI (2-wire) for advanced coexistence;
- 802.11 be/ac/ax explicit transmit beamforming (TxBF);
- 802.11 be/ac/ax beamformee for STA mode;
- 802.11e-compatible bursting;
- Supports monitor mode;
- Supports:
 - IEEE 802.11a/b/g/n/ac/ax/be,
 - IEEE 802.11d/e/h/i/j/k/r/u/v/w,
 - IEEE 802.11ba;
- AES-CCMP/GCMP at 128/256 bits;
- WEP, TKIP hardware encryption;
- * WAPI 1.0 and WAPI 2.0 hardware encryption
- WPA/WPA2-Personal/WPA2-Enterprise and WPA3 Personal;
- FIPS ECB.

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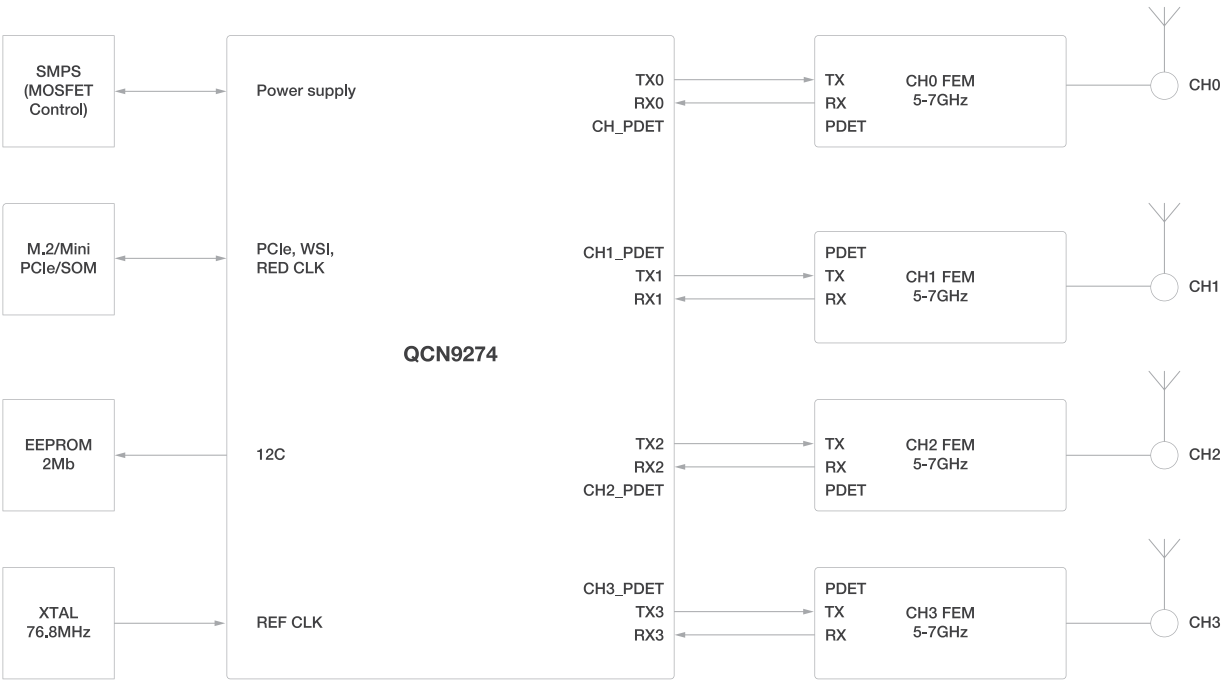
1. Specifications

Platform	
Chipset code	QCN9274/QCN6274
Interface Code	PCIe 3.0 dual lane
Linux Support	QSDK/ath12k (no upstream support)
Linux mainline kernel	From 6.1.x upwards
Windows Support	N/A
Wi-Fi	
Standard	IEEE 802.11a/b/g/n/ac/ax/be
Band	4920-7125MHz
MIMO	4x4
Monitor Mode	yes
Power (Per Chain)	up to 22 dBm
Receiver Sensitivity	-94...-92dB (4920-7125MHz)
Antenna Connector	U.FL
Module Spec	
Power Supply	3.3V
Power Consumption	9W
Temperature Range	0°C to 65°C or -40°C to 85°C
Form factor	Mini PCIe / M.2 / SOM
Certifications	CE(REDA)/ FCC/ IC**

* Certification is in progress

2. Block diagram

FIGURE 2-1. BLOCK DIAGRAM



3. Module pin out and Pin description

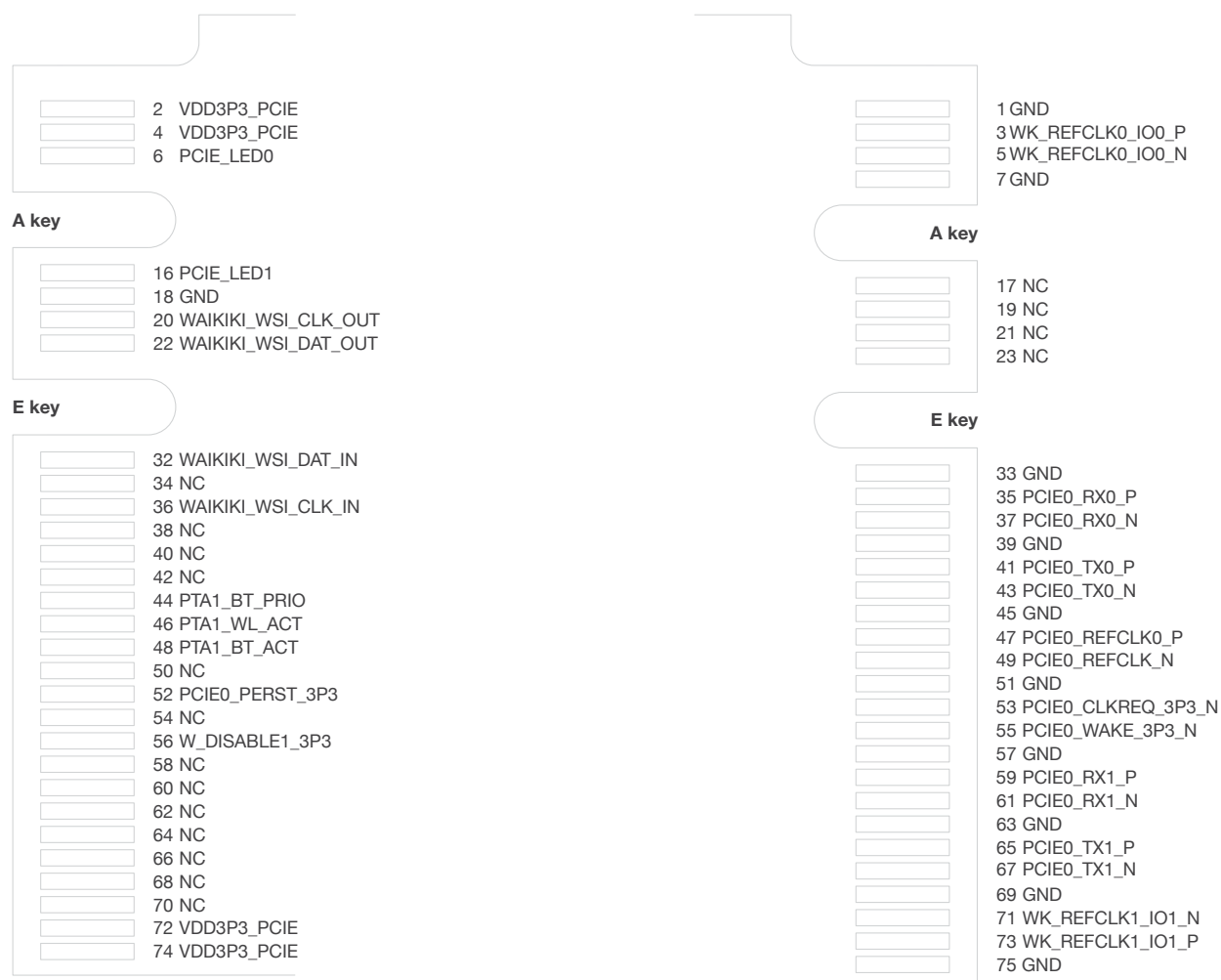


TABLE 3-1. I/O DESCRIPTION (PIN TYPE) PARAMETERS

Symbol	Description
GND	Ground
NC	Not connected
I	Digital input signal
O	Digital output signal
B	Digital bidirectional signal

TABLE 3-2. POWER, GROUND, NC

Pin ID	Pin name	Type	Description
2, 4, 72, 74	VDD3P3_PCIE	I	3.3V input voltage
1, 7, 18, 33, 39, 45, 51, 57, 63, 69, 75	GND	GND	Ground
17, 19, 21, 23, 34, 38, 40, 42, 50, 54, 58, 60, 62, 64, 66, 68, 70	NC	NC	NC

TABLE 3-3. PCIE GEN3

Pin ID	Pin name	Type	Description
53	PCIE0_CLKREQ_3P3_N	B	PCIe clock request
52	PCIE0_PERST_3P3	I	PCIe reset
55	PCIE0_WAKE_3P3_N	B	PCIe wake
56	W_DISABLE1_3P3	I	Primary reset input to the chip driven by external circuitry on board
49	PCIE0_REFCLK_N	I	Reference clock
47	PCIE0_REFCLK_P	I	
43	PCIE0_TX0_N	O	First pair PCIe receiver differential signal
41	PCIE0_TX0_P	O	
35	PCIE0_RX0_P	I	First pair PCIe receiver differential signal
37	PCIE0_RX0_N	I	
67	PCIE0_TX1_N	O	Second pair PCIe transmitter differential signal
65	PCIE0_TX1_P	O	
59	PCIE0_RX1_P	I	Second pair PCIe receiver differential signal
61	PCIE0_RX1_N	I	

TABLE 3-4. INTERFACES

Pin ID	Pin name	Type	GPIO	Description
6	PCIE_LED0	O	GPIO_25 (BOOTSTRAP)	LED interface
16	PCIE_LED1	O	GPIO_26 (BOOTSTRAP)	LED interface
20	WAIKIKI_WSI_CLK_OUT	O	GPIO_49	MLO MASTER CLK Operating at 160MHz
22	WAIKIKI_WSI_DAT_OUT	B	GPIO_48	MLO MASTER DATA Operating at 160MHz
32	WAIKIKI_WSI_DAT_IN	B	GPIO_50	MLO SLAVE DATA Operating at 160MHz
36	WAIKIKI_WSI_CLK_IN	I	GPIO_51	MLO SLAVE CLK Operating at 160MHz
44	PTA1_BT_PRIO	I	GPIO_39	Option 1: Wi-Fi coexistence with Bluetooth BT_PRIORITY (PTA1) Option 2: WSI 1.0 CLK for BT Coex
46	PTA1_WL_ACT	O	GPIO_40 (BOOTSTRAP)	Wi-Fi coexistence with Bluetooth WLAN_ACTIVE (PTA1)
48	PTA1_BT_ACT	I	GPIO_38	Option 1: Wi-Fi coexistence with Bluetooth BT_ACTIVE (PTA1) Option 2: WSI 1.0 Data for BT Coex

TABLE 3-5. CLOCK

Pin ID	Pin name	Type	Description
3	WK_REFCLK0_IO0_P	B	Differential signal pair, reference clock for sharing
5	WK_REFCLK0_IO0_N	B	
71	WK_REFCLK1_IO1_P	B	Differential signal pair, reference clock for sharing
73	WK_REFCLK1_IO1_N	B	

4. Electrical characteristics

TABLE 4-1. POWER SUPPLY DC CHARACTERISTICS

Symbol	Parameter	Minimum	Typical	Maximum	Units
+3V3	3.3 V Supply voltage	3	3.3	3.6	V
	3.3 V Supply current	0.4	1.6	2.1	A

TABLE 4-2. POWER CONSUMPTION

Scenario				Voltage, V	Current, A	Total power, W
TX	4x4	5GHz	MCS0	3.3V	2.01	6.6
		5GHz	MCS13	3.3V	1.75	5.7
RX	4x4	5GHz	-	3.3V	0.46	1.5
Max throughput + CPU load 99%	4x4	5GHz	MCS0	3.3V	2.03	6.7
		5GHz	MCS13	3.3V	1.75	6.4
TX	4x4	6GHz	MCS0	3.3V	2.09	6.6
		6GHz	MCS13	3.3V	1.76	5.8
RX	4x4	6GHz	-	3.3V	0.48	1.6
Max throughput + CPU load 99%	4x4	6GHz	MCS0	3.3V	2.09	6.9
		6GHz	MCS13	3.3V	1.96	6.4

TABLE 4-3. TEMPERATURE LIMIT RATINGS

Parameter	Minimum	Maximum	Units
Storage Temperature (Commercial)	0	+110	°C
Storage Temperature (Industrial)	-40	+110	°C
Commercial Operating Temperature	0	+65	°C
Industrial Operating Temperature	-40	+85	°C
Humidity	30	60	%RH
Storage humidity	15	70	%RH

5. Radio characteristics per chain

TABLE 5-1. 5 GHZ 802.11BE 20 MHZ

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13
Data rate (Mbps)	34.4	68.8	103.2	137.6	206.5	275.3	309.7	344.1	412.9	458.8	516.2	573.5	619.6	688.4
TX power (dBm)	18	18	18	18	16	16	16	16	15	15	14	14	12	12
RX sensitivity (dB)	-90	-89	-87	-85	-83	-79	-78	-77	-72	-69	-66	-63	-59	-58

TABLE 5-2. 5 GHZ 802.11BE 40MHZ

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13
Data rate (Mbps)	68.8	137.6	206.5	275.3	412.9	550.6	619.4	688.2	825.9	917.6	1032.4	1147.1	1240	1376
TX power (dBm)	17	17	17	17	15	15	15	15	15	14	13	13	11	11
RX sensitivity (dB)	-88	-87	-85	-83	-82	-77	-75	-74	-70	-67	-64	-61	-57	-55

TABLE 5-3. 5GHZ 802.11BE 80MHZ

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13
Data rate (Mbps)	144.1	288.2	432.4	576.5	864.7	1152.9	1297.1	1441.2	1729.4	1921.6	2161.8	2402	2596	2884
TX power (dBm)	17	17	17	17	15	15	15	15	15	14	13	13	11	11
RX sensitivity (dB)	-87	-86	-84	-82	-82	-74	-72	-71	-67	-64	-60	-58	-55	-52

TABLE 5-4. 5GHZ 802.11BE 160MHZ

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13
Data rate (Mbps)	288.2	576.5	864.7	1152.9	1729.4	2305.9	2594.1	2882.4	3458.8	3843.1	4323.5	4803.9	5188	5764
TX power (dBm)	17	17	17	17	15	15	15	15	15	14	13	13	11	11
RX sensitivity (dB)	-87	-84	-82	-79	-78	-71	-70	-68	-63	-61	-57	-55	-52	-50

TABLE 5-5. 5GHZ 802.11BE 240MHZ

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13
Data rate (Mbps)	431.9	863.8	1295.6	1731.5	2595.3	3459.1	3890.9	4034.6	5186.6	6046.4	6486.2	7206	7780	8644
TX power (dBm)	17	17	17	17	15	15	15	15	15	14	13	13	11	11
RX sensitivity (dB)	-90	-89	-87	-85	-83	-79	-78	-77	-72	-69	-66	-63	-59	-58

TABLE 5-6. 6GHZ 802.11BE 20MHZ

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13
Data rate (Mbps)	34.4	68.8	103.2	137.6	206.5	275.3	309.7	344.1	412.9	458.8	516.2	573.5	619.6	688.4
TX power (dBm)	17	17	17	17	16	15	15	14	14	12	12	11.5	9	9
RX sensitivity (dB)	-90	-89	-87	-85	-83	-79	-78	-77	-72	-69	-66	-63	-59	-58

TABLE 5-7. 6GHZ 802.11BE 40MHZ

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13
Data rate (Mbps)	68.8	137.6	206.5	275.3	412.9	550.6	619.4	688.2	825.9	917.6	1032.4	1147.1	1240	1376
TX power (dBm)	17	17	17	17	16	15	15	14	14	12	12	11.5	9	9
RX sensitivity (dB)	-88	-87	-85	-83	-82	-77	-75	-74	-70	-67	-64	-61	-57	-55

TABLE 5-8. 6GHZ 802.11BE 80MHZ

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13
Data rate (Mbps)	144.1	288.2	432.4	576.5	864.7	1152.9	1297.1	1441.2	1729.4	1921.6	2161.8	2402	2596	2884
TX power (dBm)	17	17	17	17	16	15	15	14	14	12	12	11.5	9	9
RX sensitivity (dB)	-87	-86	-84	-82	-82	-74	-72	-71	-67	-64	-60	-58	-55	-52

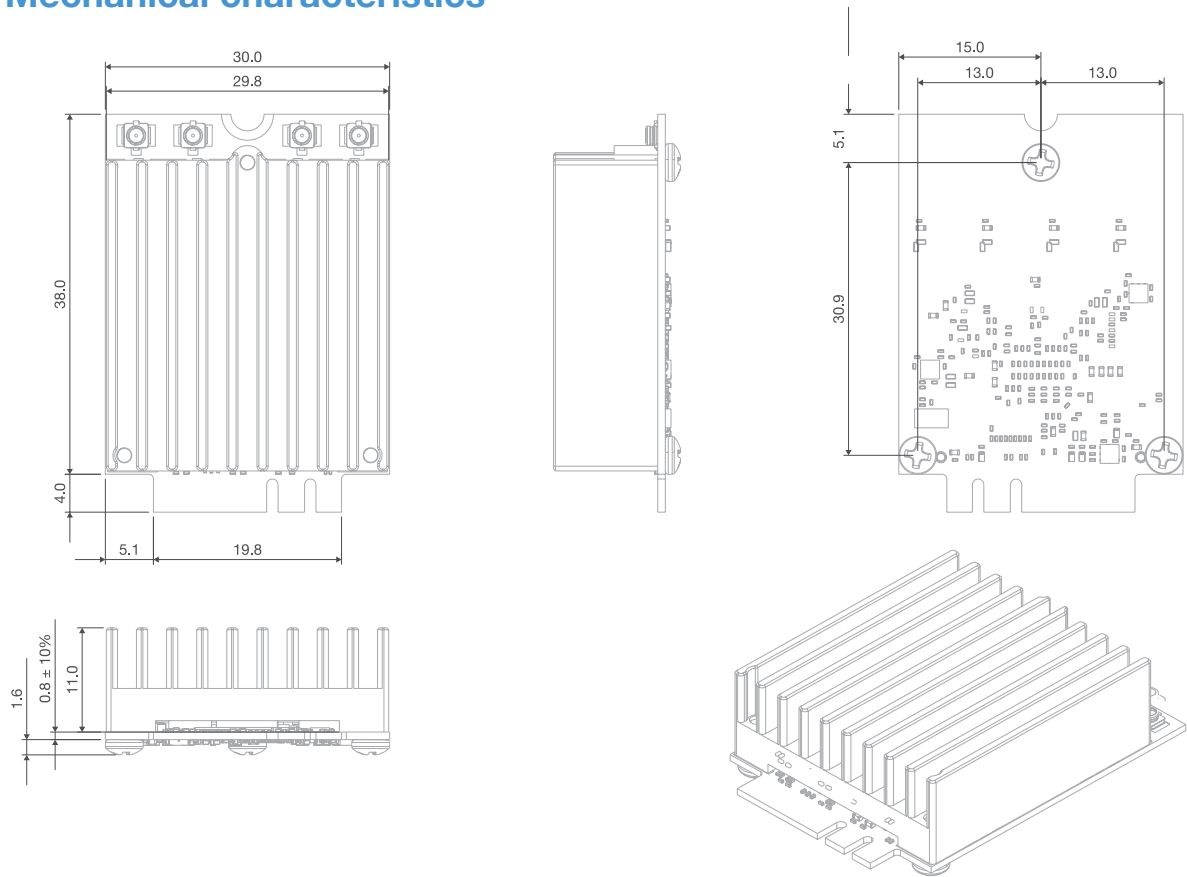
TABLE 5-9. 6GHZ 802.11BE 160MHZ

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13
Data rate (Mbps)	288.2	576.5	864.7	1152.9	1729.4	2305.9	2594.1	2882.4	3458.8	3843.1	4323.5	4803.9	5188	5764
TX power (dBm)	17	17	17	17	16	15	15	14	14	12	12	11.5	8	8
RX sensitivity (dB)	-84	-81	-79	-76	-75	-68	-67	-64	-60	-58	-54	-52	-51	-50

TABLE 5-10. 6GHZ 802.11BE 320MHZ

	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13
Data rate (Mbps)	576	1152	1728	2308	3460	4612	5188	5764	6916	7968	8648	9608	10376	11528
TX power (dBm)	17	17	17	17	16	15	15	14	14	12	12	11.5	8	8
RX sensitivity (dB)	-84	-81	-79	-76	-75	-68	-67	-64	-60	-58	-54	-52	-51	-50

6. Mechanical characteristics



7. Heatsink size recommendations

It is essential to use heatsink for the hardware designs based on Noni module. Heatsink should be able to dissipate at least 9W and the recommended area is 190cm². It should be directly attached to the top side of Noni module. Maximum ambient temperature with the given heatsink is +55 C.

8. Split mode

In addition to 4x4 MiMo, Noni can also run in split 2x2 mode, allowing it to operate both 5GHz and 6GHz frequencies.

Possible configurations:

2x2	2x2
5GHz	6GHz

NOTE: You will need Linux kernel to use the ath12k driver. Any Linux kernel older than v6.11 will most likely require extra patches and changes in the system.

ath12k is an open source implementation of the driver that supports 802.11be chipsets. This driver is still under development and it will take some time to mature. However, the open source community is actively working to recreate Qualcomm proprietary driver features like radio split mode in the ath12k driver. Note that features like these demand the latest linux kernel (v6.11+ or later) due to the MAC layer changes they rely on. This may limit the number of platforms that the ath12k driver can currently be deployed on, but this may become more broadly feasible in the future.

8.1. Wideband split mode

Noni can also run in wideband split 2x2 + 2x2 mode, allowing it to operate 5GHz and 6GHz frequencies simultaneously. Different split mode configurations can be changed at the firmware level and do not require any hardware changes.

Possible configurations:

Combo	2x2	2x2
1	5GHz	5GHz
2	5GHz	6GHz
3	6GHz	5GHz
4	6GHz	6GHz

NOTE: Radio combinations 2 and 3 are essentially the same.

Currently, wideband split mode can only run on 8devices Mango DVK or Kiwi DVK kits using Qualcomm proprietary wireless driver, which will require NDA signature and Qualcomm approval.

These products can be obtained on our website <https://www.8devices.com>

All inquiries regarding split mode premium are managed through our support page: <https://support.8devices.com/>

8.2. Comparison

- Noni56M2 -x is set to 4x4 configuration by default but can be switched to wideband split mode.
- Noni56M2-2x2 -x is set to 2x2 split mode and is not configurable.

	Noni56M2 -x		Noni56M2-2x2 +x
Radio configuration	4x4	2x2+2x2 Wideband split mode	2x2 split mode
Requires Qualcomm proprietary wireless drive	No	Yes*	No
Ath12k wireless driver support	Yes	No	Yes

* For more information refer to section 8.1.

9. Ordering information

TABLE 9-1. NONI RADIO CARD ORDER NUMBERS AND DESCRIPTIONS

Order Number	Description
Noni56M2	4x4* or 2x2+2x2** 5/6GHz M.2 3042 A+E key from factor Commercial QCN9274
Noni56M2-I	4x4* or 2x2+2x2** 5/6GHz M.2 3042 A+E key form factor Industrial QCN9274
Noni56M2-B	4x4 or 2x2+2x2* 5/6GHz M.2 3042 A+E key from factor Basic QCN6274
Noni56M2-2x2	2x2 5/6GHz M.2 3042 A+E key from factor Commercial QCN9274
Noni56M2-2x2-I	2x2 5/6GHz M.2 3042 A+E key form factor Industrial QCN9274
Noni56M2-2x2-B	2x2 5/6GHz M.2 3042 A+E key from factor Basic QCN6274

*Factory default configuration.

** Requires Qualcomm proprietary wireless driver.

10. Document Revision History

Revision	Revision Date	Description
v1.0	2023-11-28	Initial release
v1.1	2024-03-26	Radio characteristics updated
v1.2	2024-07-24	Heatsink size recommendations added
v1.3	2024-09-25	Ordering numbers updated
v1.4	2024-10-25	Split mode description updated