



# BlackPepper 4 DATASHEET

## BKP-N2N2-2450



### IEEE 820.11 a/b/g/n

High-Performance, Dual independent Radio operating in ISM 2.4 GHz license-free Band and 4.9/5 GHz Bands, 2x2 MIMO



### Optimized SWaP-C

Size, Weight, Power, Cost  
Optimized Radio Module



### Industrial grade

-40 deg C to +85 deg C  
operation temperature

dun & bradstreet



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HW REV# 01.00  
Last updated on Jun-22-24

## SWaP-C Optimized Design



MMCX Antenna Connectors

Industry Standard Connectors for Power, USB and Ethernet Signals



# TECHNICAL SPECIFICATION

RADIO MODULE – GENERAL INFO	
Radio chipset	Qualcomm QCA 9550-AT4B (CPU) & AR 8033-AL1B (Ethernet PHY) Qualcomm AR 9592-AR1B
NOR Flash	SPI Flash, 16MB
NAND Flash	NAND Flash, 256 MB
RAM	DDR2, 200 MHz, 256 MB (64Mx16x2)
Operating System	Linux, OPENWRT, supports open source ath9K Linux driver
Security	128-bit AES, WEP, TKIP and WAPI hardware encryption Support for IEEE 802.11d, e, h, i standards Small packet size (96 Bytes) in AES encryption at full packet rate Loopback mode to assist FIPS AES certification
Operating frequency – 11 b/g/n	2400 MHz to 2483.5 MHz (2S, MIMO)
Operating frequency – 11 a/b/g/n	4900 MHz to 5850 MHz (2S, MIMO)
Data rate - 1S, SISO	1 Mbps, 2 Mbps, 5.5Mbps, 111 Mbps (11b) 6Mbps, 9Mbps, 12Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps (11g)
Data rate - 2S, MIMO	MCS0, MCS1, MCS2, MCS3, MCS4, MCS5, MCS6, MCS7 (11n, 1S,SISO) MCS8, MCS9, MCS10, MCS11, MCS12, MCS13, MCS14, MCS15 (11n,2S,MIMO)
Channel BW – 2.4 GHz, 4.9 GHz, 5 GHz	5 MHz/10 MHz/20 MHz /40 MHz
Compliance	RoHS, MIL-STD-810G Shock & Vibration
MAC ID	74E277 Series
INTERFACE SPECIFICATIONS	
Power	DC in
Operating Voltage	9V to 30V
RF Antenna connector	x4 MMCX Female (Jack) connectors
ENVIRONMENTAL SPECIFICATIONS	
Operating Temperature Range	-40 deg C to +85 deg C
PHYSICAL SPECIFICATIONS	
Mechanical Dimension	(L) 94.5 mm x (W) 68.6 mm x (D) 14.9 mm
Weight	115 g
REGULATORY INFORMATION	
Compliance	In Progress
PACKAGING INFORMATION	
No of units	TBD

## ORDERING INFORMATION

BKP-N2N2-2450

BlackPepper 4, Dual Independent, 2x2 MIMO,  
IEEE 802.11 a/b/g/n, 2.4 GHz, 5 GHz Bands, 29 dBm

## RADIO SPECIFICATION

### TX/RX Specification – 2412 MHz to 2462 MHz

Sensitivity tested in ART Mode, PSR &gt;=95%, Chain0+Chain1

TX Power per chain (SISO mode) and Sensitivity Tolerance = +/- 2 dBm

Current consumption is measured at the input of the module, powered by 24V DC and it includes idle current drawn by the system.

Data Rate	TX Power per chain (dBm)	Current 24V (A)	RX Sensitivity (dBm)
54 Mbps	20	0.230	-80
48 Mbps	21	0.245	-81
36 Mbps	23	0.265	-88
24 Mbps	25	0.290	-89
18 Mbps	25	0.290	-92
12Mbps	25	0.290	-94
9 Mbps	25	0.290	-95
6 Mbps	26	0.300	-96
11 Mbps	26	0.300	-91
5.5 Mbps	26	0.300	-96
2 Mbps	26	0.300	-98
1 Mbps	26	0.300	-99
HT20-MCS7	19	0.220	-74
HT20-MCS6	20	0.230	-75
HT20-MCS5	21	0.245	-76
HT20-MCS4	22	0.255	-81
HT20-MCS3	24	0.270	-85
HT20-MCS2	24	0.270	-89
HT20-MCS1	24	0.270	-91
HT20-MCS0	26	0.300	-93
HT40-MCS7	19	0.220	-71
HT40-MCS6	20	0.230	-72
HT40-MCS5	21	0.245	-73
HT40-MCS4	22	0.255	-78
HT40-MCS3	24	0.270	-82
HT40-MCS2	24	0.270	-86
HT40-MCS1	24	0.270	-88
HT40-MCS0	26	0.300	-90

**TX/RX Specification – 4920 MHz to 4990 MHz**

Sensitivity tested in ART Mode, PSR >=95%, Chain0+Chain1

TX Power per chain (SISO mode) and Sensitivity Tolerance = +/- 2 dBm

Current consumption is measured at the input of the SBC with the 5 GHz radio module connected to it. The current consumption figures are then adjusted so that they only include extra current drawn by the 5 GHz radio module

Data Rate	TX Power per chain (dBm)	Current 24V (A)	RX Sensitivity (dBm)
54 Mbps	19	0.19	-77
48 Mbps	20	0.20	-80
36 Mbps	22	0.22	-82
24 Mbps	23	0.23	-85
18 Mbps	23	0.23	-87
12Mbps	23	0.23	-89
9 Mbps	23	0.23	-92
6 Mbps	23	0.23	-94
HT20-MCS7	18	0.19	-71
HT20-MCS6	19	0.19	-74
HT20-MCS5	20	0.20	-75
HT20-MCS4	22	0.22	-79
HT20-MCS3	23	0.23	-82
HT20-MCS2	23	0.23	-86
HT20-MCS1	23	0.23	-88
HT20-MCS0	26	0.27	-92
HT40-MCS7	18	0.19	-68
HT40-MCS6	19	0.19	-71
HT40-MCS5	20	0.20	-72
HT40-MCS4	22	0.22	-76
HT40-MCS3	23	0.23	-79
HT40-MCS2	23	0.23	-83
HT40-MCS1	23	0.23	-85
HT40-MCS0	26	0.27	-89

**TX/RX Specification – 5180 MHz to 5320 MHz**

Sensitivity tested in ART Mode, PSR >=95%, Chain0+Chain1  
 TX Power per chain (SISO mode) and Sensitivity Tolerance = +/- 2 dBm  
 Current consumption is measured at the input of the SBC with the 5 GHz radio module connected to it. The current consumption figures are then adjusted so that they only include extra current drawn by the 5 GHz radio module

Data Rate	TX Power per chain (dBm)	Current 24V (A)	RX Sensitivity (dBm)
54 Mbps	20	0.20	-77
48 Mbps	21	0.21	-80
36 Mbps	23	0.23	-82
24 Mbps	24	0.24	-85
18 Mbps	24	0.24	-87
12Mbps	24	0.24	-89
9 Mbps	24	0.24	-92
6 Mbps	24	0.24	-94
HT20-MCS7	19	0.19	-71
HT20-MCS6	20	0.20	-74
HT20-MCS5	21	0.21	-75
HT20-MCS4	23	0.23	-79
HT20-MCS3	24	0.24	-82
HT20-MCS2	24	0.24	-86
HT20-MCS1	24	0.24	-88
HT20-MCS0	26	0.27	-92
HT40-MCS7	19	0.19	-68
HT40-MCS6	20	0.20	-71
HT40-MCS5	21	0.21	-72
HT40-MCS4	23	0.23	-76
HT40-MCS3	24	0.24	-79
HT40-MCS2	24	0.24	-83
HT40-MCS1	24	0.24	-85
HT40-MCS0	26	0.27	-89

**TX/RX Specification – 5500 MHz to 5720 MHz**

Sensitivity tested in ART Mode, PSR >=95%, Chain0+Chain1  
 TX Power per chain (SISO mode) and Sensitivity Tolerance = +/- 2 dBm  
 Current consumption is measured at the input of the SBC with the 5 GHz radio module connected to it. The current consumption figures are then adjusted so that they only include extra current drawn by the 5 GHz radio module

Data Rate	TX Power per chain (dBm)	Current 24V (A)	RX Sensitivity (dBm)
54 Mbps	19	0.19	-77
48 Mbps	20	0.20	-80
36 Mbps	23	0.23	-82
24 Mbps	26	0.27	-85
18 Mbps	26	0.27	-87
12Mbps	26	0.27	-89
9 Mbps	26	0.27	-92
6 Mbps	26	0.27	-94
HT20-MCS7	19	0.19	-71
HT20-MCS6	20	0.20	-74
HT20-MCS5	21	0.21	-75
HT20-MCS4	23	0.23	-79
HT20-MCS3	24	0.24	-82
HT20-MCS2	24	0.24	-86
HT20-MCS1	24	0.24	-88
HT20-MCS0	26	0.27	-92
HT40-MCS7	19	0.19	-68
HT40-MCS6	20	0.20	-71
HT40-MCS5	21	0.21	-72
HT40-MCS4	23	0.23	-76
HT40-MCS3	24	0.24	-79
HT40-MCS2	24	0.24	-83
HT40-MCS1	24	0.24	-85
HT40-MCS0	26	0.27	-89

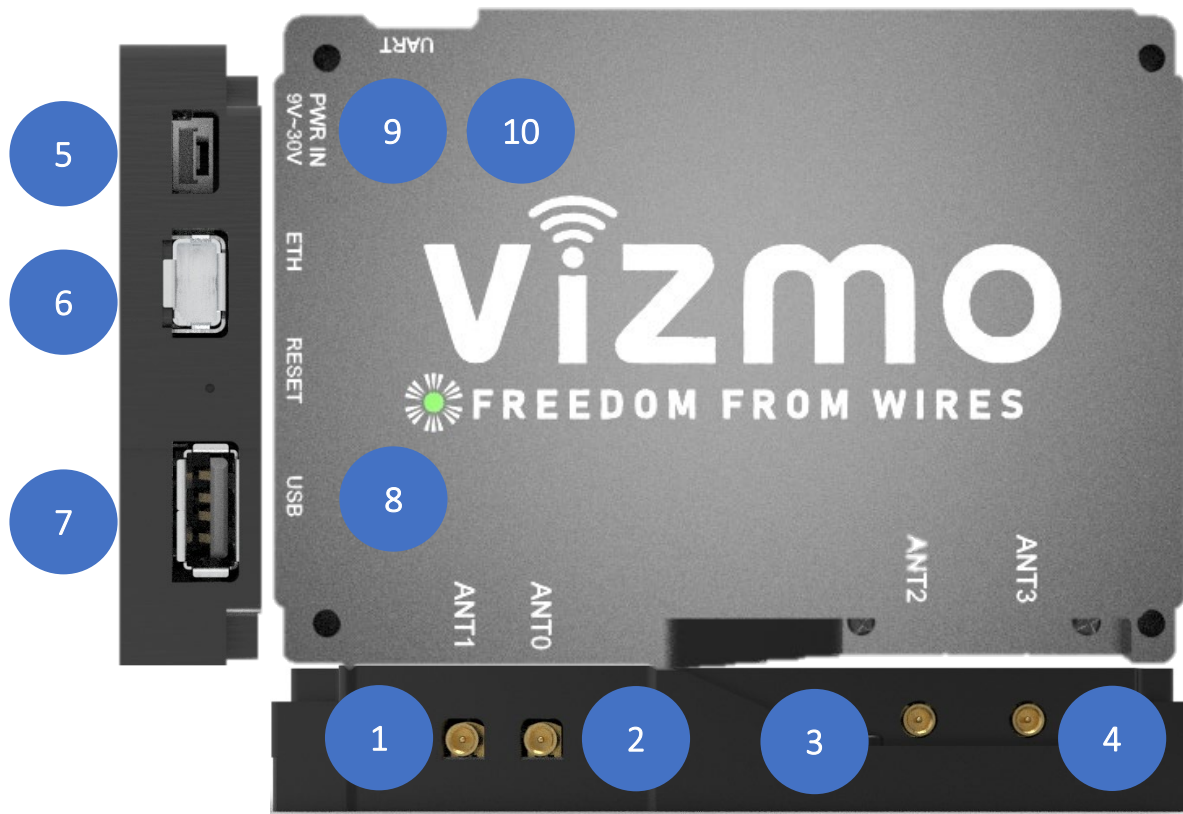
**TX/RX Specification – 5745 MHz to 5825 MHz**

Sensitivity tested in ART Mode, PSR >=95%, Chain0+Chain1  
 TX Power per chain (SISO mode) and Sensitivity Tolerance = +/- 2 dBm  
 Current consumption is measured at the input of the SBC with the 5 GHz radio module connected to it. The current consumption figures are then adjusted so that they only include extra current drawn by the 5 GHz radio module

Data Rate	TX Power per chain (dBm)	Current 24V (A)	RX Sensitivity (dBm)
54 Mbps	19	0.19	-74
48 Mbps	20	0.20	-77
36 Mbps	23	0.23	-79
24 Mbps	26	0.27	-82
18 Mbps	26	0.27	-84
12Mbps	26	0.27	-86
9 Mbps	26	0.27	-89
6 Mbps	26	0.27	-91
HT20-MCS7	18	0.19	-68
HT20-MCS6	19	0.19	-71
HT20-MCS5	20	0.20	-72
HT20-MCS4	23	0.23	-76
HT20-MCS3	24	0.24	-79
HT20-MCS2	24	0.24	-83
HT20-MCS1	24	0.24	-85
HT20-MCS0	26	0.27	-89
HT40-MCS7	18	0.19	-65
HT40-MCS6	19	0.19	-68
HT40-MCS5	20	0.20	-69
HT40-MCS4	23	0.23	-73
HT40-MCS3	24	0.24	-76
HT40-MCS2	24	0.24	-81
HT40-MCS1	24	0.24	-82
HT40-MCS0	26	0.27	-86



## CONNECTION DETAILS

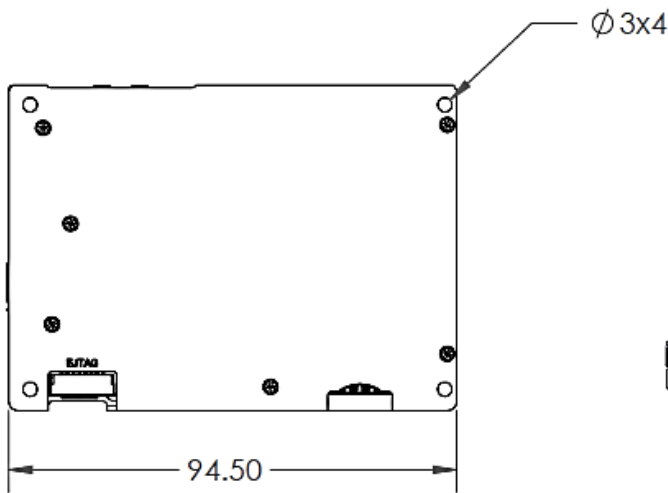
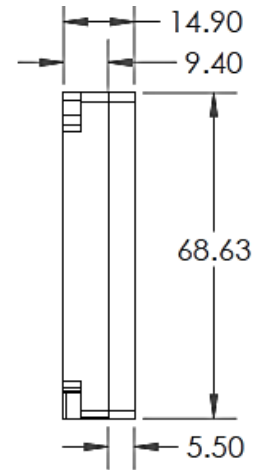
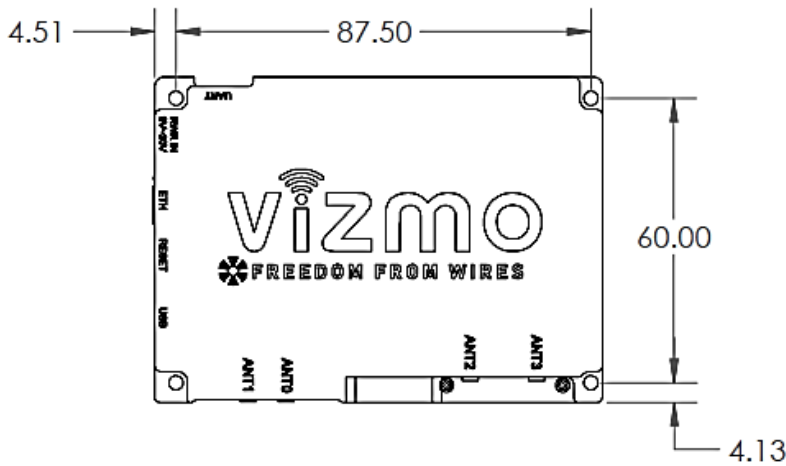


REF	PART
1	MMCX Connector, 2.4 GHz
2	MMCX Connector, 2.4 GHz
3	MMCX Connector, 4.9/5 GHz
4	MMCX Connector, 4.9/5 GHz
5	Power Connector, JST SM04B-GHS-TB
6	Ethernet Connector, HIROSE IX60G-A-10P
7	USB Connector for thumb drive
8	RGB LED
9	USB Micro-B Connector for UART
10	JST SM08B-GHS-TB for EJTAG (On bottom side)

## CONNECTION PIN-OUT

PIN#	PIN DESCRIPTION
Ant-0	2.4 GHz Ant-0
Ant-1	2.4 GHz Ant-1
Ant-2	5 GHz Ant-0
Ant-3	5 GHz Ant-1
JST SM04B-GHS-TB – Pin-1 (from left-to-down on Top side)	9V to 30V DC POWER
JST SM04B-GHS-TB – Pin-2 (from left-to-down on Top side)	9V to 30V DC POWER
JST SM04B-GHS-TB – Pin-3 (from left-to-down on Top side)	GND
JST SM04B-GHS-TB – Pin-4 (from left-to-down on Top side)	GND
JST SM08B-GHS-TB – Pin-1 (from left-to-right on Top side)	GND
JST SM08B-GHS-TB – Pin-2 (from left-to-right on Top side)	EJTAG-TCK
JST SM08B-GHS-TB – Pin-3 (from left-to-right on Top side)	EJTAG-TDI
JST SM08B-GHS-TB – Pin-4 (from left-to-right on Top side)	EJTAG-TDO
JST SM08B-GHS-TB – Pin-5 (from left-to-right on Top side)	EJTAG-TMS
JST SM08B-GHS-TB – Pin-6 (from left-to-right on Top side)	RST_B
JST SM08B-GHS-TB – Pin-7 (from left-to-right on Top side)	2.5V DC
JST SM08B-GHS-TB – Pin-8 (from left-to-right on Top side)	GND

## MECHANICAL DIMENSIONS



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