

AW-XB644NF

**IEEE 802.11 1X1 a/b/g/n/ac/ax Wireless LAN
+ Bluetooth 5.4 + 802.15.4 Tri-radio
M.2 2230 Module**

Datasheet

Rev. D

DF

(For B&O)

Features

WLAN

- ◆ IEEE 802.11a/b/g/n/ac/ax, 1x1 SISO 2.4 GHz and 5 GHz, up to 80 MHz channel
- ◆ Integrated high power PA up to +21 dBm transmit power
- ◆ Integrated LNA and T/R switches
- ◆ UL/DL OFDMA, UL/DL MU-MIMO
- ◆ 802.11ax ER, DCM, TWT
- ◆ 802.11az accurate ranging
- ◆ Security: WPA3 security with hardware encryption engines

Bluetooth

- ◆ Supports Bluetooth 5.4 Class 2 and Bluetooth Low Energy
- ◆ BDR/EDR packet types—1 Mbps (GFSK), 2 Mbps (/4-DQPSK), 3 Mbps (8DPSK)
- ◆ Bluetooth LE long range (125/500 kbps) support improving range by 4x
- ◆ Bluetooth LE 2 Mbps
- ◆ Bluetooth LE advertising extensions for improved capacity
- ◆ Isochronous channels (ISOC) supporting Bluetooth Low Energy (LE) audio
- ◆ Security: AES

802.15.4

- ◆ IEEE 802.15.4-2020 compliant supporting Thread in 2.4 GHz band
- ◆ Shared transmitter and antenna pin with Bluetooth
- ◆ Simultaneous receive with Wi-Fi and Bluetooth
- ◆ MAC accelerator with packet formatting, CRCs, address check, auto-acks, timers

Revision History

Document NO: R2-2644NF-DST-01

Version	Revision Date	DCN NO.	Description	Initials	Approved
A	2024/07/04	DCN031866	Draft version	Hank Li	N.C Chen
B	2024/07/12	DCN031934	Update operating temperature	Hank Li	N.C Chen
C	2024/10/16	DCN032510	- Update Bluetooth 5.4 - Add Thread specification	Hank Li	N.C Chen
D	2024/10/22	DCN032562	STD updated to B&O	Hank Li	N.C Chen

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1. Introduction

1.1 Product Overview

AzureWave Technologies, Inc. introduces the IEEE 802.11a/b/g/n/ac/ax 1x1 dual band WLAN, BT, and 802.15.4 tri-radio module – **AW-XB644NF**. With full-feature Wi-Fi subsystem integrated into a module, **AW-XB644NF** provides the best and most convenient SMT process. The module is targeted to smart entertainment, gateways, hubs, bridges, smart home, industrial, point of sale (POS) terminal, smart appliances which need convenient SMT process.

By using **AW-XB644NF**, the customers can easily integrate the Wi-Fi, BT, 802.15.4 by a combo module with the benefits of **high design flexibility, high success rate on SMT process, short development cycle, and quick time-to-market.**

Compliance with the IEEE 802.11 a/b/g/n/ac/ax standard, the **AW-XB644NF** uses **DSSS, OFDM, DBPSK, DQPSK, CCK** and **QAM** baseband modulation technologies. A high level of integration and full implementation of the power management functions specified in the IEEE 802.11 standard minimize the system power requirements by using **AW-XB644NF**.

The **AW-XB644NF** supports standard interface **SDIO3.0 for WLAN, UART for BT and SPI for 802.15.4**. AW-XB644NF is suitable for multiple mobile processors for different applications. With the combo functions and the good performance, the **AW-XB644NF** is the best solution for the consumer electronics and smart applications.

1.2 Block Diagram

TBD.

1.3 Specifications Table

1.3.1 General

Features	Description
Product Description	IEEE 802.11 a/b/g/n/ac/ax Wi-Fi with Bluetooth 5.4 and 802.15.4 tri-radio Module
Major Chipset	NXP IW612 HVQFN (116 pins)
Host Interface	WiFi + BT + 802.15.4 ● SDIO + UART + SPI
Dimension	22 mm X 30 mm x 2.45 mm(Max)
Form Factor	M.2 2230 module, 75 pins
Antenna	IPEX MHF1 connector Receptacle (20449) ANT1 : Wi-Fi→ TX / RX ANT2 : Bluetooth/802.15.4→ TX / RX
Weight	TBD

1.3.2 WLAN

Features	Description
WLAN Standard	IEEE 802.11 a/b/g/n/ac/ax Wi-Fi 6
WLAN VID/PID	NA
WLAN SVID/SPID	NA
Frequency Range	2.4 GHz ISM Bands 2.412-2.472 GHz 5.15-5.25 GHz (FCC UNII-low band) for US/Canada/Japan/Europe 5.25-5.35 GHz (FCC UNII-middle band) for /Canada/Japan/Europe 5.47-5.725 GHz for US/Canada/Japan/Europe 5.725-5.850 GHz (FCC UNII-high band) for US/Canada/Europe 5.850-5.895 GHz (FCC UNII-4) for US/Canada
Modulation	DSSS, OFDM, DBPSK, DQPSK, CCK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM, OFDMA

Number of Channels	2.4GHz:				
	■ USA, NORTH AMERICA, Canada and Taiwan - 1 ~ 11				
	■ China, Australia, Most European Countries - 1 ~ 13				
	■ Japan, 1 ~ 13				
Number of Channels	5GHz:				
	■ USA, Canada, Most European Countries - 36,40,44,48,52,56,60,64,100,104,108,112,116,120,124,128,132,136,140,149,153,157,161,165, 169, 173, 177				
	■ Japan - 36,40,44,48,52,56,60,64,100,104,108,112,116,120,124,128,132,136,140				
	■ China - 36,40,44,48,52,56,60,64, 149,153,157,161,165				
Output Power (Board Level Limit)*	2.4G				
		Min	Typ	Max	Unit
	11b (11Mbps) @EVM<35%	15.5	17	18.5	dBm
	11g (54Mbps) @EVM≤-27 dB	14.5	16	17.5	dBm
	11n (HT20 MCS7) @EVM≤-28 dB	12.5	14	15.5	dBm
	11n (HT40 MCS7) @EVM≤-28 dB	12.5	14	15.5	dBm
	11ax(HE20 MCS11) @EVM≤-35 dB	10.5	12	13.5	dBm
	11ax(HE40 MCS11) @EVM≤-35 dB	10.5	12	13.5	dBm
	5G				
		Min	Typ	Max	Unit
	11a (54Mbps) @EVM≤-27 dB	14	16	18	dBm
	11n (HT20 MCS7) @EVM≤-28 dB	14	16	18	dBm
	11n (HT40 MCS7) @EVM≤-28 dB	14	16	18	dBm
	11ac(VHT20 MCS8) @EVM≤-31 dB	11	13	15	dBm
	11ac(VHT40 MCS9) @EVM≤-32 dB	11	13	15	dBm
	11ac(VHT80 MCS9) @EVM≤-32 dB	11	13	15	dBm
	11ax(HE20 MCS11) @EVM≤-35 dB	9	11	13	dBm
	11ax(HE40 MCS11) @EVM≤-35 dB	9	11	13	dBm

	11ax(HE80 MCS11) @EVM $\leq$ -35 dB	9	11	13	dBm
Receiver Sensitivity	2.4G				
		Min	Typ	Max	Unit
	11b (11Mbps)	-	-86	-83	dBm
	11g (54Mbps)	-	-73	-70	dBm
	11n (HT20 MCS7)	-	-70	-67	dBm
	11n (HT40 MCS7)	-	-68	-65	dBm
	11ax (HE20 MCS11)	-	-62	-59	dBm
	11ax (HE40 MCS11)	-	-58	-55	dBm
	5G				
		Min	Typ	Max	Unit
	11a (54Mbps)	-	-72	-69	dBm
	11n (HT20 MCS7)	-	-71	-68	dBm
	11n (HT40 MCS7)	-	-67	-64	dBm
	11ac(VHT20 MCS8)	-	-66	-63	dBm
	11ac(VHT40 MCS9)	-	-63	-60	dBm
	11ac(VHT80 MCS9)	-	-60	-57	dBm
	11ax(HE20 MCS11)	-	-60	-57	dBm
	11ax(HE40 MCS11)	-	-56	-53	dBm
	11ax(HE80 MCS11)	-	-56	-53	dBm
Data Rate	WLAN: 802.11b : 1, 2, 5.5, 11Mbps 802.11a/g : 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n : Maximum data rates up to 72 Mbps (20 MHz channel), 150 Mbps (40 MHz channel) 802.11ac: Maximum data rates up to 433 Mbps (80 MHz channel) 802.11ax: Maximum data rates up to 600 Mbps (80 MHz channel)				
Security	■ WiFi: WPA3, WPA2, WPA2 and WPA mixed mode, WEP ■ BT: AES ■ 802.15.4 :AES				

* If you have any certification questions about output power please contact FAE directly.

1.3.3 Bluetooth

Features	Description
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Bluetooth Standard	Full Bluetooth 5.4 features				
Frequency Range	2402MHz~2483MHz				
Modulation	Header GFSK Payload 2M: $\pi/4$ -DQPSK Payload 3M: 8DPSK				
Output Power		Min	Typ	Max	Unit
	BDR	0	2	4	dBm
	EDR	0	2	4	dBm
	Low Energy	0	2	4	dBm
Receiver Sensitivity	BT Sensitivity (BER<0.1%)				
		Min	Typ	Max	Unit
	BDR(DH1)	-	-88	-85	dBm
	EDR(2DH5)	-	-87	-84	dBm
	EDR(3DH5)	-	-81	-78	dBm
	Low Energy	-	-94	-91	dBm

1.3.4 Thread

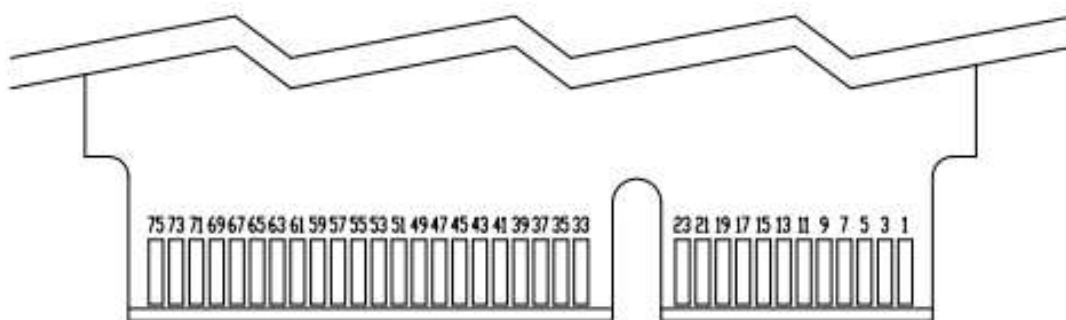
Features	Description				
Thread Standard	IEEE 802.15.4-2020 compliant supporting Thread in 2.4 GHz band				
Frequency Range	2400MHz~2483.5MHz				
Modulation	O-QPSK				
Output Power		Min	Typ	Max	Unit
	Thread	2	4	6	dBm
Receiver Sensitivity	Thread Sensitivity (PER<1%)				
		Min	Typ	Max	Unit
	Thread	-	-95	-92	dBm

1.3.5 Operating Conditions

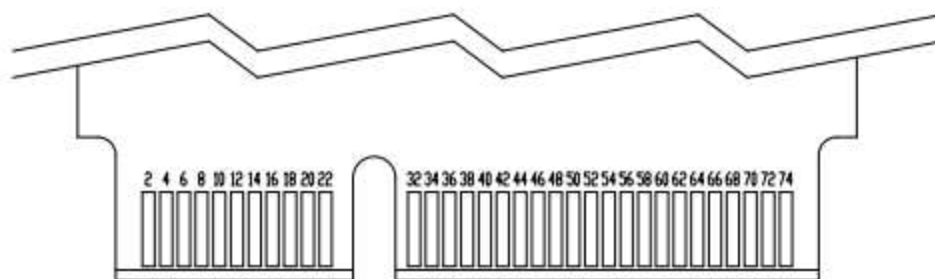
Features	Description
Operating Conditions	
Voltage	3.3V $\pm$ 5%
Operating Temperature	-30 °C to +85 °C
Operating Humidity	Less than 85% R.H.
Storage Temperature	-40 °C to +85 °C
Storage Humidity	Less than 60% R.H.
ESD Protection	
Human Body Model	$\pm$ 2kV
Changed Device Model	$\pm$ 500V

2. Pin Definition

2.1 Pin Map



AW-XB644NF Pin Map (top view)



AW-XB644NF Pin Map (bottom view)

2.2 Pin Table

Pin No	Definition	Basic Description	Voltage	Type
1	GND	Ground	---	---
2	3.3V	3.3V Power Supply	3.3V	P
3	NC	NC	---	---
4	3.3V	3.3V Power Supply	3.3V	P
5	NC	NC	---	---
6	LED1#	GPIO mode: GPIO[25] (input/output) WCI-2 coexistence mode: WCI-2_SIN - Receive signal from external radio (input)	VDDIO	I/O
7	GND	Ground	---	---
8	PCM_CLK/I2S_SCK	PCM clock signal. GPIO[4] input/output . Central mode: output . Peripheral mode: input	VDDIO	I/O
9	SDIO_CLK	SDIO 4-bit mode: Clock input SDIO 1-bit mode: Clock input	VDDIO	I/O
10	PCM_SYNC/I2S_WS	PCM sync pulse signal. GPIO[7] input/output . Central mode: output . Peripheral mode: input	VDDIO	I/O
11	SDIO_CMD	SDIO 4-bit mode: Command/response (input/output) SDIO 1-bit mode: Command line (input/output)	VDDIO	I/O
12	PCM_OUT/I2S_SD_OUT	PCM audio codec input data (for playback). GPIO[5] input/output	VDDIO	O
13	SDIO_D0	SDIO 4-bit mode: Data line bit[0] SDIO 1-bit mode: Data line	VDDIO	I/O
14	PCM_IN/I2S_SD_IN	PCM audio codec output data (for recording). GPIO[6] input/output	VDDIO	I
15	SDIO_D1	SDIO 4-bit mode: Data line bit[1] SDIO 1-bit mode: Data line	VDDIO	I/O
16	LED2#	GPIO mode: GPIO[26] (input/output) WCI-2 coexistence mode: WCI-2_SOUT - Transmit signal to external radio (output)	VDDIO	I/O
17	SDIO_D2	SDIO 4-bit mode: Data line bit[2] SDIO 1-bit mode: Data line	VDDIO	I/O
18	GND	Ground	---	---
19	SDIO_D3	SDIO 4-bit mode: Data line bit[3] SDIO 1-bit mode: Data line	VDDIO	I/O
20	UART_WAKE#	Bluetooth/802.15.4 radio wake-up input signal. Multi-functional pin: GPIO[18] input/output	VDDIO	I
21	SDIO_WAKE#	Wi-Fi radio wake-up input signal. Multi-functional pin: GPIO[16] input/output	VDDIO	I
22	UART_TXD	UART serial output signal Multi-functional pin: GPIO[11] input/output	VDDIO	O
23	SDIO_RESET#	Independent software reset for Wi-Fi	VDDIO	I

		Multi-functional pin: GPIO[1] input/output		
32	UART_RXD	UART serial input signal Multi-functional pin: GPIO[10] input/output	VDDIO	I
33	GND	Ground	---	---
34	UART_RTS	UART request-to-send output signal Multi-functional pin: GPIO[9] input/output	VDDIO	O
35	NC	NC	---	---
36	UART_CTS	UART clear-to-send input signal Multi-functional pin: GPIO[8] input/output	VDDIO	I
37	NC	NC	---	---
38	VENDOR DEFINED 38	SPI receive input signal Multi-functional pin: GPIO[14] input/output	VDDIO	I
39	GND	Ground	---	---
40	VENDOR DEFINED 40	SPI transmit output signal Multi-functional pin: GPIO[15] input/output	VDDIO	O
41	NC	NC	---	---
42	VENDOR DEFINED 42	SPI clock input signal Multi-functional pin: GPIO[12] input/output	VDDIO	I
43	NC	NC	---	---
44	NC	NC	---	---
45	GND45	Ground	---	---
46	NC	NC	---	---
47	NC	NC	---	---
48	NC	NC	---	---
49	NC	NC	---	---
50	NC	NC	---	---
51	GND	Ground	---	---
52	NC	NC	---	---
53	NC	NC	---	---
54	WDISABLE2#	IND_RST_BT: Independent software reset for Bluetooth. Active Low by default Connect to MPU/MCU GPIO.	VDDIO	O
55	NC	NC	---	---
56	WDISABLE1#	Full Power-down (input) (active low)	1.8V/3.3V	I
57	GND	Ground	---	---
58	I2C_DATA	I2C data for I/O expander. Open-drain. Pullup required on platform.	1.8V	I/O
59	NC	NC	---	---
60	I2C_CLK	I2C clock from MPU/MCU for I/O expander.	1.8V	O
61	NC	NC	---	---
62	ALERT#	SPI interrupt output signal. Multi-functional pin: GPIO[20] input/output	VDDIO	O
63	GND	Ground	---	---
64	RESERVED	SPI data frame signal, driven by the SPI controller.	VDDIO	I
65	NC	NC	---	---
66	NC	NC	---	---

67	NC	NC	---	---
68	UIM_PWR_SNK/C LKREQ1#	GPIO mode: GPIO[23] (input/output)	VDDIO	I/O
69	GND	Ground	---	---
70	UIM_PWR_SRC/G PIO1/PEWake1#	GPIO mode: GPIO[27] (input/output)	VDDIO	I/O
71	NC	NC	---	---
72	3.3V	3.3V Power Supply	3.3V	P
73	NC	NC	---	---
74	3.3V	3.3V Power Supply	3.3V	P
75	GND	Ground	---	---

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VBAT	DC supply for the 3.3V input	-	3.3	3.96	V
VDDIO	I/O power supply	-	3.3	3.96	V

		-	1.8	2.16	
--	--	---	-----	------	--

3.2 Recommended Operating Conditions

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V _{BAT}	DC supply for the 3.3V input	3.14	3.3	3.46	V
V _{DDIO}	1.8V/3.3V digital I/O power supply	3.14	3.3	3.46	V
		1.71	1.8	1.98	

3.3 Digital IO Pin DC Characteristics

3.3.1 1.8V Operation (V_{DDIO})

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V _{IH}	Input high voltage	0.7*V _{IO}	-	V _{IO} +0.4	V
V _{IL}	Input low voltage	-0.4	-	0.3*V _{IO}	
V _{OH}	Output high voltage	V _{IO} -0.4	-	-	
V _{OL}	Output low voltage	-	-	0.4	
V _{HYS}	Input Hysteresis	100			mV

3.3.2 3.3V Operation (V_{DDIO})

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V _{IH}	Input high voltage	0.7*V _{IO}	-	V _{IO} +0.4	V
V _{IL}	Input low voltage	-0.4	-	0.3*V _{IO}	
V _{OH}	Output High Voltage	V _{IO} -0.4	-	-	
V _{OL}	Output Low Voltage	-	-	0.4	
V _{HYS}	Input Hysteresis	100			mV

3.4 Host Interface

3.4.1 SDIO Interface

The AW-XB644NF supports a SDIO device interface that conforms to the industry SDIO Full-Speed card specification and allows a host controller using the SDIO bus protocol to access the Wireless SoC device.

The AW-XB644NF acts as the device on the SDIO bus. The host unit can access registers of the

SDIO interface directly and can access shared memory in the device through the use of BARs and a DMA engine.

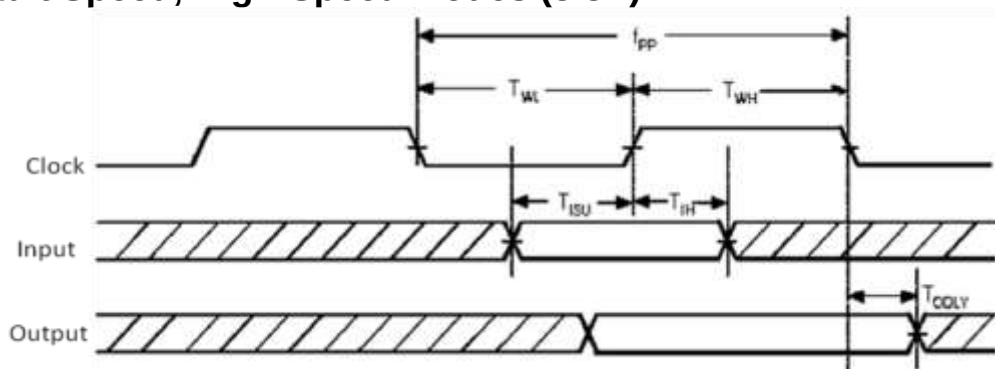
- ◆ Support SDIO 3.0 Standard.
- ◆ On-chip memory used for CIS.
- ◆ Supports 4-bit SDIO and 1-bit SDIO transfer modes.
- ◆ Special interrupt register for information exchange.
- ◆ Allows card to interrupt host.

SDIO Interface Signals

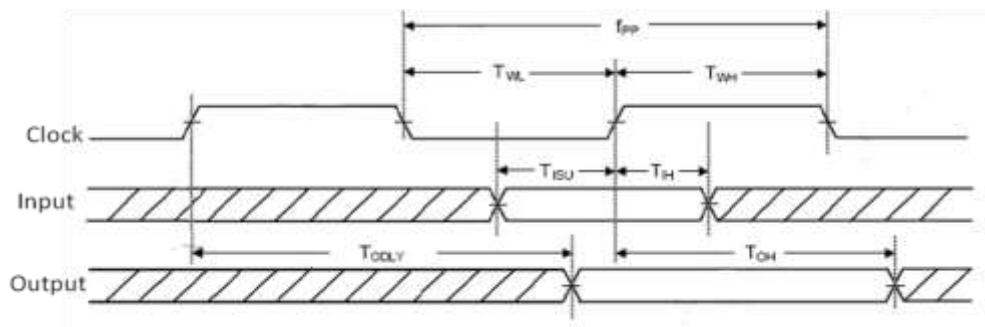
AW-XB644NF SDIO Pin Name	Type	Description
SDIO_CLK	I	SDIO 4-bit mode: Clock SDIO 1-bit mode: Clock
SDIO_CMD	I/O	SDIO 4-bit mode: Command line SDIO 1-bit mode: Command line
SDIO_DATA3	I/O	SDIO 4-bit mode: Data line Bit[3] SDIO 1-bit mode: Not used
SDIO_DATA2	I/O	SDIO 4-bit mode: Data line Bit[2] or Read Wait (optional) SDIO 1-bit mode: Read Wait (optional)
SDIO_DATA1	I/O	SDIO 4-bit mode: Data line Bit[1] SDIO 1-bit mode: Interrupt
SDIO_DATA0	I/O	SDIO 4-bit mode: Data line Bit[0] SDIO 1-bit mode: Data line

3.4.2 SDIO Protocol Timing

3.4.2.1 Default Speed, High-Speed Modes (3.3V)



SDIO protocol timing Diagram - Default mode. (3.3V)

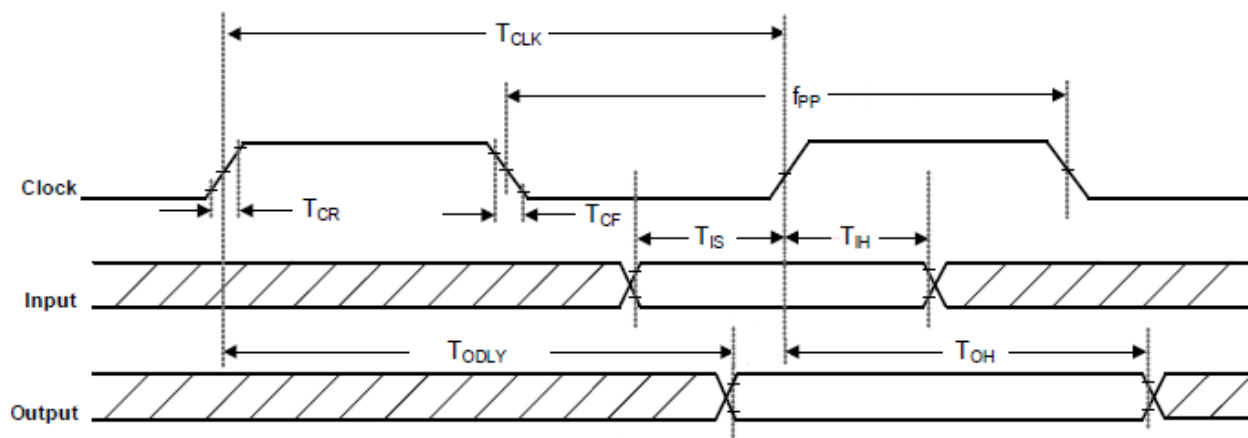


SDIO protocol timing Diagram - High Speed mode. (3.3V)

Symbol	Parameter	Condition	Min	Typ	Max	Units
fpp	CLK Frequency	Normal	0	--	25	MHz
		High Speed	0	--	50	MHz
TWH	CLK High Time	Normal	10	--	--	ns
		High Speed	7	--	--	ns
TWL	CLK Low Time	Normal	10	--	--	ns
		High Speed	7	--	--	ns
TISU	Input Setup Time	Normal	5	--	--	ns
		High Speed	6	--	--	ns
TIH	Input Hold Time	Normal	5	--	--	ns
		High Speed	2	--	--	ns
TODLY	Output Delay Time	Normal	--	--	14	ns
	CL ≤ 40pF (1 card)	High Speed	--	--	14	ns
TOH	Output Hold Time	High Speed	2.5	--	--	ns

SDIO Timing Data – Default Speed / High-Speed modes. (3.3V)

3.4.2.2 SDR12, SDR25, SDR50 Modes (up to 100MHz) (1.8V)

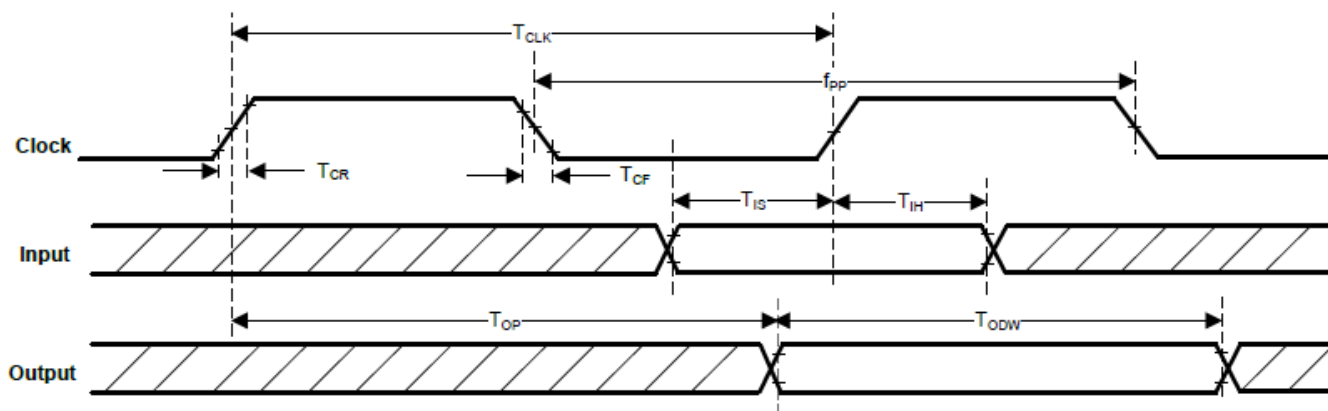


SDIO Protocol Timing Diagram - SDR12, SDR25, SDR50 Modes (up to 100 MHz)(1.8V)

Symbol	Parameter	Condition	Min	Typ	Max	Units
F_{pp}	CLK Frequency	SDR12/25/50	25	-	100	MHz
T_{CLK}	Clock Time	SDR12/25/50	10	-	40	ns
T_{IS}	Input Setup Time	SDR12/25/50	3	-	-	ns
T_{IH}	Input Hold Time	SDR12/25/50	0.8	-	-	ns
T_{CR}, T_{CF}	Rise time, fall time TCR, TCF < 2ns(max) at 100MHz CCARD = 10pF	SDR12/25/50	-	-	$0.2 \cdot T_{CLK}$	ns
T_{ODLY}	Output Delay Time $CL \leq 30pF$	SDR12/25/50	-	-	7.5	ns
T_{OH}	Output Hold Time $CL = 15pF$	SDR12/25/50	1.5	-	-	ns

SDIO Timing Data - SDR12/25/50 modes. (1.8V)

3.4.2.3 SDR104 mode (208MHz) (1.8V)

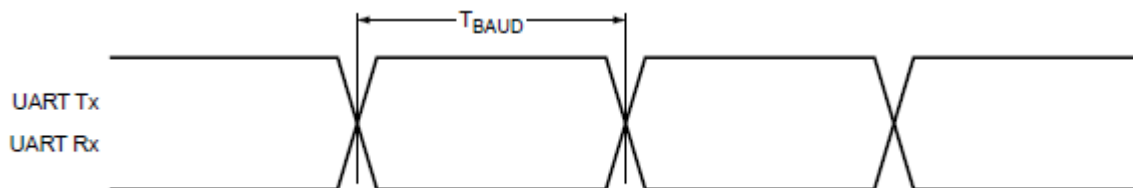


Symbol	Parameter	Condition	Min	Typ	Max	Units
F_{pp}	CLK Frequency	SDR104	0	-	208	MHz
T_{CLK}	Clock Time	SDR104	4.8	-	-	ns
T_{IS}	Input Setup Time	SDR104	1.4	-	-	ns
T_{IH}	Input Hold Time	SDR104	0.8	-	-	ns
T_{CR}, T_{CF}	Rise time, fall time TCR, TCF < 0.96ns(max) at 208MHz CCARD = 10pF	SDR104	-	-	$0.2 \cdot T_{CLK}$	ns
T_{OP}	Card output phase	SDR104	0	-	10	ns

T_{ODW}	Output timing of variable data window	SDR104	2.88	-	-	ns
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3.4.3.High-Speed UART Interface

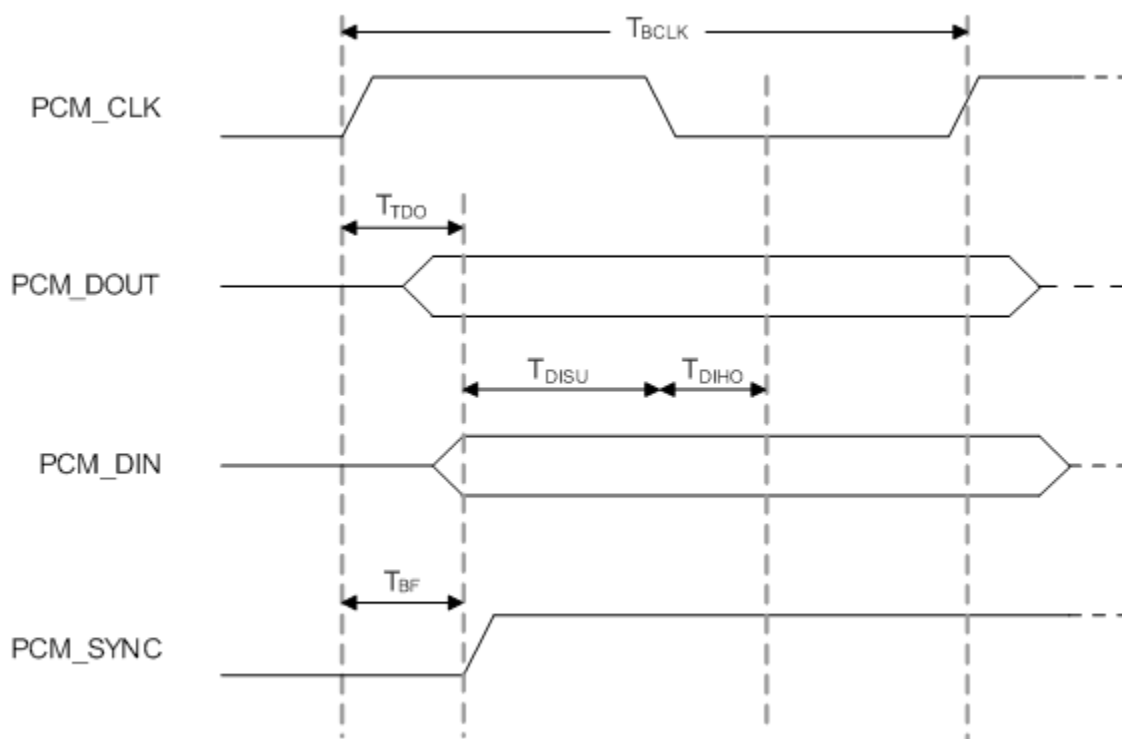
The AW-XB644NF supports a high-speed Universal Asynchronous Receiver/Transmitter (UART) interface, compliant to the industry standard 16550 specification. High-speed baud rates are supported to provide the physical transport between the device and the host for exchanging Bluetooth data.



Symbol	Parameter	Condition	Min	Typ	Max	Units
T_{BAUD}	Baud rate	26MHz or 40MHz input clock	250	-	-	ns

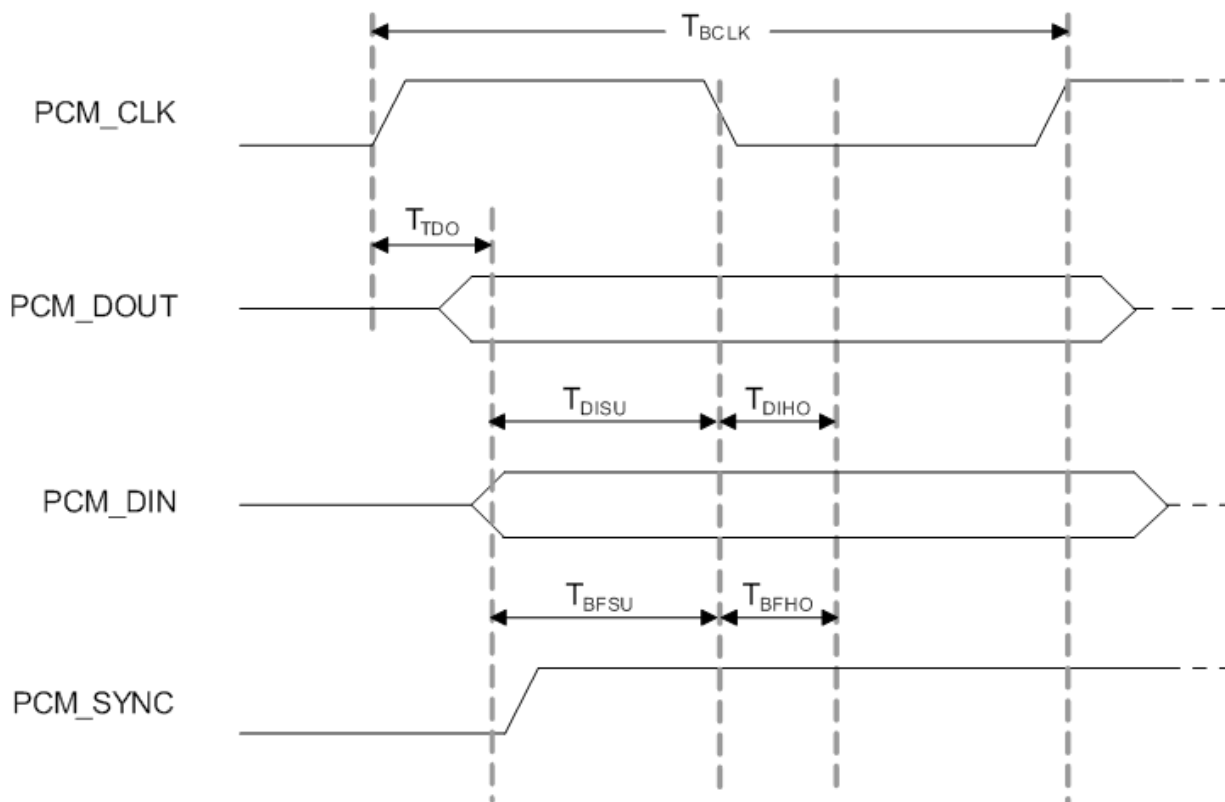
3.4.4 PCM Interface

3.4.4.1 PCM Timing Specification – Master Mode



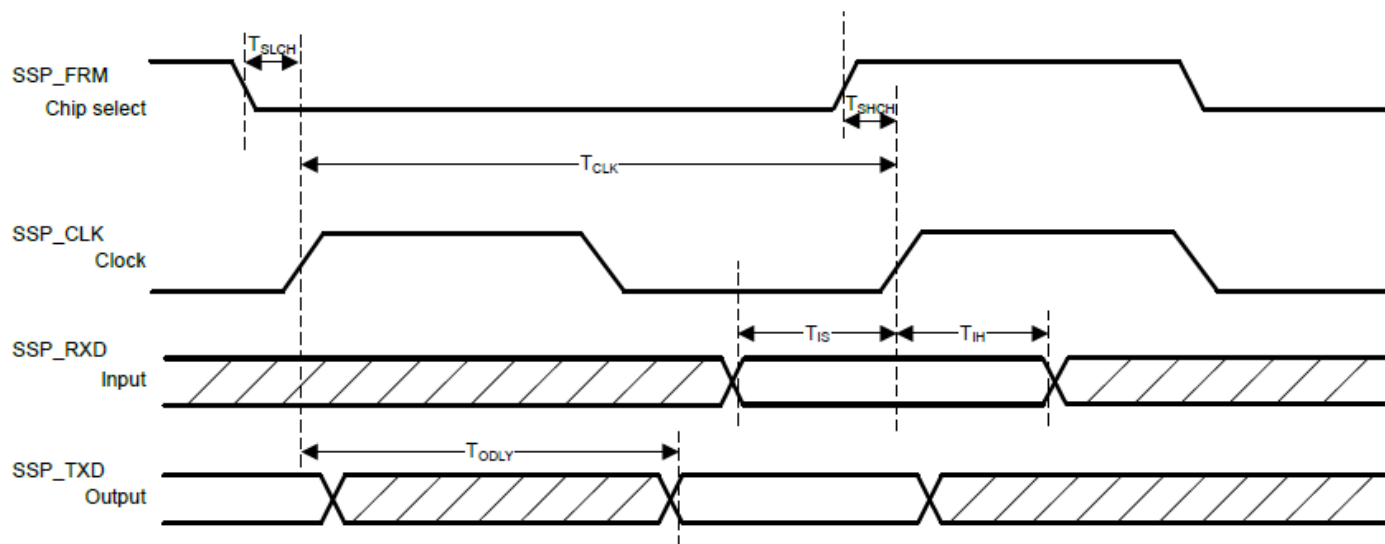
Symbol	Parameter	Condition	Min	Typ	Max	Units
F_{BCLK}	--	--	--	2/2.048	--	MHz
Duty Cycle _{BCLK}	--	--	0.4	0.5	0.6	--
T_{BCLK} rise/fall	--	--	--	3	--	ns
T_{DO}	--	--	--	--	15	ns
T_{DISU}	--	--	20	--	--	ns
T_{DIHO}	--	--	15	--	--	ns
T_{BF}	--	--	--	--	15	ns

3.4.4.2 PCM Timing Specification – Slave Mode



Symbol	Parameter	Condition	Min	Typ	Max	Units
F_{BCLK}	--	--	--	2/2.048	--	MHz
Duty Cycle $_{BCLK}$	--	--	0.4	0.5	0.6	--
$T_{BCLK \text{ rise/fall}}$	--	--	--	3	--	ns
T_{DO}	--	--	--	--	30	ns
T_{DISU}	--	--	15	--	--	ns
T_{DIHO}	--	--	10	--	--	ns
T_{BFSU}	--	--	15	--	--	ns
T_{BFHO}	--	--	10	--	--	ns

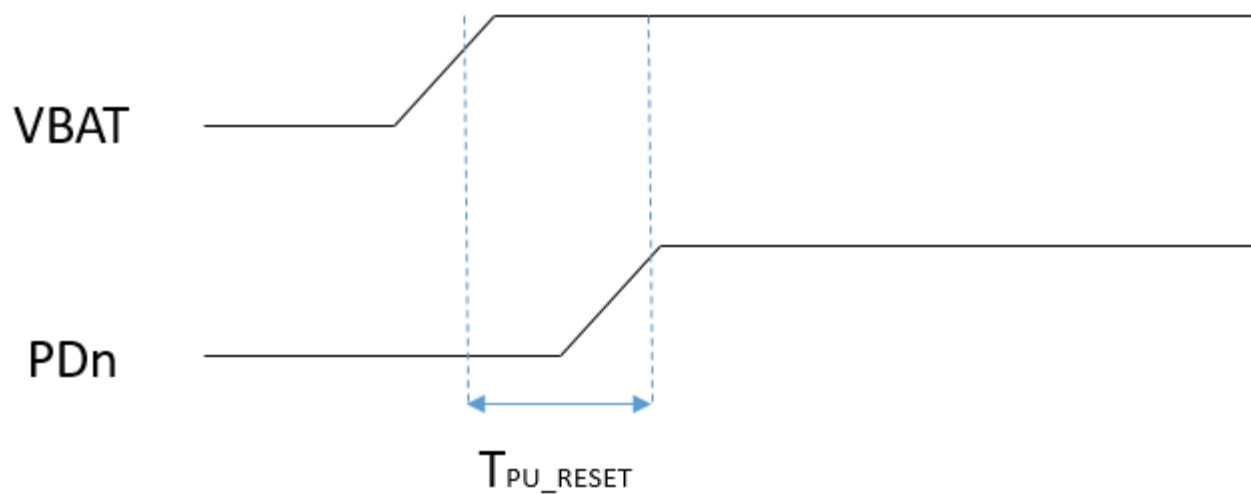
3.4.5 SPI Interface



Symbol	Parameter	Condition	Min	Typ	Max	Units
T_{SLCH}	Chip select setup time	--	12	--	--	ns
T_{SHCH}	Chip select hold time	--	12	--	--	ns
T_{CLK}	Clock period	--	40	--	--	ns
T_{IS}	Input setup time	--	12	--	--	ns
T_{IH}	Input hold time	--	0	--	--	ns
T_{ODLY}	Output delay	--	--	--	12	ns

3.5 Timing Sequence

AW-XB644NF power up timing sequence.



Symbol	Parameter	Min	Typ	Max	Units
TPU_RESET	Valid power to PDn deasserted	0	-	-	ms
VIH	Input high voltage	1.4	-	4.5	V
VIL	Input low voltage	-0.4	-	0.5	V

3.6 Power Consumption*

3.6.1 WLAN

No.	Item			JP1_PIN2 VBAT_3.3V (mA)		
				Max.	Avg.	
1	Pdn ^{*(1)(2)}			TBD	TBD	
2	Deepsleep ^{*(2)(3)}			TBD	TBD	
3	Power Save 2.4GHz (DTIM-1) ^{*(2)(3)(4)}			TBD	TBD	
4	Power Save 5GHz (DTIM-1) ^{*(2)(3)(4)}			TBD	TBD	
Band (GHz)	Mode	BW (MHz)	RF Power (dBm)	Transmit (mA)		
				Max.	Avg.	Duty Cycle Avg. (%)
2.4	11b@1Mbps	20	17	TBD	TBD	TBD
	11g@54Mbps	20	16	TBD	TBD	TBD
	11n@MCS0	40	14	TBD	TBD	TBD
	11n@MCS7	40	14	TBD	TBD	TBD
	11ax@MCS0 NSS1	40	12	TBD	TBD	TBD
	11ax@MCS11 NSS1	40	12	TBD	TBD	TBD
5	11a@6Mbps	20	16	TBD	TBD	TBD
	11n@MCS0	40	16	TBD	TBD	TBD
	11n@MCS7	40	16	TBD	TBD	TBD
	11ac@MSC0 NSS1	80	13	TBD	TBD	TBD
	11ac@MSC9 NSS1	80	13	TBD	TBD	TBD
	11ax@MSC0 NSS1	80	11	TBD	TBD	TBD
	11ax@MSC11 NSS1	80	11	TBD	TBD	TBD
Band (GHz)	Mode	BW(MHz)		Receive (mA)		
				Max.	Avg.	
2.4	11b@11Mbps	20		TBD	TBD	
	11n@MCS7	40		TBD	TBD	
	11ax@MCS11 NSS1	40		TBD	TBD	
5	11a@54Mbps	20		TBD	TBD	
	11n@MCS7	40		TBD	TBD	
	11ac@MCS9 NSS1	80		TBD	TBD	
	11ax@MCS11 NSS1	80		TBD	TBD	

No.	Item			JP4_PIN2 VIO_3.3V (uA)	
				Max.	Avg.
1	Pdn ^{*(1)(2)}			TBD	TBD
2	Deepsleep ^{*(2)(3)}			TBD	TBD
3	Power Save 2.4GHz (DTIM-1) ^{*(2)(3)(4)}			TBD	TBD
4	Power Save 5GHz (DTIM-1) ^{*(2)(3)(4)}			TBD	TBD
Band (GHz)	Mode	BW (MHz)	RF Power (dBm)	Transmit (uA)	
				Max.	Avg.
2.4	11b@1Mbps	20	17	TBD	TBD
	11ax@MCS11 NSS1	40	12	TBD	TBD
5	11a@6Mbps	20	16	TBD	TBD
	11ax@MCS11 NSS1	80	11	TBD	TBD
Band (GHz)	Mode	BW(MHz)		Receive (uA)	
				Max.	Avg.
2.4	11b@11Mbps	20		TBD	TBD
5	11ax@MCS11 NSS1	80		TBD	TBD

No.	Item			JP4_PIN2 VIO_1.8V (uA)	
				Max.	Avg.
1	Pdn ^{*(1)(2)}			TBD	TBD
2	Deepsleep ^{*(2)(3)}			TBD	TBD
3	Power Save 2.4GHz (DTIM-1) ^{*(2)(3)(4)(5)}			TBD	TBD
4	Power Save 5GHz (DTIM-1) ^{*(2)(3)(4)(5)}			TBD	TBD
Band (GHz)	Mode	BW (MHz)	RF Power (dBm)	Transmit (uA)	
				Max.	Avg.
2.4	11b@1Mbps	20	17	TBD	TBD
	11ax@MCS11 NSS1	40	12	TBD	TBD
5	11a@6Mbps	20	16	TBD	TBD
	11ax@MCS11 NSS1	80	11	TBD	TBD
Band (GHz)	Mode	BW(MHz)		Receive (uA)	
				Max.	Avg.
2.4	11b@11Mbps	20		TBD	TBD
5	11ax@MCS11 NSS1	80		TBD	TBD

3.6.2 Bluetooth

No.	Mode	Packet Type	RF Power (dBm)	JP1_PIN2 VBAT_3.3V (mA)	
				Max.	Avg.

1	Deepsleep ^{*(1)}	N/A		TBD	TBD
2	Transmit ^{*(2)}	DH5	2	TBD	TBD
3	Receive ^{*(2)}	DH5	N/A	TBD	TBD
No.	Mode	Packet Type	RF Power (dBm)	JP4_PIN2 VIO_3.3V (uA)	
				Max.	Avg.
1	Deepsleep ^{*(1)}	N/A		TBD	TBD
2	Transmit ^{*(2)}	DH5	2	TBD	TBD
3	Receive ^{*(2)}	DH5	N/A	TBD	TBD
No.	Mode	Packet Type	RF Power (dBm)	JP4_PIN2 VIO_1.8V (uA)	
				Max.	Avg.
1	Deepsleep ^{*(1)}	N/A		TBD	TBD
2	Transmit ^{*(2)}	DH5	2	TBD	TBD
3	Receive ^{*(2)}	DH5	N/A	TBD	TBD

3.6.3 802.15.4

No.	Mode	Modulation Type	RF Power (dBm)	JP1_PIN2 VBAT_3.3V (mA)	
				Max.	Avg.
1	Deepsleep ^{*(1)(2)}	N/A		TBD	TBD
2	Transmit ^{*(3)(4)}	O-QPSK	4	TBD	TBD
3	Receive ^{*(3)(5)}	O-QPSK	N/A	TBD	TBD
No.	Mode	Packet Type	RF Power (dBm)	JP4_PIN2 VIO_3.3V (uA)	
				Max.	Avg.
1	Deepsleep ^{*(1)(2)}	N/A		TBD	TBD
2	Transmit ^{*(3)(4)}	O-QPSK	4	TBD	TBD
3	Receive ^{*(3)(5)}	O-QPSK	N/A	TBD	TBD
No.	Mode	Packet Type	RF Power (dBm)	JP4_PIN2 VIO_1.8V (uA)	
				Max.	Avg.
1	Deepsleep ^{*(1)(2)}	N/A		TBD	TBD
2	Transmit ^{*(3)(4)}	O-QPSK	4	TBD	TBD
3	Receive ^{*(3)(5)}	O-QPSK	N/A	TBD	TBD

3.7 Sleep Clock (Optional)

An external crystal is used for generating all radio frequencies and normal operation clocking. As an alternative, an external frequency reference driven by a temperature-compensated crystal oscillator (TCXO) signal may be used. No software settings are required to differentiate between the two. In

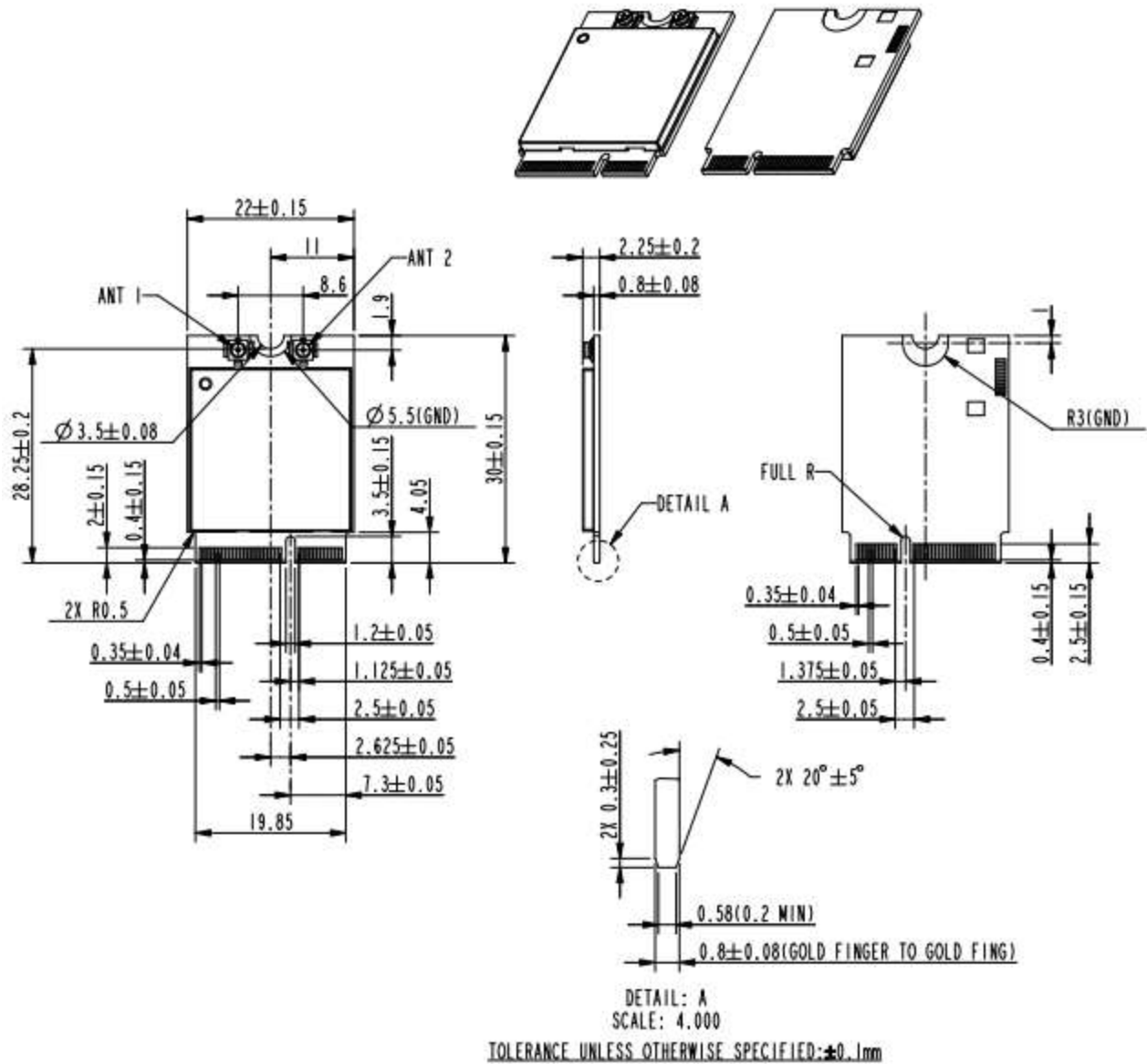
addition, a low-power oscillator (LPO) is provided for lower power mode timing.

External 32.768KHz Low-Power Oscillator

Symbol	Parameter	Min	Typ	Max	Units
CLK	Clock frequency range/ accuracy ■ CMOS input clock signal type ■ ± 250 ppm (initial, aging, temperature)	-	32.768	-	kHz
PN	Phase noise requirement (@ 100KHz)	-	-125	-	dBc/Hz
Jc	Cycle jitter	-	1.5	-	ns (RMS)
SR	Slew rate limit (10-90%)	-	-	100	ns
DC	Duty cycle tolerance	20	-	80	%

4. Mechanical Information

4.1 Mechanical Drawing

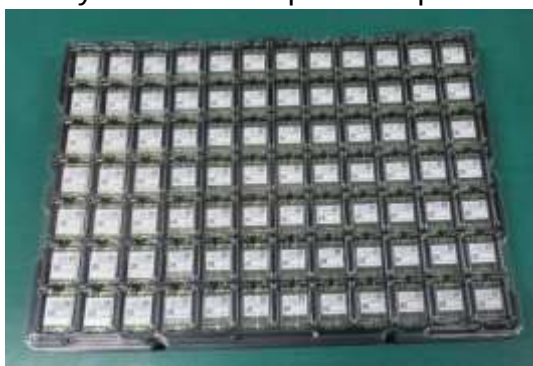


5. Packing Information

1. 84pcs M.2 2230 modules put in one tray



2. 13pcs of trays are stacked with each other, and add more one transparent tray on the top, so the total number of trays is 14pcs, i.e. 13pcs tray are full and 1pcs transparent tray is empty



3. Use P.P Strap to pack 14pcs trays and add one packing label on the top



Example:



4. Put the two packed tray into the box



5. Seal the carton by AzureWave tape



6. One carton label and one box label pasted on the carton. If the carton is not full, add one balance label pasted on the carton

One carton label



One box label



Federal Communication Commission Interference Statement

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.

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.

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

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance **20cm** between the radiator & your body.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

Industry Canada Statement

CAN ICES-3(B)/ NMB-3(B)

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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;
- (2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Radiation Exposure Statement:

This equipment complies with ISSED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with greater than **20cm** between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements ISSED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à plus de **20 cm** entre le radiateur et votre corps.

Caution :

- (i) the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;
- (ii) for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit;
- (iii) for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits as appropriate;
- (iv) where applicable, antenna type(s), antenna models(s), and worst-case tilt angle(s) necessary to remain compliant with the e.i.r.p. elevation mask requirement set forth in section 6.2.2.3 shall be clearly indicated.

Avertissement:

- (i) les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;
- (ii) pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis pour les dispositifs utilisant les bandes de 5 250 à 5 350 MHz et de 5 470 à 5 725 MHz doit être conforme à la limite de la p.i.r.e.;
- (iii) pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis (pour les dispositifs utilisant la bande de 5 725 à 5 850 MHz) doit être conforme à la limite de la p.i.r.e. spécifiée, selon le cas;
- (iv) lorsqu'il y a lieu, les types d'antennes (s'il y en a plusieurs), les numéros de modèle de l'antenne et les pires angles d'inclinaison nécessaires pour rester conforme à l'exigence de la p.i.r.e. applicable au masque

d'élévation, énoncée à la section 6.2.2.3, doivent être clairement indiqués.

The transmitter module may not be co-located with any other transmitter or antenna.
 Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

This module is limited to OEM installation ONLY.

2.2 List of applicable FCC rules

Compliance with FCC Part 15C, 15E regulation.

2.3 Specific operational use conditions

The module is tested for standalone mobile RF exposure use condition. Any other usage conditions such as co-location with other transmitter(s) will need a separate reassessment through a class II permissive change application or new certification.

2.4 Limited module procedures

Not applicable to this device

2.6 RF exposure considerations

This module is limited to installation in mobile or fixed applications, according to §2.1091(b). The separate approval is required for all other operating configurations, including portable configurations with respect to Part §2.1093 and different antenna configurations

2.7 Antennas:

- (1) The antenna must be installed such that 20 cm is maintained between the antenna and users,
- (2) The transmitter module may not be co-located with any other transmitter or antenna.
- (3) To comply with FCC/IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile exposure condition must not exceed:

Antenna Number	Frequency Band	Model Number	Antenna Type	Gain(dBi)	P2MP reduction in power (dB)
Antenna 1	2400-2483.5MHz 5150-5850MHz	2195501-2	PCB	2.4GHz: 0.47	-
				5GHz: 1.88	-
Antenna 2	2400-2483.5MHz 5150-5850MHz	2195505-2	PCB	2.4GHz: 0.77	-
				5GHz: 0.96	-
Antenna 3	2400-	WA-P-LB-02-	PCB	2.4GHz: 4.43	-

	2483.5MHz 5150- 5850MHz	587		5GHz: 7.52	1.52
Antenna 4	2400- 2483.5MHz 5150- 5850MHz	WA-P-LB-03- 129	PCB	2.4GHz: 6.51	0.51
				5GHz: 3.2	-
Antenna 5	2400- 2483.5MHz 5150- 5850MHz	WA-P-LB-03- 130	PCB	2.4GHz: 4.91	-
				5GHz: 5.84	-
Antenna 6	2400- 2483.5MHz 5150- 5850MHz	WA-F-LB-03- 110	PCB	2.4GHz: - 0.27	-
				5GHz: 2.74	-
Antenna 7	2400- 2483.5MHz 5150- 5850MHz	WA-F-LB-02- 187	PCB	2.4GHz: 0.07	-
				5GHz: 2.39	-
Antenna 8	2400- 2483.5MHz	WA-F-LA-01- 015	PCB	2.4GHz: 5.66	-

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC/IC authorization is no longer considered valid and the FCC ID/IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC/IC authorization.

2.8 Label and compliance information

When the module is installed in the host device, the FCC ID/ IC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: “Contains FCC ID: TLZ-XB644NF”, “Contains IC: 6100A-XB644NF “

The grantee's FCC ID/IC ID can be used only when all FCC/IC compliance requirements are met.

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

Federal Communication Commission Interference Statement

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 a **Class B** digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least **20** cm from all persons.

This device and its antenna(s) must **not be co-located** or operating in conjunction with any other antenna or transmitter.

This module cannot be installed into a host with a weatherized enclosure.

The host must be powered from a wired permanent indoor local power connection, battery powered is not allowed.

The host must bear a statement in a conspicuous location on the device and the user's manual: "FCC regulations restrict the operation of this device to indoor use only."

Industry Canada Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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;
- (2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users.

This device is intended only for OEM integrators under the following conditions:

- 1) The antenna must be installed such that 20cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

- 1) L'antenne doit être installée de telle sorte qu'une distance de 20cm est respectée entre l'antenne et les utilisateurs, et
- 2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

2.9 Information on test modes and additional testing requirements

This radio module must not be installed to co-locate and operating simultaneously with other radios in the host system except in accordance with FCC multi-transmitter product procedures. Additional testing and equipment authorization may be required operate simultaneously with other radio.

2.10 Additional testing, Part 15 Subpart B disclaimer

The host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).

2.11 Note EMI Considerations

Please follow the guidance provided for host manufacturers in KDB publications 996369 D02 and D04.

2.12 How to make changes

Only Grantees are permitted to make permissive changes. Please contact us if the host integrator expect the module to be used differently than as granted:

Company Name: AzureWave Technologies (USA), Inc.

Company Address: 467 Saratoga ave #108 San Jose, CA 95129 United States

NCC :

取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率

或變更原設計之特性及功能。低功率射頻器材之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前述合法通信，指依電信管理法規定作業之無線電通信。低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

應避免影響附近雷達系統之操作。

本模組於取得認證後將依規定於模組本體標示審驗合格標籤，並要求平台廠商於平台上標示「本產品內含射頻模組  CC XX xx LP yyy Z z。」

「本公司於說明書中提供所有必要資訊以指導使用者/安裝者正確的安裝及操作」

Japan :

5GHz band (W52,W53): Indoor use only (except communicate to W52 high power radio)