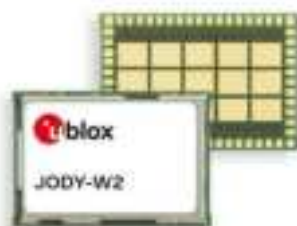# JODY-W2 series

Host-based multiradio modules with Wi-Fi and Bluetooth 5

Data sheet

Abstract

This technical data sheet describes the JODY-W2 series modules with 1x1 802.11n/ac and dual-mode Bluetooth 5. JODY-W2 is ideal for in-vehicle infotainment and telematics applications with simultaneous use cases requiring high data rates, such as in-car hotspots, Wi-Fi display applications such as Apple CarPlay, or video streaming across multiple clients. Connection to a host processor is through SDIO, or High-Speed UART interfaces (Bluetooth only).

Document information

Title	**JODY-W2 series**
Subtitle	Host-based multiradio modules with Wi-Fi and Bluetooth 5
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Product status	Corresponding content status	
Functional Sample	Draft	For functional testing. Revised and supplementary data will be published later.
In Development / Prototype	Objective specification	Target values. Revised and supplementary data will be published later.
Engineering Sample	Advance information	Data based on early testing. Revised and supplementary data will be published later.
Initial Production	Early production information	Data from product verification. Revised and supplementary data may be published later.
Mass Production / End of Life	Production information	Document contains the final product specification.

This document applies to the following products:

Product name	Type number	Chipset	PCN reference	Product status
JODY-W263-A	JODY-W263-00A-00	88W8987A	N/A	Initial production
JODY-W263-A	JODY-W263-01A-00	88W8987S	N/A	Initial production
JODY-W263	JODY-W263-00B-00	88W8987	N/A	Initial production

Contents

1 Functional description

1.1 Overview

The JODY-W2 series are compact modules based on the NXP 88W8987 chipset family. The chipsets used in the automotive grade JODY-W2 modules are AEC-Q100 compliant. They enable Wi-Fi, Bluetooth, and Bluetooth Low Energy (LE) communication, and are ideal for automotive and industrial applications.

The JODY-W2 modules can be operated in the following modes:

- Wi-Fi 1x1 802.11a/b/g/n/ac in 2.4 GHz or 5 GHz
- Dual-mode Bluetooth 5, including audio, can be operated fully simultaneous with Wi-Fi

JODY-W2 undergoes extended automotive qualification according to ISO 16750-4 and is manufactured in line with ISO/TS 16949. Connection to a host processor is through SDIO, or High-Speed UART interfaces.

1.2 Applications

Automotive applications
- In-car Access Point for internet access
- In the car applications such as Apple Car-Play, Miracast, and so on.
- Rear-seat display
- Rapid sync-n-go applications and fast content download to the vehicle.
- Hands-free equipment (Bluetooth)

Industrial applications
- Manufacturing floor automation, wireless control terminals and point-to-point backhaul
- Machine control
- Medical in-hospital applications
- Security and surveillance
- Outdoor content distribution
- Robust wireless connectivity in a broad range of industrial applications

1.3 Block diagram

Figure 1 shows the various components and interfaces supported in JODY-W2 series modules.
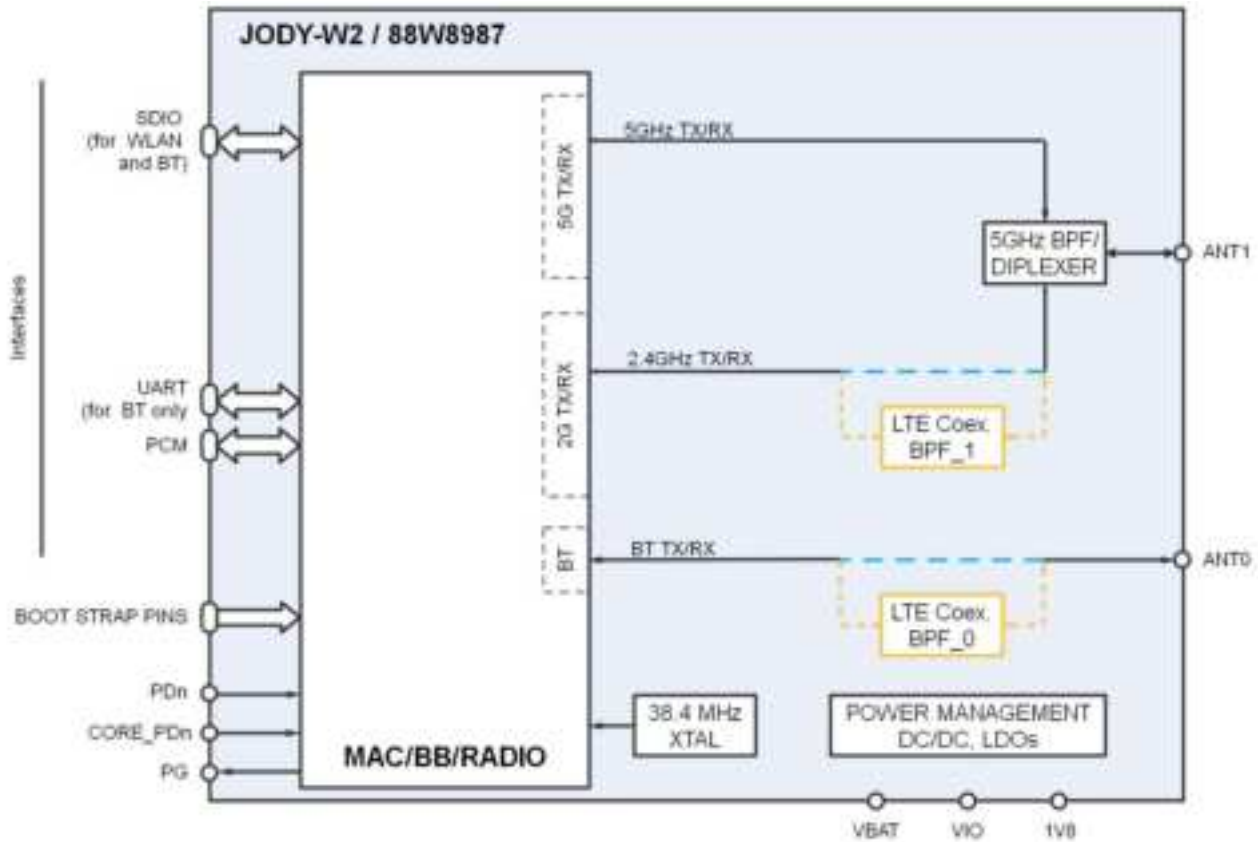
Figure 1: JODY-W263-A block diagram

☞ JODY-W2 variants with a dedicated LTE Coexistence Filter (2.4 GHz BPF) are available on request. Coexistence filters are only needed if LTE bands 7, 38, 40, and 41 are used.

The type numbers and corresponding configuration options for JODY-W2 series modules are shown in Table 1.

Type number	Antenna configuration		LTE Coexistance BPF	
	ANT0	ANT1	BPF_0	BPF_1
JODY-W263-00A-00 JODY-W263-01A-00 JODY-W263-00B-00	Bluetooth	2.4 and 5 GHz Wi-Fi	No	No

Table 1: Supported JODY-W2 configurations

1.4 Product features

Item	JODY-W263-A	JODY-W263
Grade	Automotive	Professional
Chipset	NXP 88W8987A/S	NXP 88W8987
Antenna type	Two antenna pins for Wi-Fi and Bluetooth	Two antenna pins for Wi-Fi and Bluetooth
Supported Wi-Fi radio modes	IEEE 802.11 a/b/g/n/ac	IEEE 802.11 a/b/g/n/ac
Supported Wi-Fi bands	2.5 / 5 GHz	2.5 / 5 GHz
Max. Wi-Fi output power	19 dBm (at antenna pin)	19 dBm (at antenna pin)
Bluetooth version	5.0	5.0
Bluetooth profiles	HCI	HCI
Supported Bluetooth radio modes	Bluetooth BR/EDR Bluetooth Low Energy	Bluetooth BR/EDR Bluetooth Low Energy
Supported Bluetooth LE data rates	1 Mbps 2 Mbps	1 Mbps 2 Mbps
LTE coexistence filter	-	-
OS support	Linux / Android	Linux / Android
Interfaces	SDIO 3.0 (Wi-Fi/Bluetooth) UART (Bluetooth) PCM (Bluetooth digital audio)	SDIO 3.0 (Wi-Fi/Bluetooth) UART (Bluetooth) PCM (Bluetooth digital audio)
Features	Micro access point with max. 8 connected clients	Micro access point with max. 8 connected clients
	Simultaneous client and access point mode	Simultaneous client and access point mode
	WPA3	WPA3
	RF parameters/MAC addresses in OTP	RF parameters/MAC addresses in OTP
Max. ambient operating temperature	85 °C (JODY-W263-00A) 105 °C (JODY-W263-01A)	85 °C
Module size	19.8 x 13.8 mm	19.8 x 13.8 mm

Table 2: JODY-W2 series product features

1.4.1 Wi-Fi features

- Standards: IEEE 802.11a/b/g/n/ac/d/e/h/i/k/mc/r/u/v/w[1]
- IEEE 802.11ac PHY data rates up to 433 Mbit/s (80 MHz)
- 20/40/80 MHz bandwidth
- Simultaneous client and access point operation
- Support of Wi-Fi direct/P2P mode
- 128-bit AES hardware crypto engine. TKIP/WEP, AES/CCMP, AES/CMAC, AES/GCMP
- WPA/WPA2 and WAPI encryption is supported by hardware
- SDIO 3.0 host interface for Wi-Fi (and optionally Bluetooth)
- WPA3-SAE is supported in station and AP mode

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[1] 802.11k/r/u/v in STA mode only

1.4.2 Wi-Fi Simultaneous operation modes

- AP Simultaneous operation
  - o AP + AP - Multi-BSS support (MAX_UAP_BSS = 2)
  - o AP + AP + STA
  - o AP + STA
- P2P Simultaneous operation
  - o P2P + STA
  - o P2P + AP
  - o P2P + STA + AP

  ☞ Please note that two or more Wi-Fi interfaces should operate in the same channel.

1.4.3 Bluetooth features

- Bluetooth 5 with Bluetooth Low Energy
- BDR and EDR packet types – 1 Mbit/s, 2 Mbit/s, and 3 Mbit/s
- LE 2 Mbit/s PHY
- LE Data Length Extension
- LE Advertising Extension
- Bluetooth Class 1 and 2
- Standard SDIO and UART HCI transport layer
- PCM interface for voice applications

1.4.4 General product features

- Driver support for Linux, Android
- Coexistence with cellular and other on-chip radios
- Small footprint (19.8 mm x 13.8 mm), LGA package
- Automotive qualification tests (climatic, mechanical, and operating life tests) in accordance with ISO 16750-4 planned

1.4.5 Reserved MAC addresses

JODY-W2 series modules have four consecutive MAC addresses that are unique for each module variant. The first two of these four addresses are configured during production.

The first address is used for the Bluetooth communication, while the second address is configured for Wi-Fi communication. The Data Matrix Code shown on the product label includes the Bluetooth MAC address, as shown in section 9. The remaining two MAC addresses are not used in the manufacturing configuration but are reserved for module usage.

MAC address	Assignment	Last two bits of MAC address	Example
Module1, address 1	Bluetooth	0b00	*D4:CA:6E:44:00:04*
Module1, address 2	Wi-Fi	0b01	D4:CA:6E:44:00:05
Module1, address 3	(free for use)	0b10	D4:CA:6E:44:00:06
Module1, address 4	(free for use)	0b11	D4:CA:6E:44:00:07
Module2, address 1	Bluetooth	0b00	*D4:CA:6E:44:00:08*
Module2, address 2	Wi-Fi	0b01	D4:CA:6E:44:00:09
Module2, address 3	(free for use)	0b10	D4:CA:6E:44:00:0A
Module2, address 4	(free for use)	0b11	D4:CA:6E:44:00:0B

Table 3: MAC address assignment

For further details about using the MAC address for secondary Wi-Fi interfaces, refer to section 3.8.1 in the JODY-W2 system integration manual [2].

2 Interfaces

2.1 Host interface configuration

The JODY-W2 series provides two configuration pins, **CONFIG[0]** and **CONFIG[1]**, for selecting the host interface configuration and additional configuration pins are used to set parameters following a reset. To set a configuration bit to 0, attach a 100 kΩ resistor to GND. No external pull-up resistor is required to set a configuration bit to 1. Table 4 Table 5 show all strapping options.

CONFIG[1]	CONFIG[0]	Wi-Fi	Bluetooth	Firmware download	Number of SDIO functions
1	0	SDIO	UART	SDIO+UART(parallel/Serial)	1 (Wi-Fi)
1	1	SDIO	SDIO	SDIO+SDIO(parallel/Serial)	2 (Wi-Fi, Bluetooth)

Table 4: Host interface configuration options

Additional configuration pins are listed in Table 5.

Name	Pin	Description
PCM_OUT	17	Set high during reset.
BT_UART_RTS	38	Set high during reset.
LTE_COEX_TX	13	Set high during reset.
BT_UART_TX	36	Set low during reset. A 51 kΩ pull down resistor is implemented on the module.

Table 5: Additional configuration pins

2.2 SDIO interface

The SDIO device interface conforms to the industry standard SDIO 3.0 specification (UHS-I, up to 104 MByte/s). The interface allows host controllers to access the Wi-Fi, and optionally Bluetooth, functions of JODY-W2 series modules using the SDIO bus protocol. The interface supports 4-bit SDIO transfer mode at the full clock range up to 208 MHz. For SDIO 2.0 running at 25 MHz and 50 MHz clock frequencies. Only a signal voltage of 1.8 V is supported for all bus speed modes.

Bus speed mode	Max clock frequency [MHz]	Signal voltage [V]	Max. bus speed [MB/s]
DS: Default Speed	25	1.8	12.5
HS: High Speed	50	1.8	25
SDR12	25	1.8	12.5
SDR25	50	1.8	25
SDR50	100	1.8	50
SDR104	208	1.8	104
DDR50	50	1.8	50

Table 6: Supported SDIO bus speed modes

2.2.1 Default speed and high speed modes (1.8 V)
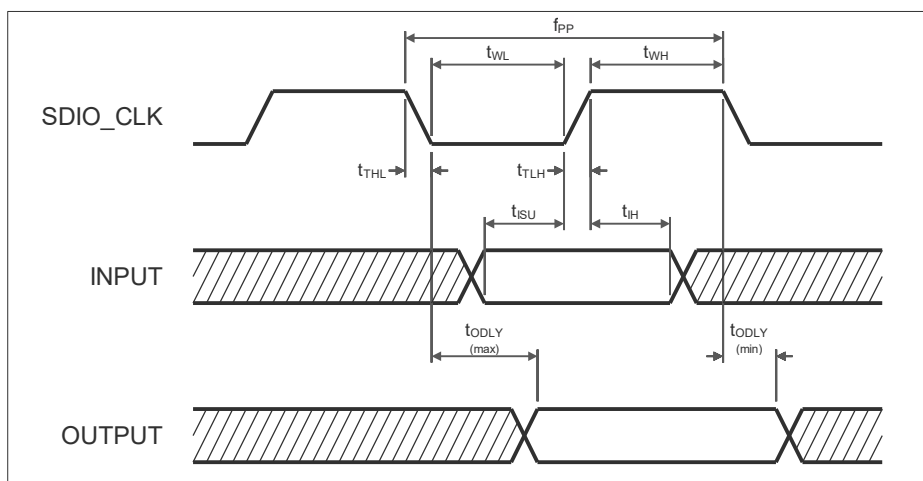
Figure 2: SDIO Protocol timing diagram - default speed mode (1.8 V)
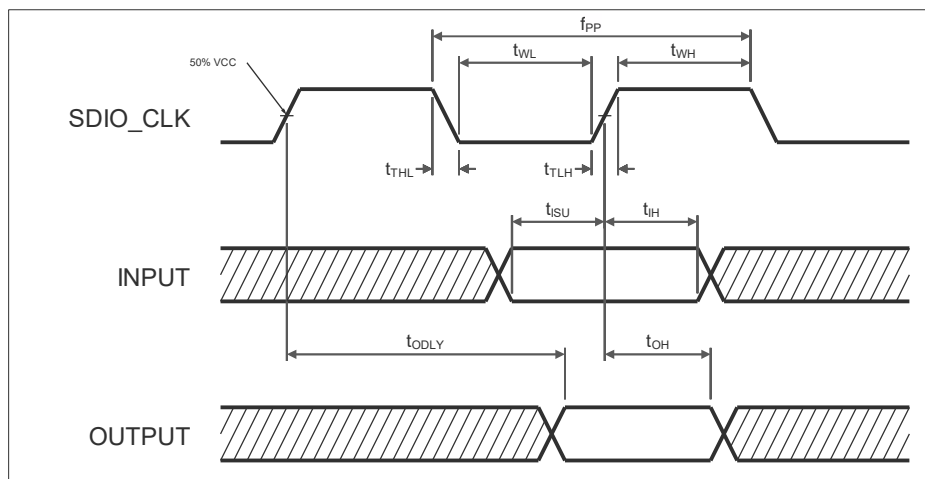
Figure 3: SDIO Protocol timing diagram – high speed mode (1.8 V)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
f_{PP}	Clock frequency – Data Transfer Mode	Normal	0	-	25	MHz
		High speed	0	-	50	MHz
f_{OD}	Clock frequency – Identification Mode	Normal	0		400	KHz
		High speed	0	-	400	KHz
t_{WL}	Clock low time	Normal	10	-	-	ns
		High speed	7	-	-	ns
t_{WH}	Clock high time	Normal	10	-	-	ns
		High speed	7	-	-	ns
t_{TLH}	Clock rise time	Normal	-	-	10	ns
		High speed	-	-	3	ns
t_{THL}	Clock low time	Normal	-	-	10	ns
		High speed	-	-	3	ns
t_{ISU}	Input setup time	Normal	5	-	-	ns
		High speed	6	-	-	ns

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
t_{IH}	Input hold time	Normal	5	-	-	ns
		High speed	2	-	-	ns
t_{ODLY}	Output delay time	Normal	-	-	14	ns
t_{ODLY}	Output delay time CL ≤ 40 pF (1 card)	High speed	-	-	14	ns
t_{OH}	Output hold time	High speed	2.5	-	-	ns

Table 7: SDIO timing data – Default speed, High speed modes (1.8 V)

2.2.2   SDR12, SDR25, SDR50 modes (up to 100 MHz, 1.8 V)
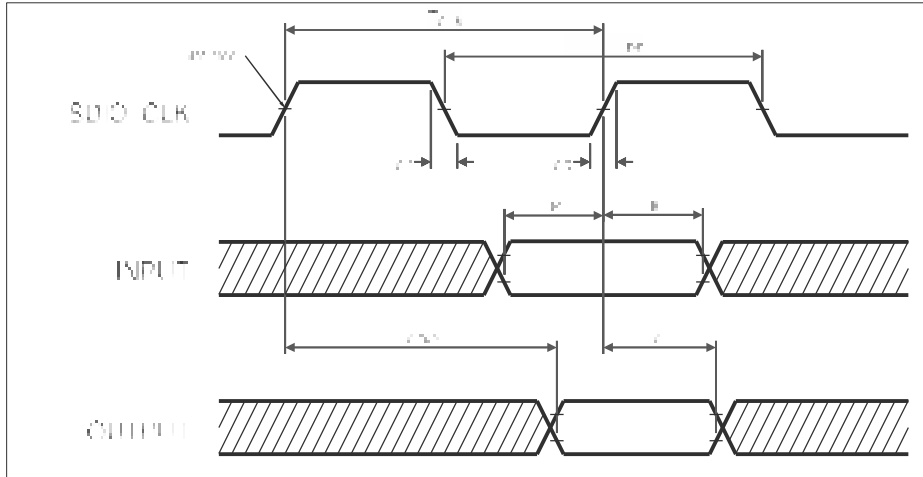
Figure 4: SDIO protocol timing diagram – SDR12, SDR25, SDR50 modes (up to 100 MHz, 1.8 V)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
f_{PP}	Clock frequency	SDR12	0	-	25	MHz
		SDR25	0	-	50	MHz
		SDR50	0	-	100	MHz
t_{IS}	Input setup time	SDR12/25/50	3	-	-	ns
t_{IH}	Input hold time	SDR12/25/50	0.8	-	-	ns
t_{CLK}	Clock time	SDR12/25/50	10	-	40	ns
t_{CR}, t_{CF},	Rise time, fall time T_{CR}, T_{CF} < 2 ns (max) at 100 MHz C_{CARD} = 10 pF	SDR12/25/50		-	$0.2*T_{CLK}$	ns
t_{ODLY}	Output delay time $C_L \leq 30$ pF	SDR12/25	-	-	14	ns
		SDR50	-		7.5	
t_{OH}	Output hold time C_L = 15 pF	SDR12/25/50	1.5	-	-	ns

Table 8: SDIO timing data – SDR12, SDR25, SDR50 modes (up to 100 MHz, 1.8 V)

2.2.3 SDR104 mode (208 MHz, 1.8 V)
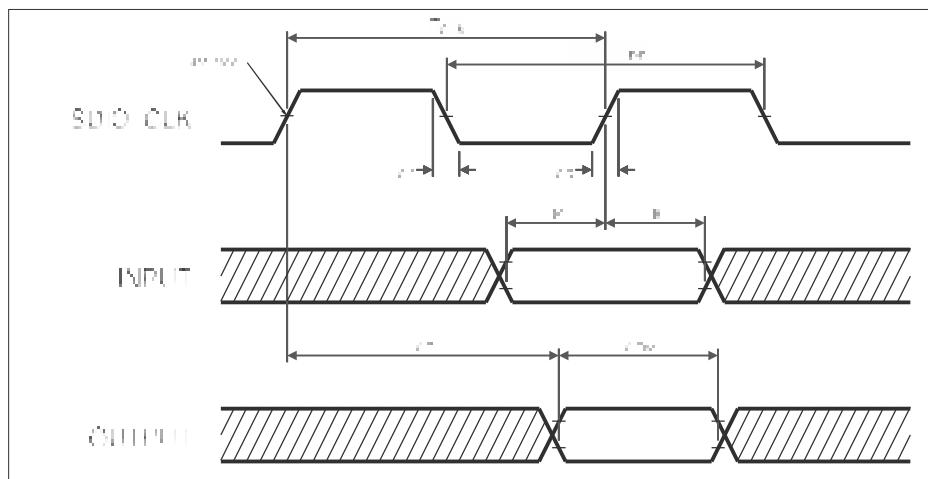
Figure 5: SDIO protocol timing diagram – SDR104 mode (208 MHz, 1.8 V)

Symbol	Parameter	Condition	Min.	Typ	Max.	Units
f_{PP}	Clock frequency	SDR104	0	-	208	MHz
T_{IS}	Input setup time	SDR104	1.4	-	-	ns
T_{IH}	Input hold time	SDR104	0.8	-	-	ns
T_{CLK}	Clock time	SDR104	4.8	-	-	ns
$t_{CR}, t_{CF,}$	Rise time, fall time T_{CR}, T_{CF} < 0.96 ns (max) at 208 MHz C_{CARD} = 10 pF	SDR104		-	$0.2{*}T_{CLK}$	ns
T_{OP}	Card output phase	SDR104	0	-	10	ns
T_{ODW}	Output timing of variable data window	SDR104	2.88	-	-	ns

Table 9: SDIO timing data – SDR104 mode (208 MHz) (1.8 V)

2.2.4 DDR50 Mode (50 MHz, 1.8 V)
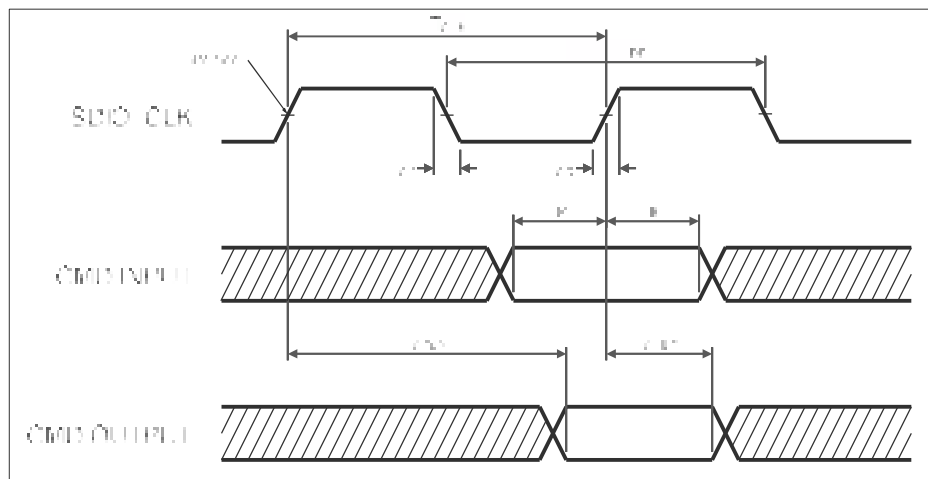
Figure 6: SDIO CMD timing diagram – DDR50 mode (50 MHz, 1.8 V)
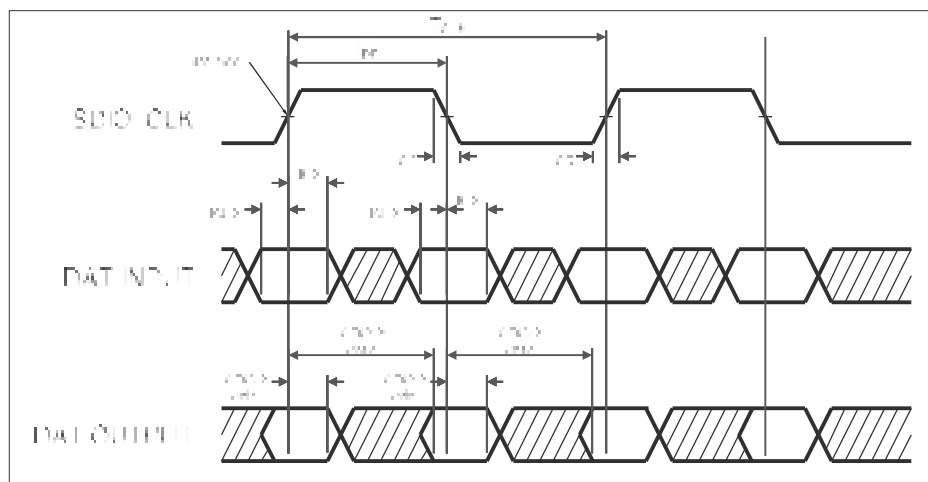
Figure 7: SDIO DAT [3:0] timing diagram – DDR50 mode (50 MHz, 1.8 V)

Symbol	Parameter	Condition	Min.	Typ	Max.	Units
Clock						
TCLK	Clock time 50 MHz (max) between rising edges	DDR50	20	-	-	ns
tCR, tCF,	Rise time, fall time TCR, TCF < 4.00 ns (max) at 50 MHz CCARD = 10 pF	DDR50	-	-	0.2*TCLK	ns
Clock Duty		DDR50	45	-	55	%
CMD Input (referenced to clock rising edge)						
tIS	Input setup time CCARD ≤ 10 pF (1 card)	DDR50	6	-	-	ns
tIH	Input hold time CCARD ≤ 10 pF (1 card)	DDR50	0.8	-	-	ns
CMD Output (referenced to clock rising edge)						
tODLY	Output delay time during data transfer mode CL ≤ 30 pF (1 card)	DDR50	-	-	13.7	ns
tOHLD	Output hold time CL ≥ 15 pF (1 card)	DDR50	1.5	-	-	ns
DAT[3:0] Input (referenced to clock rising and falling edges)						
tIS2x	Input setup time CCARD ≤ 10 pF (1 card)	DDR50	3			ns
tIH2x	Input hold time CCARD ≤ 10 pF (1 card)	DDR50	0.8			ns
DAT[3:0] Output (referenced to clock rising and falling edges)						
tODLY2x (max)	Output delay time during data transfer mode CL ≤ 25 pF (1 card)	DDR50			7.0	ns
tODLY2x (min)	Output hold time CL ≥ 15 pF (1 card)	DDR50	1.5			ns

Table 10: SDIO timing data – DDR50 mode (50 MHz, 1.8 V)

2.3 High Speed UART interface

JODY-W2 series modules support a high-speed Universal Asynchronous Receiver/Transmitter (UART) interface in compliance with the industry standard 16550 specification.

The main features of the UART interface are:

- FIFO mode permanently selected for transmit and receive operations
- Automatic baud rate detection
- Two pins for transmit and receive operations
- Two flow control pins
- Interrupt triggers for low-power, high throughput operation
- High throughput (4 Mbps)

Baud rate				
1200	38400	460800	1500000	3000000 (default)
2400	57600	500000	1843200	3250000
4800	76800	921600	2000000	3692300
9600	115200	1000000	2100000	4000000
19200	230400	1382400	2764800	

Table 11: Supported UART baud rates
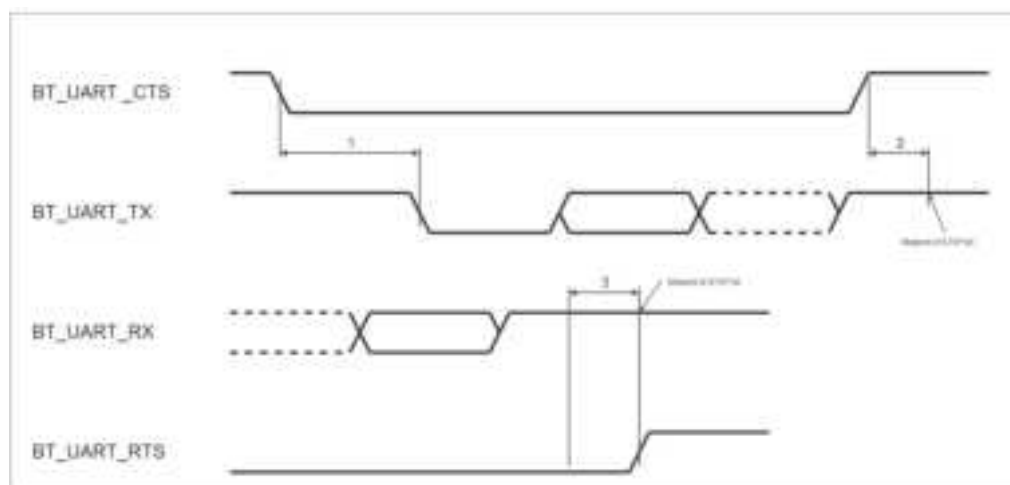
Figure 8: UART timing characteristics

Reference	Characteristic	Min.	Typ.	Max.	Units
1	Delay time, BT_UART_CTS low to BT_UART_TX valid	-	-	1.5	Bit period
2	Setup time, BT_UART_CTS high before midpoint of stop bit	-	-	0.5	Bit period
3	Delay time, midpoint of stop bit to BT_UART_RTS high	-	-	0.5	Bit period

Table 12: UART timing specification

2.4 PCM Interface

JODY-W2 series modules include a Pulse Code Modulation (PCM) interface that supports:

- Master or Slave mode
- PCM bit width size of 8 bits or 16 bits
- Up to 4 slots with configurable bit width and start positions
- Short frame and long frame synchronization
- Burst PCM mode

In PCM master mode, the interface generates a 2 MHz or a 2.048 MHz PCM_CLK and 8 kHz PCM_SYNC signal.

In slave mode, the interface has both **PCM_CLK** and **PCM_SYNC** inputs to allow another unit on the PCM bus generate the signals.

2.4.1 PCM Interface specifications
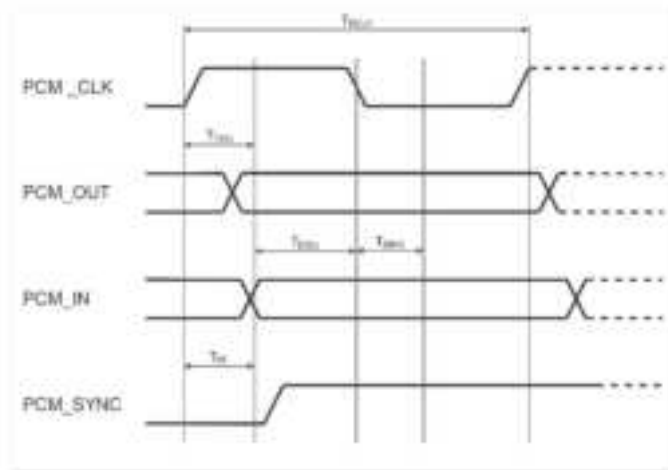
Figure 9: PCM timing specification – Master mode

Symbol	Parameter	Condition	Min.	Typ	Max.	Units
FBCLK	PCM clock frequency	-	-	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

Table 13: PCM timing specification – Master mode
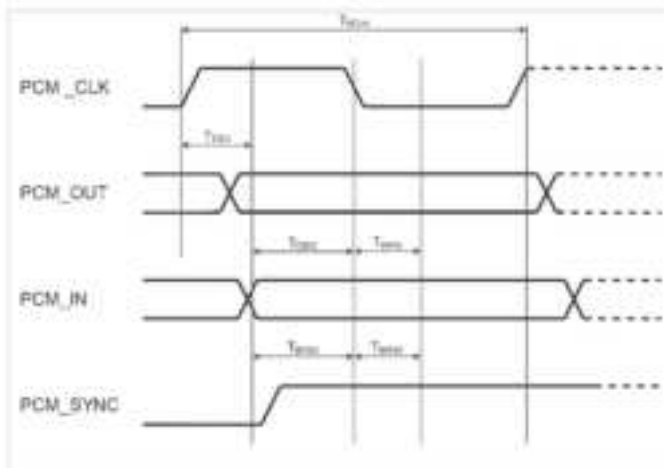
Figure 10: PCM timing specification – Slave mode

Symbol	Parameter	Condition	Min.	Typ	Max.	Units
FBCLK	PCM clock frequency	-	-	2/2.048	-	MHz
Duty Cycle$_{BCLK}$	-		0.4	0.5	0.6	-
T$_{BCLK\ rise/fall}$	-	-	-	3	-	ns
T$_{DO}$	-	-	-	-	30	ns
T$_{DISU}$	-	-	20	-	-	ns
T$_{DIHO}$	-	-	15	-	-	ns
T$_{BF}$	-	-	-	-	15	ns

Table 14: PCM timing specification – Slave mode

2.5 LTE Coexistence interface

To manage wireless medium sharing for optimal coexistence performance[2], an external handshake through the LTE Coexistence interface enables signaling between the JODY-W2 series modules and an external co-located wireless device.

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[2] LTE coexistence interface is not supported in current firmware.

3 Pin definition

3.1 Pin description

Figure 11: JODY-W2 pin assignment (top view)

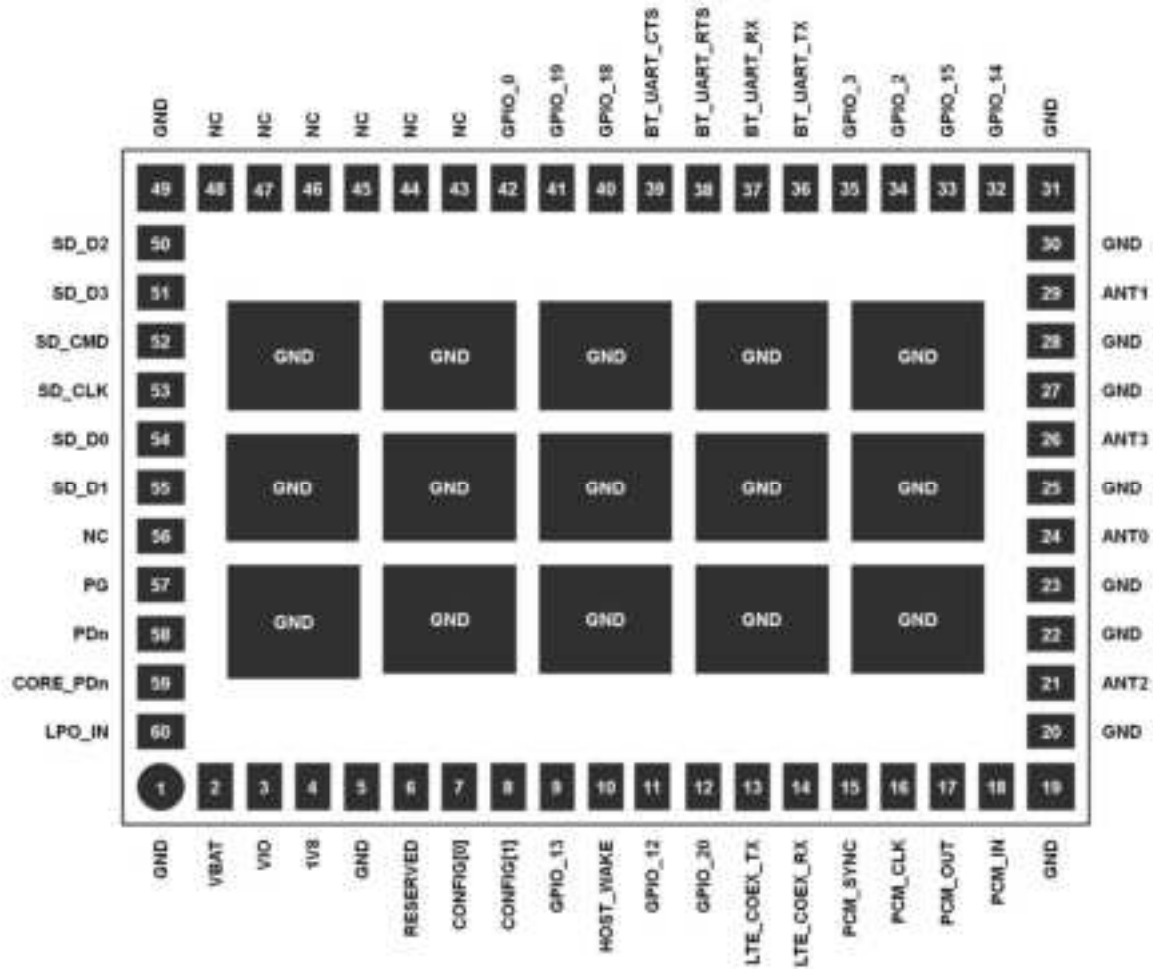| Function	Pin Name	Pin No.	Power	Type	Signal Name	Remarks
Power	VBAT	2	VBAT	PWR	Module supply input	Voltage supply range: 2.8 V – 5.5 V
	VIO	3	VIO	PWR	VIO supply	Nominal supply range: 1.8 V or 3.3 V
	1V8	4	1V8	PWR	VIO supply for SDIO Supply for analog part	Nominal supply: 1.8 V
	GND	1, 5, 19, 20, 22, 23, 25, 27, 28, 30, 31, 49	GND	GND		
	Exposed Pins	-	GND	GND		Connect to Ground
SDIO host interface	SD_CLK	53	1V8	I	SDIO Clock	SDIO Clock input
	SD_CMD	52	1V8	I/O	SDIO Command	SDIO command line
	SD_D0	54	1V8	I/O	SDIO data 0	SDIO data line bit [0]
	SD_D1	55	1V8	I/O	SDIO data 1	SDIO data line bit [1]
	SD_D2	50	1V8	I/O	SDIO data 2	SDIO data line bit [2]
	SD_D3	51	1V8	I/O	SDIO data 3	SDIO data line bit [3]
UART host interface	BT_UART_TX	36	VIO	O	UART TX	Bluetooth UART, connect to Host RX
	BT_UART_RX	37	VIO	I	UART RX	Bluetooth UART, connect to Host TX
	BT_UART_RTS	38	VIO	O	UART RTS	Bluetooth UART, connect to Host CTS
	BT_UART_CTS	39	VIO	I	UART CTS	Bluetooth UART, connect to Host RTS
PCM interface	PCM_CLK	16	VIO	I/O	PCM clock	Input if slave, Output if master
	PCM_SYNC	15	VIO	I/O	PCM Frame Sync	Input if slave, Output if master
	PCM_IN	18	VIO	I	PCM data in	
	PCM_OUT	17	VIO	O	PCM data out	
Configuration	CONFIG[0]	7	1V8	I	Configuration pin	See section 2.1 for bootstrap configuration
	CONFIG[1]	8	1V8	I	Configuration pin	See section 2.1 for bootstrap configuration
	RESERVED CONFIG[2]	6	1V8			Reserved for future configuration, A "DNI" pull-up resistor should be added at this pin to respond to future chipset changes.
Clock and power up/down interface	PDn	58	1V8	PDn	Wi-Fi power enable	Power-down interface of the chipset: 0 = power-down mode 1 = normal mode
	CORE_PDn	59	1V8	I	CORE_PDn	Enable pin of the core voltage regulator. 0 = power supply off Connect with PDn

Function	Pin Name	Pin No.	Power	Type	Signal Name	Remarks
	LPO_IN	60	-	I	Sleep clock input	32.768 kHz clock input. Only supported on professional grade variant, JODY-W263-00B
	PG	57	-	OD		Open-drain output from the internal DC/DC converter, which indicates the power quality of the 2.2 V rail. High impedance indicates power good. Low level indicates 2.2V is not in power good. A (100kΩ) pull-up resistor must be connected to this pin to detect the power good state.
GPIOs	LTE_COEX_TX	13	VIO	O	UART TX	Not supported in current firmware
	LTE_COEX_RX	14	VIO	I	UART RX	Not supported in current firmware
	HOST_WAKE	10	VIO	O	Host wake-up signal output	Asserted: Host device must wake-up or remain awake De-asserted: Host device can sleep when the sleep criteria is met
	GPIO_0	42	VIO	I/O	GPIO	
	GPIO_2	34	VIO	I/O	GPIO	
	GPIO_3	35	VIO	I/O	GPIO	
	GPIO_12	11	VIO	I/O	GPIO	
	GPIO_13	9	VIO	I	GPIO	
	GPIO_14	32	VIO	I/O	GPIO	
	GPIO_15	33	VIO	I/O	GPIO	
	GPIO_18	40	VIO	I/O	GPIO	
	GPIO_19	41	VIO	I/O	GPIO	
	GPIO_20	12	VIO	I/O	GPIO	
Radio	ANT0	24	VBAT	RF	Antenna signal	Bluetooth
	ANT1	29	VBAT	RF	Antenna signal	Wi-Fi Dual Band
	ANT2	21	-	-	Not used	Do not connect
	ANT3	26	-	-	Not used	Do not connect
Other	NC	21, 26, 43, 44, 45, 46, 47 48, 56	-	-	Reserved	Do not connect

Table 15: JODY-W2 series pin description

4 Electrical specification

⚠️ Operating JODY-W2 modules above any of the absolute maximum ratings shown in Table 16 can cause permanent damage to the device. Extended exposure to conditions outside of the absolute maximum ratings can also affect the device reliability.

4.1 Absolute maximum ratings

Symbol	Description	Min.	Max.	Units
VBAT	Power supply voltage	-0.3	7.0	V
VIO	I/O supply voltage 1.8V/3.3V	-	4.0	V
1V8	Analog power supply voltage 1.8V	-	1.98	V
$T_{STORAGE}$	Storage temperature	-40	+105[3]	ºC

Table 16: Absolute maximum ratings

⚠️ The product is not protected against overvoltage or reversed voltages. Voltage spikes exceeding the power supply voltage specification, given in table above, must be limited to values within the specified boundaries by using appropriate protection devices.

4.2 Operating conditions

Symbol	Parameter	Min.	Typ	Max.	Units
VBAT	Power supply voltage	2.8	-	5.5	V
VIO	I/O supply voltage 1.8V	1.67	-	1.92	V
	I/O supply voltage 3.3V	3.07	-	3.53	V
1V8	Analog power supply voltage 1.8V	1.71	1.8	1.89	V
T_A	Ambient operating temperature JODY-W263-00A/B	-40	-	+85	ºC
	Ambient operating temperature JODY-W263-01A	-40	-	+105	ºC
Ripple Noise	Peak-to-peak voltage ripple on all supply lines.	-	-	10	mV

Table 17: Operating conditions

☞ Operating condition ranges specified in Table 17 define the limits within which the functionality of the device is guaranteed.

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[3] Qualification pending

4.3   Wi-Fi power consumption

Peak current condition	Temperature	VBAT (3.3 V) [A]	1V8 (1.8 V) [A]
Active transmission	Room temperature	0.5	0.18
	T_max (105° C)	0.8	0.2
Firmware Initialization	Room temperature	0.7	0.2
	T_max (105° C)	0.7	0.2

Table 18: Peak current consumption

Wi-Fi operation modes	VBAT (3.3 V) [mA]	1V8 (1.8 V) [mA]	VIO (1.8 V) [μA]
Power – save modes			
Power down	5.97	0.04	7
Wi-Fi and BT both in deep-sleep[4]	7.74	0.85	66
IEEE Power Save DTIM 1 and BT deep-sleep	8.71	1.60	63
IEEE Power Save DTIM 2 and BT deep-sleep	8.26	1.26	64
IEEE Power Save DTIM 3 and BT deep-sleep	8.04	1.08	63
Active transmit modes			
CCK 11 Mbps, BW20, Ch7, Core2, 18 dBm	355	75	60
MSC7, HT20, Ch7, Core2, 15dBm	265	70	60
BPSK, 6 Mbps, HT20, Ch100, 18 dBm	320	131	60
MCS7, HT20, CH100, 15 dBm	250	120	60
MCS9, VHT40, Ch100, 15 dBm	273	126	60
MCS9, VHT80, Ch100, 15 dBm	300	130	60

Table 19: Wi-Fi radio typical current consumption with different modes of operation

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[4] The high sleep current of 7.74mA is seen in deep-sleep mode because of the DC-DC converter used in the module which has a quiescent current of 5.7mA. A new design is under development with an alternate DC-DC converter with very low quiescent current.

4.4   Bluetooth power consumption

Bluetooth operation modes	VBAT (3.3 V) [mA]	1V8 (1.8 V) [mA]	VIO (1.8 V) [µA]
Operating modes			
BLE advertisement	8.21	1.45	64
BT page scan	7.83	0.98	64
BT page & inquiry scan	7.89	1.13	64
Active transmit/receive mode (average over 100ms, measured using HCI commands)			
BT TX, pattern - DH5, power: 4 dBm, Ch1	13.62	2.00	64
BT TX, pattern - DH5, power: 10 dBm, Ch1	14.34	6.87	64
BT RX pattern - DH5, Ch1	14.08	5.05	64
BLE TX	14.86	8.77	64
BLE RX	17.40	15.71	64

Table 20: Bluetooth radio typical current consumption with different operating modes

4.5   Digital pad ratings

Symbol	Parameter	VIO	Min.	Max.	Units
V_{IH}	Input high voltage	1.8 V - 3.3 V	0.7*VIO	VIO+0.4	V
V_{IL}	Input low voltage	1.8 V - 3.3 V	-0.4	0.3*VIO	V
V_{HYS}	Input hysteresis	1.8 V - 3.3 V	100	-	mV
V_{OH}	Output high voltage	1.8 V - 3.3V	VIO-0.4	-	V
V_{OH}	Output low voltage	1.8 V - 3.3 V	-	0.4	V

Table 21: DC characteristics VIO

4.6   Radio specifications

4.6.1   Bluetooth

Parameter	Specification
RF Frequency Range	2.4 – 2.5 GHz
Supported Modes	Bluetooth 5
Number of channels	79 (BR/EDR)
	40 (LE)
Modulation	1 Mbps: GFSK (BR) 2 Mbps: π/4 DQPSK (EDR) 3 Mbps: 8DQPSK (EDR)
Transmit Power	Class 1 BR +10 dBm
	Class 1 EDR +9 dBm
	LE +8 dBm
Receiver sensitivity (typical values)	BR -87 dBm ± 1.5 dB
	EDR -86 dBm ± 1.5 dB
	LE -99 dBm ± 1.5 dB

Table 22: Bluetooth radio parameters

4.6.2 Wi-Fi

JODY-W2 series modules support dual-band Wi-Fi with 802.11a/b/g/n/ac operation in the 2.4 GHz and 5 GHz radio bands.

Parameter	Operation mode	Specification
RF Frequency range	802.11b/g/n	2.400 – 2.500 GHz
	802.11a/n/ac	4.900 – 5.925 GHz
Modulation	802.11b	CCK and DSSS
	802.11a/g/n/ac	OFDM
Supported data rates	802.11b	1, 2, 5.5, 11 Mbps
	802.11a/g	6, 9, 12, 18, 24, 36, 48, 54 Mbps
	802.11n SISO	MCS0 - MCS7 (150 Mbps)
	802.11ac SISO	MCS0 – MCS9 (433 Mbps)
Supported channel bandwidth	802.11n	20, 40 MHz
	802.11ac	20, 40, 80 MHz
Supported guard interval (GI)	802.11n	400, 800 ns
	802.11ac	Short guard interval supported

Table 23: Wi-Fi radio features and specifications

Parameter	Frequency	Operation mode	802.11 EVM limit	Preliminary specification (typ. output power tolerance ± 2 dB)
Maximum transmit power	2.4 GHz	DSSS/CCK	-9 dB	19 dBm[5]
		OFDM, BPSK	-8 dB	19 dBm
		OFDM, QPSK	-13 dB	18 dBm
		OFDM, 16-QAM	-19 dB	18 dBm
		OFDM, 64-QAM, 3/4	-25 dB	17 dBm
		OFDM, 64-QAM, 5/6	-28 dB	17 dBm
	5 GHz	OFDM, BPSK	-5 dB	16 dBm
		OFDM, QPSK	-13 dB	15 dBm
		OFDM, 16-QAM	-19 dB	15 dBm
		OFDM, 64-QAM, 3/4	-25 dB	15 dBm
		OFDM, 64-QAM, 5/6	-28 dB	15 dBm
		OFDM, 256-QAM, 3/4	-30 dB	15 dBm
		OFDM, 256-QAM, 5/6	-32 dB	14 dBm

Table 24: Wi-Fi Radio maximum transmit power parameter

Band	Operating mode	Data rate	Bandwidth	Specification
2.4 GHz	802.11b	1Mbps/2Mbps	20MHz	-97dBm/-94dBm
		5.5Mbps/11Mbps		-92dBm/-88dBm
	802.11g	6Mbps/9Mbps		-89dBm/-88dBm
		12Mbps/18Mbps		-86dBm/-84dBm
		24Mbps/36Mbps		-81dBm/-79dBm
		48Mbps/54Mbps		-75dBm/-73dBm
	802.11n	MCS0/MCS1		-89dBm/-88dBm

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[5] FCC output power limit 12 dBm

Band	Operating mode	Data rate	Bandwidth	Specification
		MCS2/MCS3		-86dBm/-84dBm
		MCS4/MCS5		-81dBm/-79dBm
		MCS6/MCS7		-75dBm/-73dBm
5 GHz	802.11a	6Mbps/9Mbps	20MHz	-88dBm/-87dBm
		12Mbps/18Mbps		-88dBm/-86dBm
		24Mbps/36Mbps		-83dBm/-80dBm
		48Mbps/54Mbps		-75dBm/-74dBm
	802.11ac	MCS0/MCS1	20MHz	-88dBm/-87dBm
		MCS2/MCS3		-85dBm/-82dBm
		MCS4/MCS5		-80dBm/-76dBm
		MCS6/MCS7		-75dBm/-73dBm
		MCS8		-69dBm
		MCS0/MCS1	40MHz	-85dBm/-84dBm
		MCS2/MCS3		-82dBm/-79dBm
		MCS4/MCS5		-77dBm/-73dBm
		MCS6/MCS7		-72dBm/-71dBm
		MCS8/MCS9		-67dBm/-65dBm
		MCS0/MCS1	80MHz	-81dBm/-81dBm
		MCS2/MCS3		-79dBm/-76dBm
		MCS4/MCS5		-74dBm/-70dBm
		MCS6/MCS7		-69dBm/-68dBm
		MCS8/MCS9		-63dBm/-61dBm

Table 25: Wi-Fi radio sensitivity

5 Host drivers and firmware

5.1 General principle

JODY-W2 series modules do not contain any persistent software. A firmware binary is downloaded by the host operating system driver at start-up.

5.2 Supported operating systems

5.2.1 Linux

The reference driver, developed by NXP and distributed by u-blox, is only made available to customers that have signed a limited use license agreement (LULA) [4] with u-blox. A valid non-disclosure agreement (NDA) is mandatory to get the driver package directly from NXP. The package includes:

- Dedicated kernel driver that binds the Wi-Fi device to the kernel. Driver sources are provided.
- Dedicated Wi-Fi firmware image that is uploaded during initialization of the Wi-Fi device.
- Dedicated Bluetooth firmware image that is uploaded during initialization of the Bluetooth device.
- Laboratory and manufacturing tools.

5.2.2 Android

The Linux driver can be integrated with Android BSP. Detailed instructions for integrating the operating system on the module are provided in the application note [5].
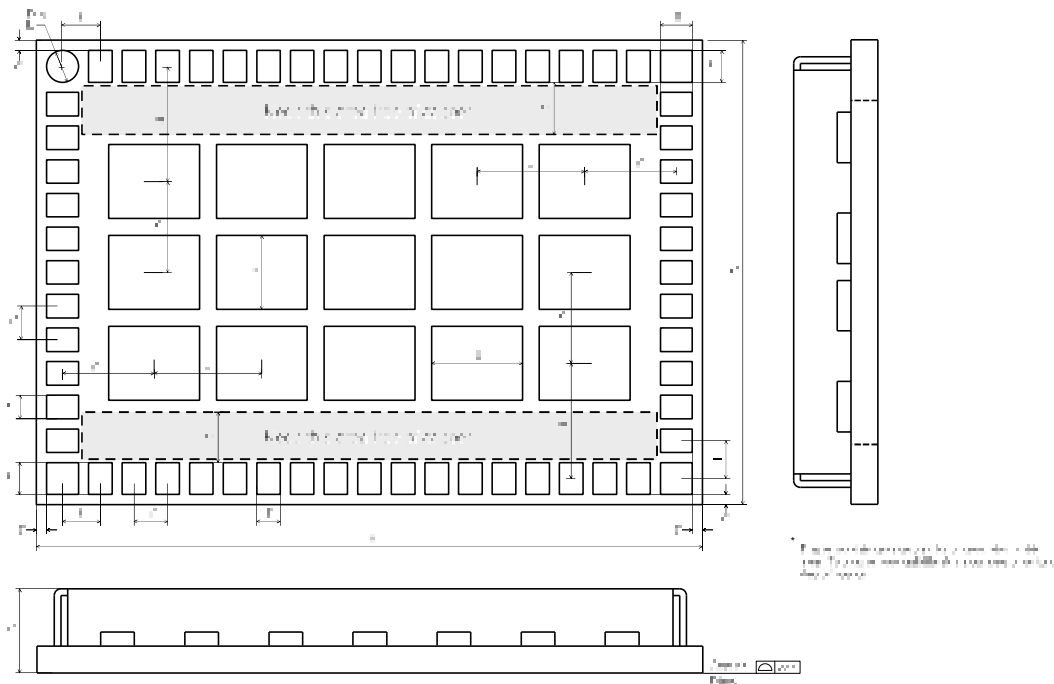
6 Mechanical specifications

Figure 12: JODY-W2 series dimensions (bottom view)

Parameter	Description	Typical		Tolerance	
A	Module length [mm]	19.8	(779.5 mil)	+0.35/-0.1	(+13.8/-3.9 mil)
B	Module width [mm]	13.8	(543.3 mil)	+0.1/-0.1	(+3.9/-3.9 mil)
C	Module thickness [mm]	2.5	(98.4 mil)	+0.2/-0.2	(+7.9/-7.9 mil)
ccc	Seating plane coplanarity [mm]	<0.1	(3.94 mil)		
D	PCB edge-to-pin Edge [mm]	0.3	(11.8 mil)	+0.20/-0.20	(+7.9/-7.9 mil)
E	Pin width [mm]	0.7	(27.6 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
F	Pin length [mm]	0.95	(37.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
G	Pin to pin pitch [mm]	1.0	(39.4 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
H	Horizontal corner pin-to-pin pitch [mm]	1.125	(44.3 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
I	Lateral corner pin-to-pin pitch [mm]	1.125	(44.3 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
J	Horizontal thermal pads pitch [mm]	3.2	(126.0 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
K	Thermal pad height [mm]	2.2	(86 6 mil)	+0.1/-0.1	(+3.9/-3.9 mil)
L	Thermal pad length [mm]	2.7	(106.3 mil)	+0.1/-0.1	(+3.9/-3.9 mil)
M	Pin 1 diameter [mm]	0.95	(37.4 mil)	+0.05/-0.05	(+2.0/-2.0 mil)
N	Horizontal pin-to-thermal pad pitch [mm]	3.425	(134.8 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
O	Lateral pin-to-thermal pad distance [mm]	2.725	(107.3 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
P	Lateral thermal pads pitch [mm]	2.7	(106.3 mil)	+0.02/-0.02	(+0.8/-0.8 mil)
R	Reserved area for future module variants	1.55	(61.0 mil)	+0.05/-0.05	(+2.0/-2.0 mil)

Table 26: Description of parameters

7 Approvals

JODY-W2 series modules comply with the regulatory demands of Radio Equipment Directive (RED), Federal Communications Commission (FCC), Innovation Science and Economic Development (ISED)[6].

⚠️ **All approvals are pending.**

☞ See JODY-W2 series System Integration Manual [2] for detailed information about regulatory compliance requirements of end products that use JODY-W2 series modules.

7.1 European Union regulatory compliance

For information about the regulatory compliance of JODY-W2 series modules against requirements and provisions in the European Union, see JODY-W2 Declaration of Conformity [9].

⚠️ **All approvals are pending.**

7.1.1 Radio Equipment Directive (RED) 2014/53/EU

JODY-W2 series modules comply with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU.

Essential Requirements Radio Equipment Directive 2014/53/EU	Standards
Health and safety (Article 3.1a)	EN 62368-1:2014+A11:2017 EN 62311:2008 (Wi-Fi) EN 62479:2010 (Bluetooth and Bluetooth Low Energy)
EMC (Article 3.1b)	EN 301 489-1 V2.1.1 EN 301 489-17 V3.1.1
Radio Spectrum Efficiency (Article 3.2)	EN 300 328 V2.2.2 EN 301 893 V2.1.1 EN 300 440 V2.1.1

Essential Requirements RoHS Directive 2011/65/EU	Standards
Prevention (Article 4.1)	EN 50581:2012

7.1.2 Compliance with the RoHS directive

JODY-W2 series modules comply with the Directive 2011/65/EU (EU RoHS 2) and its amendment Directive (EU) 2015/863 (EU RoHS 3).

7.2 United States (FCC)

⚠️ **Approvals are pending.**

This section contains the FCC compliance information for the JODY-W2 series modules.

⚠️ According to FCC regulations, the transmission line from the antenna pin in the module to the antenna or antenna connector on the host PCB is considered part of the approved antenna design. Consequently, module integrators must follow exactly the antenna reference design used in the module's FCC type approval or certify their own designs. See Appendix A for details.

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[6] Approvals are pending.

Below is the list of the FCC IDs allocated to JODY-W2 series modules.

Model[7]	FCC ID
JODY-W263-00A, JODY-W263-01A, JODY-W263-00B	XPYJODYW263

Table 27: FCC and ISED IDs for different variants of JODY-W2 series modules

7.2.1 FCC compliance statement

The JODY-W2 series modules have modular approval and comply 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.

⚠ Any changes or modifications NOT explicitly APPROVED by u-blox could cause the JODY-W2 series module to cease to comply with FCC rules part 15 thus void the user's authority to operate the equipment.

The internal / external antenna(s) used for this module must provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

In accordance with 47 CFR § 15.19, the end product into which this module is integrated shall bear the following statement in a conspicuous location on the device:

"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."

When the end-product is so small or for such use that it is not practical to place the above statement on it, the information shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or on the container in which the device is marketed. However, the FCC ID label must be displayed on the device.

If the end-product will be installed in locations where the end-user is not able to see the FCC ID and/or this statement, the FCC ID and the statement shall also be included in the end-product manual.

☞ The outside of final products containing the JODY-W2 module must display in a user accessible area a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: XPYJODYW263" or "Contains FCC ID: XPYJODYW263".

7.3 Canada (ISED)

⚠ **Approvals are pending.**

⚠ According to ISED regulations, the transmission line from the antenna pin in the module to the antenna or antenna connector on the host PCB is considered part of the approved antenna design. Consequently, module integrators must follow exactly the antenna reference design used in the module's ISED type approval or certify their own designs. See Appendix A for details.

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[7] The model name is identical to the ordering code. Refer to Table 34 for details.

JODY-W2 series module are certified for use in accordance with the Canada Innovation, Science and Economic Development Canada (ISED) Radio Standards Specification (RSS) RSS-247 Issue 2 and RSSGen. Below is the list of the ISED IDs allocated to JODY-W2 series modules.

Model	ISED certification number
JODY-W263-00A, JODY-W263-01A, JODY-W263-00B	8595A-JODYW263

Table 28: ISED ID for different variants of JODY-W2 series modules

7.3.1   ISED compliance statement

The JODY-W2 series module complies with ISED (Innovation, Science and Economic Development Canada)[8] license-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause interference, and

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

☞   Any notification to the end user of installation or removal instructions about the integrated radio module is NOT allowed. Unauthorized modification could void authority to use this equipment.

This equipment complies with ISED RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

This radio transmitter IC: 8595A-JODYW263 has been approved by ISED to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

☞   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;

☞   Operation in the 5600-5650 MHz band is not allowed in Canada. High-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

The ISED certification label of a module shall be clearly visible at all times when installed in the host device; otherwise, the host device must be labeled to display the ISED certification number for the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows: "Contains transmitter module IC: 8595A-JODYW263".

Le présent appareil est conforme aux CNR d'ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet équipement est conforme aux limites d'exposition de rayonnement d'ISED RSS-102 déterminées pour un environnement non contrôlé. Cet équipement devrait être installé et actionné avec la distance minimum 20 cm entre le radiateur et votre corps.

Cet émetteur radio, IC: 8595A-JODYW263 été approuvé par ISED pour fonctionner avec les types d'antenne énumérés ci-dessous avec le gain maximum autorisé et l'impédance nécessaire pour chaque type d'antenne indiqué. Les types d'antenne ne figurant pas dans cette liste et ayant un gain supérieur au gain maximum indiqué pour ce type-là sont strictement interdits d'utilisation avec cet appareil.

☞   Le dispositif de fonctionnement dans la bande 5150-5250 MHz est réservé à une utilisation en intérieur pour réduire le risque d'interférences nuisibles à la co-canal systèmes mobiles par satellite

☞   Opération dans la bande 5600-5650 MHz n'est pas autorisée au Canada. Haute puissance radars sont désignés comme utilisateurs principaux (c.-àutilisateurs prioritaires) des bandes 5250-5350

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[8] Formerly known as IC (Industry Canada).

MHz et 5650-5850 MHz et que ces radars pourraient causer des interférences et / ou des dommages à dispositifs LAN-EL.

L'étiquette d'homologation d'ISED d'un module donné doit être posée sur l'appareil hôte à un endroit bien en vue en tout temps. En l'absence d'étiquette, l'appareil hôte doit porter une étiquette sur laquelle figure le numéro d'homologation du module d'ISED, précédé des mots « Contient un module d'émission », ou du mot « Contient », ou d'une formulation similaire allant dans le même sens et qui va comme suit : « Contient le module d'émission IC: 8595A-JODYW263 ».

This radio transmitter IC: 8595A-JODYW263 has been approved by ISED to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio IC: 8595A-JODYW263 a été approuvé par ISED pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

The internal / external antenna(s) used for this module must provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

☞ The approval type for all the JODY-W2 series variants is a single modular approval. Due to ISED Modular Approval Requirements (Source: RSP-100 Issue 10), any application which includes the module must be approved by the module manufacturer (u-blox). The application manufacturer must provide design data for the review procedure.

7.4   Certification in other countries

Additional country certifications can be progressed upon request. For further information, contact the support team for your area, as listed in the Contact section.

7.5   Approved antennas

7.5.1   Wi-Fi / Bluetooth dual band antennas

For Bluetooth and Wi-Fi operation in the 2.4 GHz band and Wi-Fi operation in the 5 GHz band, the module has been tested and approved for use with the antennas listed in Table 29.

Manufacturer	Part Number	Antenna type	Peak gain [dBi]		Validated Regulatory Domain
			2.4 GHz band	5 GHz band	
Linx	ANT-DB1-RAF-RPS	Dual-band dipole antenna [6]	2.5	4.6	FCC/ISED, ETSI

Table 29: List of approved dual-band antennas

⚠ Important: To be compliant to FCC §15.407(a) the EIRP is not allowed to exceed 125 mW (21 dBm) at any elevation angle above 30 degrees as measured from the horizon when operated as an outdoor access point in U-NII-1 band, 5.150-5.250 GHz.

7.5.2   Bluetooth antenna

The following antennas are designated for Bluetooth transmission on JODY-W2:

Manufacturer	Part Number	Antenna type	Peak gain [dBi] 2.4 GHz band	Validated Regulatory Domain
Linx	ANT-2.4-CW-RCT-RP	Single-band dipole antenna [8]	2.2	FCC/ISED, ETSI

Table 30: List of approved single-band antennas

8 Product handling

8.1 Packaging

For efficient production, production lot set-up and tear-down, JODY-W2 series modules are delivered as hermetically sealed devices on tape and reel. For more information about packaging, see the u-blox package Information Guide **Error! Reference source not found.**.

8.1.1 Reels

JODY-W2 series modules are deliverable in quantities of 500 pieces on a reel. The modules are shipped on reel Type A, as described in the u-blox package information guide **Error! Reference source not found.**.

8.1.2 Tapes
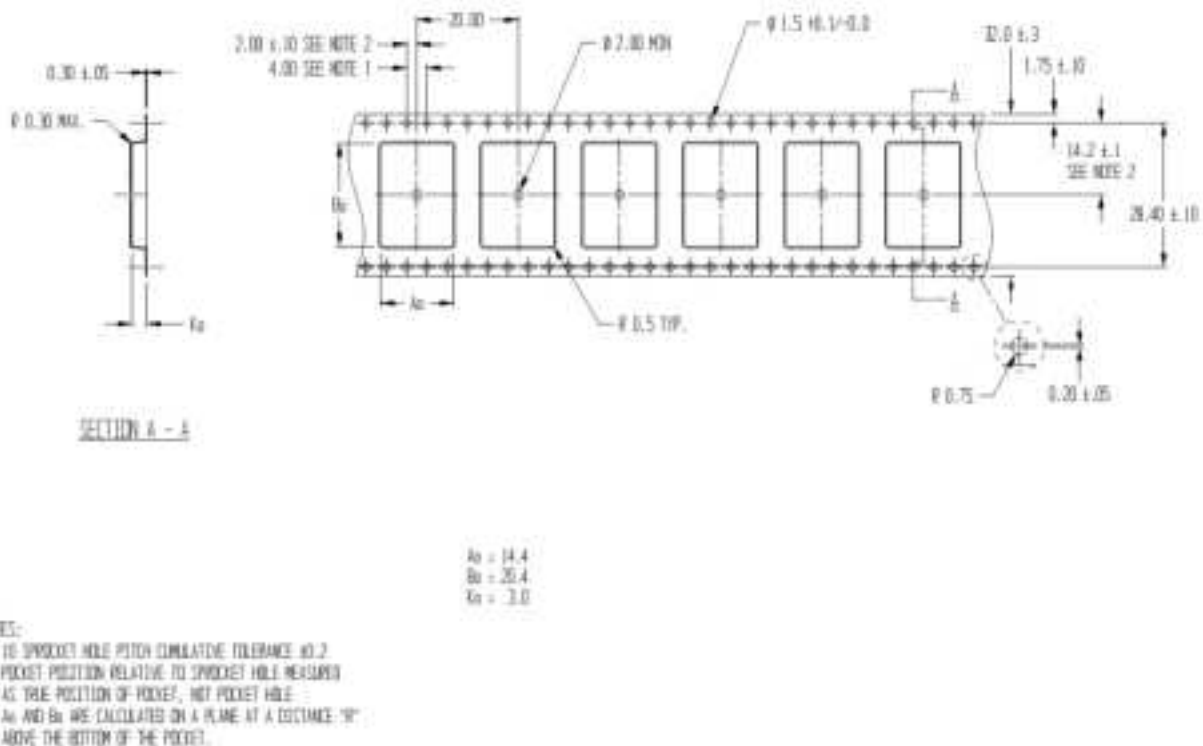
The dimensions of the tapes are shown in Figure 13.

Figure 13: JODY-W2 Tape dimensions

8.2 Shipment, storage, and handling

☞ For more information regarding shipment, storage and handling see the u-blox package information guide **Error! Reference source not found.**.

8.2.1 Moisture sensitivity levels

JODY-W2 series automotive-grade modules are rated at moisture sensitivity level 3. See moisture sensitive warning label on each shipping bag for detailed information. After opening the dry pack, modules must be mounted within 168 hours in factory conditions of maximum 30 °C/60%RH or must be stored at less than 10%RH. Modules require baking if the humidity indicator card shows more than 10% when read at 23±5°C or if the conditions mentioned above are not met. Please refer to J-STD-033B standard for bake procedure.

8.2.2   Mounting process and soldering recommendations

Reflow profiles are to be selected according to u-blox recommendations. See JODY-W2 series System integration manual [2] for more information.

8.2.3   ESD handling precautions

⚠   JODY-W2 series modules are Electrostatic Sensitive Devices (ESD). Observe precautions for handling! Failure to observe these precautions can result in severe damage to the Wi-Fi receiver!

Wi-Fi transceivers are Electrostatic Sensitive Devices (ESD) and require special precautions during handling. To minimize the risk of damage caused by electrostatic charges, be sure to handle the patch antennas with care. In addition to standard ESD safety practices, the following measures should be observed when handling the receiver:

*   Unless there is a galvanic coupling between the local GND (on the work bench, or similar) and the PCB GND, the first point of contact when handling the PCB must always be between the local GND and PCB GND.
*   Be sure to ground the module before mounting an antenna patch.

*   When handling the RF pin, avoid any contact with charged capacitors. Also be careful when contacting materials that can develop charges, like the patch antenna (~10 pF), coaxial cable (~50-80 pF/m), soldering iron, and so on.

*   To prevent electrostatic discharge through the RF input, do not touch any exposed antenna area. If there is any risk that the exposed antenna area might be touched in a non-ESD protected work area, be sure to implement proper ESD protection measures in the application design.

*   When soldering RF connectors and patch antennas to the RF pin of the receiver, be sure to use an ESD safe soldering iron (tip).

9 Labeling and ordering information

9.1 Product labeling

The labels of JODY-W2 series include important product information as described in this section. The data matrix code for automotive and professional grade variants of JODY-W2 series includes a serial number.

Figure 14 illustrates the sample label of the JODY-W2 series and includes: the u-blox logo, product name (model), type number, FCC and IC certification number and date of unit production encoded YY/WW (year/week).
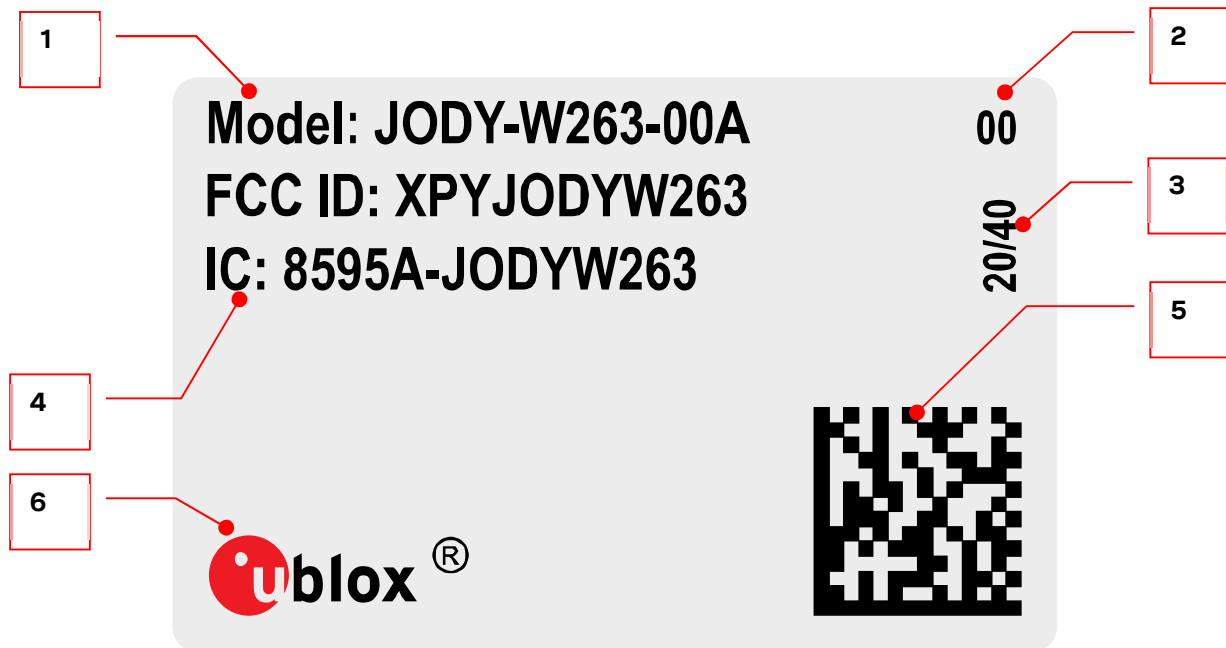

Figure 14: JODY-W2 series sample label

Detailed descriptions of the label components are shown in Table 31.

Reference	Description
1	Text in bold font: MODEL: type number with the product version. Same as product name.
2	Minor product version
3	Date of production encoded YY/WW (year/week)
4	FCC/ISED ID with which the module has been listed with
5	Data Matrix with unique serial number comprising 19 alphanumeric symbols. The first 3 symbols represent the unique module type number. The following 12 symbols represent the unique hexadecimal Bluetooth MAC address of the module in the format AABBCCDDEEFF. The last 4 symbols represent the hardware and firmware version encoded HHFF.
6	u-blox logo. The red dot above the logo represents the physical location of pin 1.

Table 31: JODY-W2 series label descriptions

9.2   Explanation of codes

Two different product code formats are used. The **Product name** is used to identify the module in all related documentation. An appropriate name is given for all u-blox products – regardless of the packaging and quality grade.

The Ordering code includes options and quality, while the **Type Number** includes the hardware and firmware versions. Table 32 describes these three different code formats.

Format	Structure
Product name	PPPP-TGVV
Ordering code	PPPP-TGVV-TTQ
Type number	PPPP-TGVV-TTQ-XX

Table 32: Product code formats

Table 33 describes the identification codes associated with each module variant.

Code	Description	Example
PPPP	Form factor	JODY
TG	Platform T – Dominant technology, For example, W: Wi-Fi, B: Bluetooth G - Generation	W2
VV	Variant based on the same platform; range [00…99]	63
TT	Major Product Version	00
Q	Quality grade A: Automotive B: Professional C: Standard	A
XX	Minor product version (not relevant for certification)	00

Table 33: Part identification codes

9.3   Ordering codes

Ordering code	Product name	Product
JODY-W263-00A	JODY-W263-A	Automotive grade module based on NXP 88W8987(A) transceiver. Equipped with a single Wi-Fi antenna and one Bluetooth antenna, the module has an operational temperature of -40 ^{0}C to +85 ^{0}C.
JODY-W263-01A	JODY-W263-A	Automotive grade module based on NXP 88W8987S transceiver. Equipped with a single Wi-Fi antenna and single Bluetooth antenna, the module has an operational temperature of -40 ^{0}C to +105 ^{0}C.
JODY-W263-00B	JODY-W263	Professional grade module based on NXP 88W8987(I) transceiver. Equipped with a single Wi-Fi antenna and single Bluetooth antenna, the module has an operational temperature of -40 ^{0}C to +85 ^{0}C.

Table 34: Product ordering codes

☞ Product changes affecting the form, fit or function of the module are documented by u-blox. For a list of Product Change Notifications (PCNs) visit www.u-blox.com.

Appendix

A.1   Antenna reference design

A.1.1   Scope

This appendix defines the essential specifications necessary to implement the JODY-W2 antenna reference designs as used in certification. It is part of the equipment certification application issued to FCC and ISED. The information contained herein and its references should be sufficient to guide a skilled person to implement the design on a host carrier. It will provide the designer with PCB layout details and expected performance specifications.

This appendix supports a connector-based design for the use of external antennas (one for each antenna pin of the module).

A.1.2   General description and requirements

JODY-W2 series modules provide two RF interfaces for connecting external antennas. The antenna ports ANT0 and ANT1 have a nominal characteristic impedance of 50 Ω and must be connected to the related antenna through a 50 Ω transmission line to allow proper impedance matching along the RF path. A bad termination of the pin may result in poor performance or even damage the RF section of the module.

For optimal performance in multiradio mode, the isolation between the antennas shall target the requirements as specified in Table 1 and Table 2 in order to ensure good performance.

Item	Requirements	Remarks
Impedance	50 Ω nominal characteristic impedance	The impedance of the antenna RF connection must match the 50 Ω impedance of the antenna pins.
Frequency range	2400 - 2500 MHz 5150 - 5850 MHz	For 802.11b/g/n and Bluetooth. For 802.11a/n/ac.
Return loss	S11 < -10 dB (VSWR < 2:1) recommended S11 < -6 dB (VSWR < 3:1) acceptable	The return loss or the S11, as the VSWR, refers to the amount of reflected power, measuring how well the primary antenna RF connection matches the 50 Ω characteristic impedance of antenna pins. The impedance of the antenna termination must match as much as possible the 50 Ω nominal impedance of antenna pins over the operating frequency range, to maximize the amount of power transferred to the antenna.
Efficiency	> -1.5 dB (> 70%) recommended > -3.0 dB (> 50%) acceptable	The radiation efficiency is the ratio of the radiated power to the power delivered to antenna input: the efficiency is a measure of how well an antenna receives or transmits.
Maximum gain		The maximum antenna gain must not exceed the value specified in type approval documentation to comply with regulatory agencies radiation exposure limits.

Table 35: Summary of antenna interface requirements

Item	Requirements	Remarks
Isolation (in-band)	$S_{21} > 25$ dB recommended $S_{21} > 20$ dB acceptable	The antenna to antenna isolation is the S_{21} parameter between the two antennas in the band of operation.
Isolation (out-of-band)	$S_{21} > 35$ dB recommended $S_{21} > 30$ dB acceptable	Out-of-band isolation is evaluated in the band of the aggressor to ensure that the transmitting signal from the other radio is sufficiently attenuated by the receiving antenna to avoid saturation and intermodulation effect at the receiver's port.
Envelope correlation Coefficient (ECC)	ECC < 0.1 recommended ECC < 0.5 acceptable	The ECC parameter correlates the far field parameters between antennas in the same system. A low ECC parameter is fundamental to improve performance in MIMO-based systems.

Table 36: Summary of MIMO and Wi-Fi/Bluetooth coexistence requirements. MIMO is not applicable for JODY-W2.

A.1.3   Reference design of RF path

JODY-W2 is certified with a set-up including **JODY-W2 module board** with it's RF paths connected to the **carrier board** with RF coaxial cables. The antennas are connected to the carrier board through SMA connectors. Below are the relevant components listed.

- **Module board** including U.FL connectors with JODY-W2 mounted.

- **Carrier board** including U.FL connectors to interface the module board and SMA connectors to connect antennas.

- **Coaxial cables** with U.FL connectors connecting the module board's RF traces to the carrier board's RF traces.

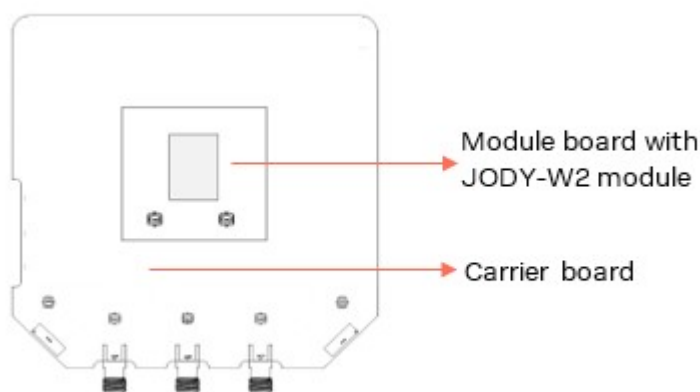- **Antennas** connected to the carrier board's SMA connectors.

Figure 15. Definition of Module board and Carrier board

Figure 16. Test set-up.

A.1.4 RF trace PCB routing

The PCB routing connecting the module's antenna pins to module board U.FL connectors are designed with coplanar microstrips. Coplanar microstrips are also used on the carrier board connecting the U.FL connectors with the SMA connectors to which the external antennas or test equipment are connected. Figure 17 and Table 37 shows the design stack-up including dimensions of the 50 Ω coplanar microstrips implemented.

Regarding the coplanar microstrips the ground planes beside the signal trace are connected to the inner layer ground plane using vias. The vias are placed with a maximum distance of 0.5 mm to the coplanar ground edge and a maximum pitch of 2 mm. The top layer is coated with generic LPI solder stop mask.

The SMA connectors on the carrier board are used for mounting antennas. For Bluetooth and Wi-Fi operation in the 2.4 GHz band and Wi-Fi operation in the 5 GHz band, the module has been tested and approved for use with antennas up to 2 dBi antenna gain.

Figure 17: Coplanar micro-strip dimension specification

Item	Value
S	200 µm
W	700 µm
T	35 µm
H	800 µm
ε_r	4.3

Table 37: Coplanar micro-strip specification

The mechanical dimensions of the module board's microstrips and position of the pi network impedance matching components are shown in Figure 18. Figure 20 shows the components used for the PI network impedance matching. Here only series 0 ohm resistors are used. The inner layers have the same dimensions and are filled with ground. No RF traces are routed in these layers.

The antenna ports shown in Figure 18 on the right hand side are from top to bottom: ANT1, ANT0, and ANT2. ANT2 is not used and shall be left unconnected.
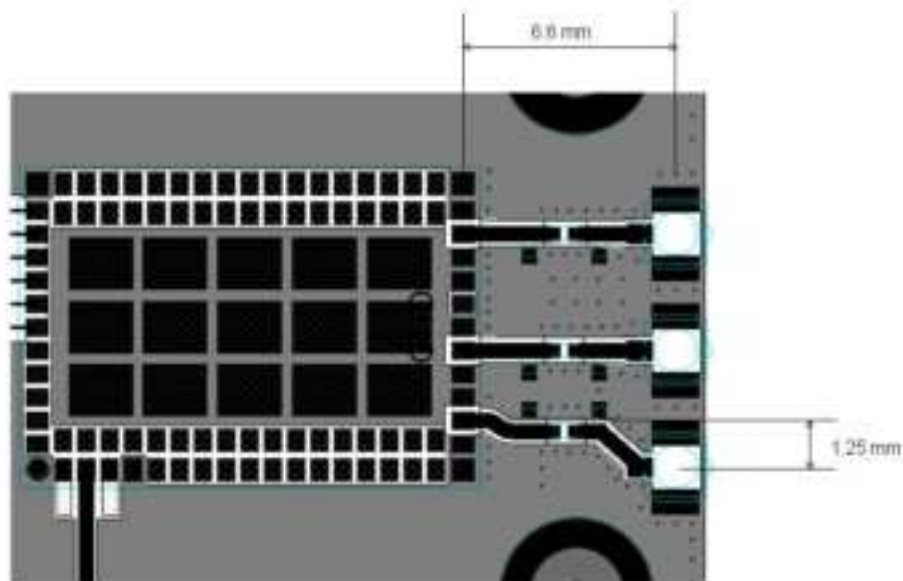

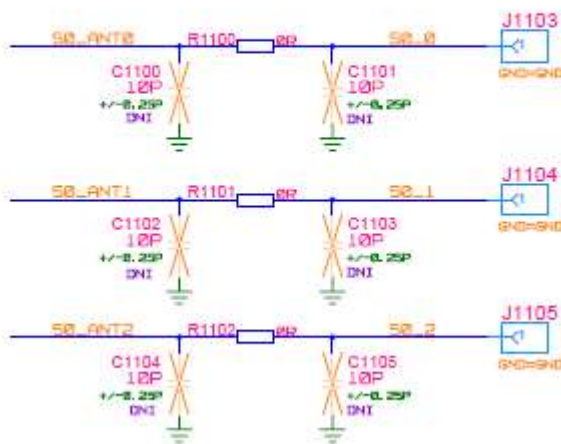**Figure 18. Module board Antenna micro strip implementation.**

Figure 19. Component selection for RF matching network on module board using 0 ohm series resistor.

The carrier board RF traces includes pi network matching components and are routed as coplanar microstrips. Here 10 pF capacitors in series are implemented.
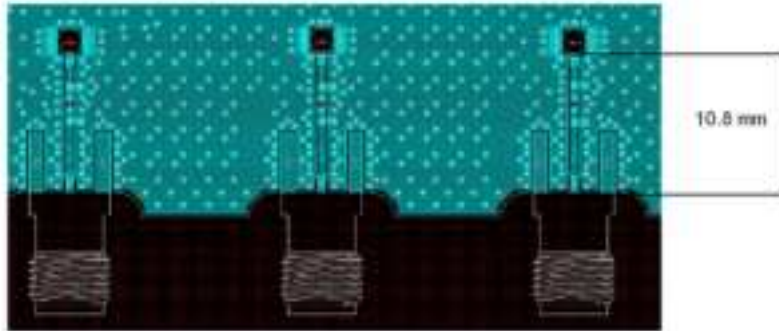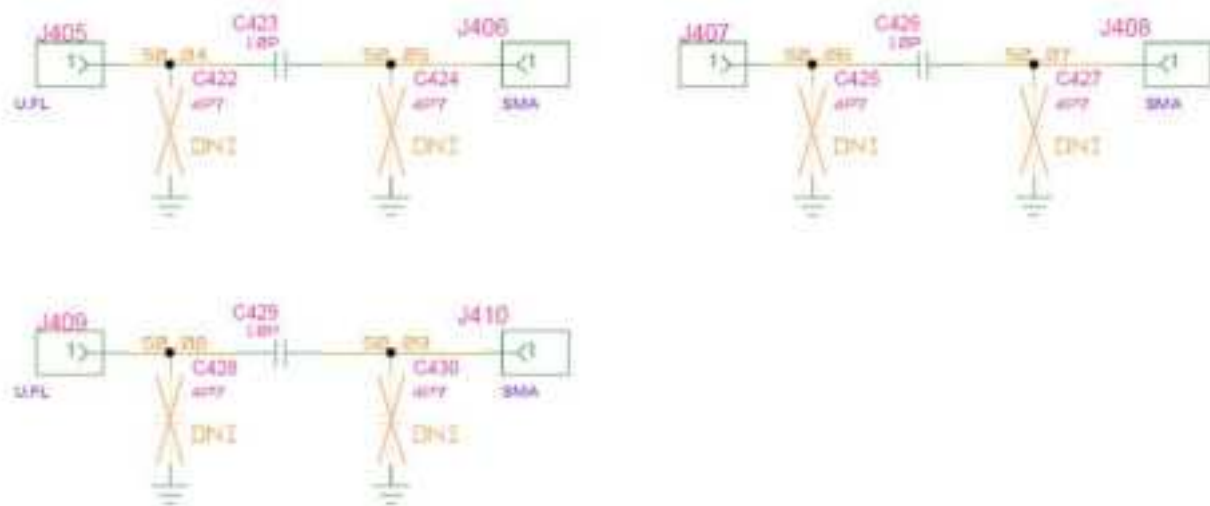

Figure 20. Carrier board Antenna micro strip implementation.

Figure 21. Component selection for RF matching network on carrier board using 10 pF series capacitors.

![u-blox logo]

A.1.5 Parts

Part	Description	Outline
Evaluation board (EVB)	Evaluation board for JODY-W263 series modules. The board includes SMA antenna connectors that connect to external antennas for Wi-Fi and Bluetooth. It has two internal dual-band Wi-Fi/Bluetooth antennas.	
External Antennas (2)	1 x dual band Wi-Fi/Bluetooth antenna, Linx Technologies ANT-DB1-RAF-SMA	
Coax RF cable	415-0086—050 Cinch connectivity solutions	

B Glossary

Abbreviation	Definition
AC	Alternating Current
CMD	Command
DC	Direct Current
DDR	Double Data Rate
ESD	Electrostatic Sensitive Devices
FCC	Federal Communications Commission
FIFO	First In, First Out
GI	Guard interval
GND	Ground
GPIO	General-purpose input/output
HD	High Definition
HCI	Host Controller Interface
ISED	Innovation, Science and Economic Development Canada
ISM	Industrial, scientific and medical
LE	Bluetooth Low Energy
LTE	Long Term Evolution
LULA	Limited Use License Agreement
MAC	Medium Access Control
MIMO	Multiple Input Multiple Output
MWS	Mobile Wireless Standards
MSL	Moisture sensitivity level
NFC	Near-Field Communication
OEM	Original equipment manufacturer
P2P	Peer-to-peer
P2P (GC)	P2P Client
P2P (GO)	P2P Group Owner
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect
PCIe	PCI Express
PCN	Product Change Notification
PCM	Pulse-code modulation
POR	Power-on reset
RED	Radio Equipment Directive
RF	Radio Frequency
RSDB	Real Simultaneous Dual Band
RSS	Radio Standards Specification
RH	Relative humidity
RoHS	Restriction of Hazardous Substances
SAR	Specific Absorption Rate
SCO	Synchronous Connection-Oriented

Abbreviation	Definition
SDIO	Secure Digital Input Output
SDR	Single Data Rate
SISO	Single-input single-output
SMD	Surface-mount Device
STA	Station
TBD	To be defined
USB	Universal Serial Bus
UART	Universal Asynchronous Receiver/Transmitter
VSDB	Virtual Simultaneous Dual Band
WAPI	WLAN Authentication and Privacy Infrastructure
WLAN	Wireless Local Area Network

Table 38: Explanation of the abbreviations and terms used

Related documents

[1]   u-blox package information guide, UBX-14001652
[2]   JODY-W2 series, system integration manual, UBX-18068879
[3]   Radio Equipment Directive (RED);
        https://ec.europa.eu/growth/sectors/electrical-engineering/red-directive; July 2017a
[4]   u-blox Limited Use License Agreement (LULA-M)
[5]   Android integration, application note, UBX-19035432
[6]   ANT-DB1-RAF-XXX Data sheet, Linx, https://linxtechnologies.com/wp/wp-content/uploads/ant-db1-raf-fff.pdf
[7]   GW.40.2153 Data sheet, Taoglas, https://fccid.io/pdf.php?id=2415249
[8]   ANT-2.4-CW-RCT-XX Data Sheet, Linx, https://linxtechnologies.com/wp/wp-content/uploads/ant-2.4-cw-rct-cc.pdf
[9]   JODY-W2 Declaration of Conformity, UBX-20053576

☞ For product change notifications and regular updates of u-blox documentation, register on our website, www.u-blox.com.

Revision history

Revision	Date	Name	Comments
R01	20-Nov-2018	shoe, mhei, kgom	Initial release.
R02	09-Apr-2019	vbak	Updated **Error! Reference source not found.** (Pin name "BT_DEV_WAKE"). Changed the power domain for SDIO lines (Table 15).
R03	02-May-2019	kgom	Changed product status for JODY-W263-01A-00 to Prototype.
R04	25-Apr-2020	vbak, aheg	Corrected pin 59 description and Wi-Fi/Bluetooth output power (Table 22 and **Error! Reference source not found.**). Added current consumption values (section ☞). Updated pin list. Updated the mechanical specifications (Figure 12).
R05	7-Dec-2020	lber, aheg	Updated the regulatory compliance section with the details about on-going certifications. Approvals are pending. A further update of this data sheet will be distributed once certification reports are available.
R06	11-Dec-2020	mzes	Corrected product name and chipset references in document information and section 1.4.
R07	28-Jan-2021	vbak	Corrected Wi-Fi simultaneous operation modes in section 1.4.2.

Contact

For complete contact information, visit us at www.u-blox.com.

u-blox Offices

North, Central and South America
u-blox America, Inc.
Phone: +1 703 483 3180
E-mail: info_us@u-blox.com
Regional Office West Coast:
Phone: +1 408 573 3640
E-mail: info_us@u-blox.com
Technical Support:
Phone: +1 703 483 3185
E-mail: support@u-blox.com

Headquarters
Europe, Middle East, Africa
u-blox AG
Phone: +41 44 722 74 44
E-mail: info@u-blox.com
Support: support@u-blox.com

Asia, Australia, Pacific
u-blox Singapore Pte. Ltd.
Phone: +65 6734 3811
E-mail: info_ap@u-blox.com
Support: support_ap@u-blox.com
Regional Office Australia:
Phone: +61 2 8448 2016
E-mail: info_anz@u-blox.com
Support: support_ap@u-blox.com
Regional Office China (Beijing):
Phone: +86 10 68 133 545
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com
Regional Office China (Chongqing):
Phone: +86 23 6815 1588
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com
Regional Office China (Shanghai):
Phone: +86 21 6090 4832
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com
Regional Office China (Shenzhen):
Phone: +86 755 8627 1083
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com
Regional Office India:
Phone: +91 80 405 092 00
E-mail: info_in@u-blox.com
Support: support_in@u-blox.com
Regional Office Japan (Osaka):
Phone: +81 6 6941 3660
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com
Regional Office Japan (Tokyo):
Phone: +81 3 5775 3850
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com
Regional Office Korea:
Phone: +82 2 542 0861
E-mail: info_kr@u-blox.com
Support: support_kr@u-blox.com
Regional Office Taiwan:
Phone: +886 2 2657 1090
E-mail: info_tw@u-blox.com
Support: support_tw@u-blox.com