Panasonic
INDUSTRY

PAN W602

Wi-Fi Single-Band 2.4 GHz and Bluetooth® Module

Wi-Fi Dual-Band 2.4/5 GHz and Bluetooth® Module

Product Specification

Rev. 1.1





Wireless Connectivity

Overview

The PAN W602-1x is a single band 2.4 GHz companion module with integrated Bluetooth® Low Energy for cost-effective projects and is based on the chipset CC3301 from Texas Instruments.

The PAN W602-2x is a dual band 2.4 & 5 GHz companion module with integrated Bluetooth® Low Energy for projects which require higher data rates or less interference and is based on the chipset CC3351 from Texas Instruments.

In a compact form factor the module either comes with an integrated chip antenna or the option to connect an external antenna via the bottom pad.

Latest technologies like multiuser MIMO and OFDMA improve efficiency in large networks. Integrated power management, 802.11i/w security standard support, and high-speed data interfaces deliver the performance for the speed, reliability, and quality requirements of next generation products.

Features

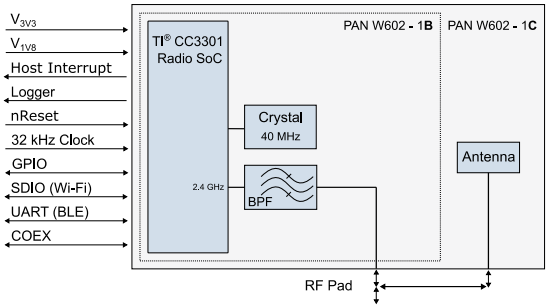
- Single & Dual band (2.4 GHz & 5 GHz) 802.11 a/b/g/n/ax Wi-Fi
- Bluetooth® 5.4 Low Energy (1M, 2M, LE Coded PHY)
- WPA3 Personal and Enterprise as station
- Multirole support: Access point & station
- Wi-Fi 6: Target Wake Time (TWT), OFDMA, MUMIMO (Downlink), Basic Service Set Coloring
- Simultaneous operation of Wi-Fi and Bluetooth®
- IEEE 802.11ax, 1×1 spatial stream with data rates up to 86 Mbps (MCS7, 20 MHz channel bandwidth)
- Enhanced security such as firmware authentication and anti-rollback protection
- Support for host processors running a Linux® operating system

Characteristics

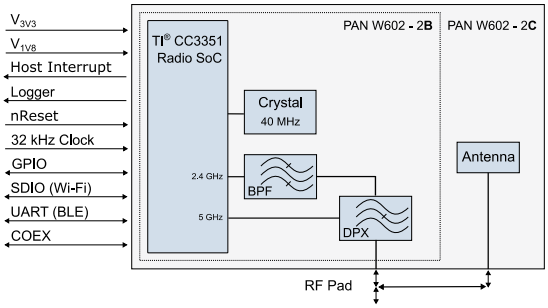
- Integrated antenna or bottom pad version
- Dimensions [mm]
  - Bottom Pad: 8.8 x 10.0 x 1.8
  - Integrated Antenna: 8.8 x 15.25 x 1.8
- Host Interface
  - Wi-Fi: SDIO 2.0 (1.8 V)
  - Bluetooth®: Highspeed UART (1.8 V)
- Coexistence: 3-wire or 1-wire PTA for external coexistence with additional 2.4-GHz radios
- Tx power up to +16 dBm
- 20 MHz channel bandwidth
- Rx Sensitivity: -96 dBm at IEEE 802.11b 1 Mbps
- Power supply: 1.8 V (core and I/O) and 3.3 (PA)
- Wide temperature range: -40 °C to +85 °C
- Typical current consumption
  - Tx:95 mA (V_{1V8}) and 167 mA (V_{3V3}) @ 802.11ax (HE MCS7) 2.4 GHz, Rx: 59 mA @ 2.4 GHz,
  - Tx:145 mA (V_{1V8}) and 163 mA (V_{3V3}) @ 802.11ax (HE MCS7) 5 GHz, Rx:88 mA @ 5 GHz
- Low Power Mode
  - 330 µA

Block Diagram

PAN W602 - 1x
Wi-Fi 6 & Bluetooth® Radio Module
IEEE 802.11 b/g/n/ax
Bluetooth® Low Energy



PAN W602 - 2x
Wi-Fi 6 & Bluetooth® Radio Module
IEEE 802.11 a/b/g/n/ax
Bluetooth® Low Energy



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- Improper use of the Engineering Sample.

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Information on Software

The PAN W602 module does not contain any software ex works, i.e. software is provided by 3rd party suppliers only. The essential software resources can be found on the partner website of Texas Instruments Incorporated (https://www.ti.com).

PIDEU provides a factory software programming service for your customized firmware; for further information please reach out to your local sales contact this regarding ⇨ 7.3.1 Contact Us.

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1 About This Document

1.1 Purpose and Audience

This Product Specification provides details on the functional, operational, and electrical characteristics of the Panasonic PAN W602 module. It is intended for hardware design, application, and Original Equipment Manufacturers (OEM) engineers.

The product is referred to as “PAN W602” and “module” within this document.

1.2 Revision History

Revision	Date	Modifications/Remarks
1.0	2026-08-06	Initial release
1.1	2026-09-09	• Corrected cable part numbers for TE Connectivity antenna 2108923-3/4 to 2016695-x (SMA -> RP-SMA) in ⇨ 6.4.5.3 Terminal Mount Antennas • Added cables 2583737-x to TE Connectivity antenna 2108923-3/4 in ⇨ 6.4.5.3 Terminal Mount Antennas • Added TE Connectivity antenna 2108923-1/2 to ⇨ 6.4.5.3 Terminal Mount Antennas • Added TE Connectivity antenna 2504615-x to ⇨ 6.4.5.2 PCB Antennas • Changed RED and UKCA certification status to “Available” in ⇨ 6 Regulatory and Certification Information • Updated ⇨ 6.2 Conformity According to Radio Equipment Directive (RED-2014/53/EU) for Europe and ⇨ 6.3 United Kingdom Conformity According to Statutory Instrument (SI-2017/1206) • Added notifications regarding the FCC and ISED regulatory certifications for the single band variants ENWF9211C and ENWF9211A being not yet finalized to ⇨ 3.3.6 Regulatory Label, ⇨ 6.4 Federal Communications Commission (FCC) for US and ⇨ 6.5 Innovation, Science, and Economic Development (ISED) for Canada • Removed note of incomplete certification for EU and UKCA from ⇨ 3.3.6 Regulatory Label • Removed regulatory warnings from sections that are not related to the regulatory certification.

1.3 Use of Symbols

Symbol	Description
	**Note** Indicates important information for the proper use of the product. Non-observance can lead to errors.
	**Attention** Indicates important notes that, if not observed, can put the product’s functionality at risk.
⇨ [chapter number] [chapter title]	**Cross reference** Indicates cross references within the document. **Example:** Description of the symbols used in this document ⇨ 1.3 Use of Symbols.

1.4 Related Documents

For related documents please refer to the Panasonic website ⇨ 7.3.2 Product Information.

2 Overview

The PAN W602 is a single band 2.4 GHz or dual band 2.4 GHz/5GHz 802.11 a/b/g/n/ax Wi-Fi combo radio module including Bluetooth® Low Energy for cost-sensitive projects, which is based on the chipsets CC3301 and CC3351 from Texas Instruments®. The simultaneous and independent operation of the two technologies enable the high efficiency modes of 802.11ax and the low-power operation of the latest Bluetooth® Low Energy standard.

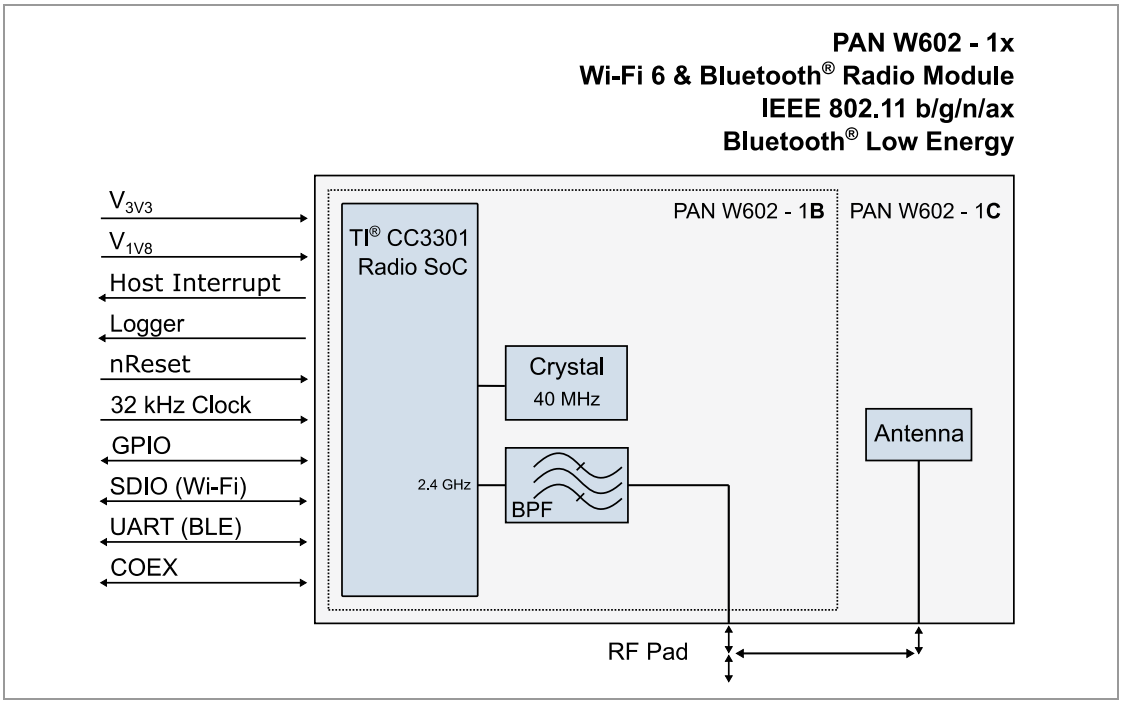
Latest technologies like multiuser MIMO and OFDMA improve the efficiency in large networks. Integrated power management, 802.11i/w security standard support, and high-speed data interfaces deliver the performance for the speed, reliability, and quality requirements of next generation products.

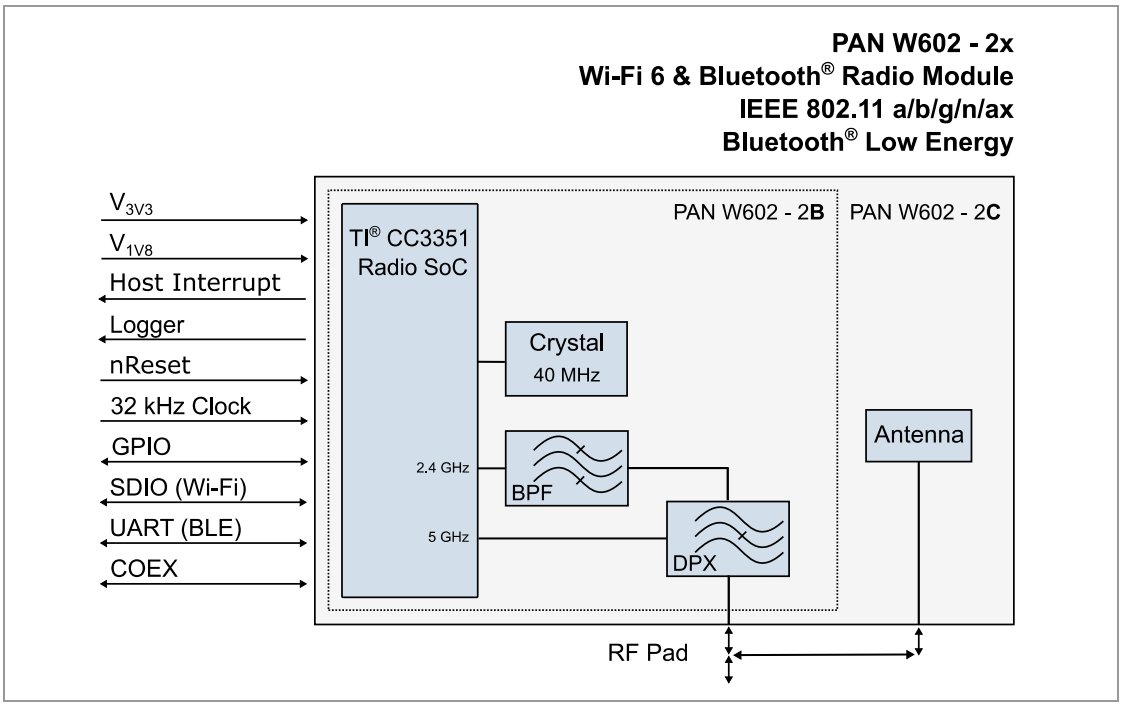
To enable seamless wireless communication, the module connects via SDIO for Wi-Fi and high-speed UART for Bluetooth® to a host processor platform capable of running a Linux® and Android® operating system.

For related documents please refer to ⇨ 7.3.2 Product Information.

For further information on the variants and versions please refer to ⇨ 7.2 Ordering Information.

2.1 Block Diagram



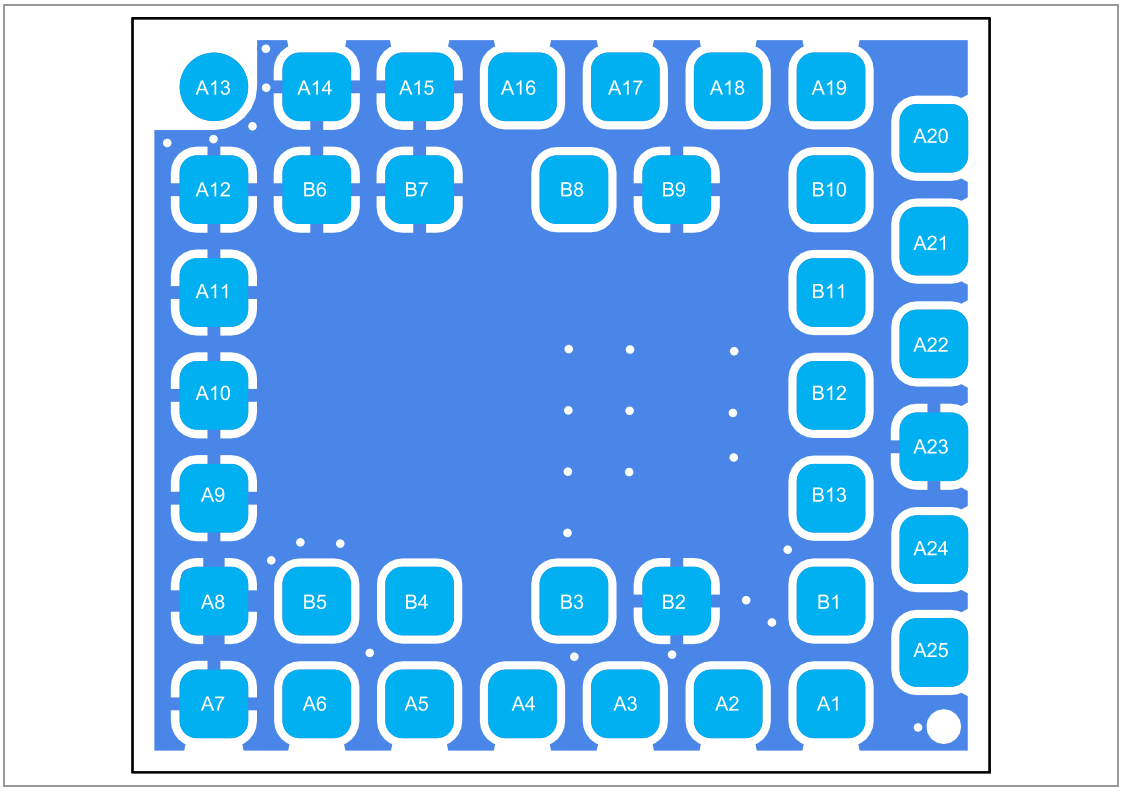


2.2 Pin Configuration

2.2.1 PAN W602-xB

Pin Assignment

Bottom View



Pin Functions

No.	Pin Name	Pin Type	Description
A1	SDIO_CMD	Digital I/O	For SDIO specific terminals please refer to ⇨ SDIO Pin Functions.
A2	SDIO_CLK	Digital I/O	
A3	SWCLK	Input signal	Serial wire debug clock
A4	LOGGER	Output signal	Tracer (UART TX debug logger)
A5	HOST_IRQ_WL	Output signal	Interrupt request to host for WLAN
A6	3V3	Power	+3.3 V power supply connection
A7	GND	Ground pin	Connect to ground
A8	GND	Ground pin	Connect to ground
A9	GND	Ground pin	Connect to ground
A10	GND	Ground pin	Connect to ground
A11	GND	Ground pin	Connect to ground

No.	Pin Name	Pin Type	Description
A12	GND	Ground pin	Connect to ground
A13	BT_WL_ANT	RF port	50 Ω bottom pad Wi-Fi/Bluetooth
A14	GND	Ground pin	Connect to ground
A15	GND	Ground pin	Connect to ground
A16	1V8	Power	+1.8 V power supply connection
A17	SLOW_CLK_IN	Input signal	External low power clock input (32.768 kHz)
A18	COEX_GRA	Output signal	Coexistence interface: Grant
A19	COEX_PRI	Input signal	Coexistence interface: Priority
A20	GPIO1	Digital I/O	General Purpose I/O – GPIO[1]
A21	UART_CTS	Input signal	Clear-to-send input from host controller
A22	UART_TX	Output signal	Serial data output to host controller
A23	GND	Ground pin	Connect to ground
A24	SDIO_D2	Digital I/O	For SDIO specific terminals please refer to ⇨ SDIO Pin Functions.
A25	SDIO_D0	Digital I/O	
B1	SDIO_D1	Digital I/O	
B2	GND	Ground pin	Connect to ground
B3	SWDIO	Digital I/O	Serial wire debug I/O
B4	HOST_IRQ_BLE	Output signal	Reserved for future use
B5	3V3	Power	+3.3 V power supply connection
B6	GND	Ground pin	Connect to ground
B7	GND	Ground pin	Connect to ground
B8	nRESET	Input signal	Reset line (active low)
B9	GND	Ground pin	Connect to ground
B10	COEX_REQ	Input signal	Coexistence interface: Request
B11	UART_RTS	Output signal	Request-to-send output to host controller
B12	UART_RX	Input signal	Serial data input from host controller
B13	SDIO_D3	Digital I/O	For SDIO specific terminals please refer to ⇨ SDIO Pin Functions.

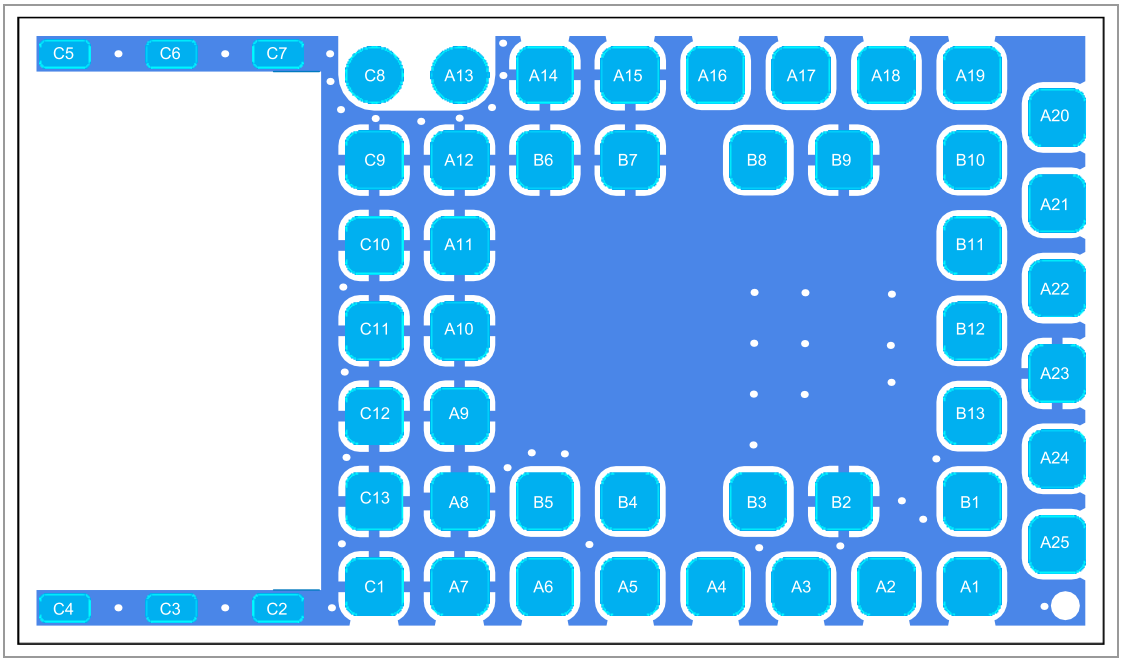
SDIO Pin Functions

No.	Pin Name	Pin Type	Description	
			SDIO 4-Bit Mode	SPI Mode
A2	SDIO_CLK	Digital I/O	Clock	Clock
A1	SDIO_CMD	Digital I/O	Command Line	Command Line
A25	SDIO_D0	Digital I/O	Data Line bit [0]	Data Line
B1	SDIO_D1	Digital I/O	Data Line bit [1] or Interrupt (optional)	Interrupt
A24	SDIO_D2	Digital I/O	Data Line bit [2] or Read Wait (optional)	Read Wait (optional)
B13	SDIO_D3	Digital I/O	Data Line bit [3]	Not used

2.2.2 PAN W602-xC

Pin Assignment

Bottom View



Pin Functions

No.	Pin Name	Pin Type	Description
A1	SDIO_CMD	Digital I/O	For SDIO specific terminals please refer to ⇨ SDIO Pin Functions.
A2	SDIO_CLK	Digital I/O	
A3	SWCLK	Input signal	Serial wire debug clock
A4	LOGGER	Output signal	Tracer (UART TX debug logger)
A5	HOST_IRQ_WL	Output signal	Interrupt request to host for WLAN

No.	Pin Name	Pin Type	Description
A6	3V3	Power	+3.3 V power supply connection
A7	GND	Ground pin	Connect to ground
A8	GND	Ground pin	Connect to ground
A9	GND	Ground pin	Connect to ground
A10	GND	Ground pin	Connect to ground
A11	GND	Ground pin	Connect to ground
A12	GND	Ground pin	Connect to ground
A13	BT_WL_ANT	RF port	50 Ω bottom pad Wi-Fi/Bluetooth
A14	GND	Ground pin	Connect to ground
A15	GND	Ground pin	Connect to ground
A16	1V8	Power	+1.8 V power supply connection
A17	SLOW_CLK_IN	Input signal	External low power clock input (32.768 kHz)
A18	COEX_GRA	Output signal	Coexistence interface: Grant
A19	COEX_PRI	Input signal	Coexistence interface: Priority
A20	GPIO1	Digital I/O	General Purpose I/O – GPIO[1]
A21	UART_CTS	Input signal	Clear-to-send input from host controller
A22	UART_TX	Output signal	Serial data output to host controller
A23	GND	Ground pin	Connect to ground
A24	SDIO_D2	Digital I/O	For SDIO specific terminals please refer to ⇨ SDIO Pin Functions.
A25	SDIO_D0	Digital I/O	
B1	SDIO_D1	Digital I/O	
B2	GND	Ground pin	Connect to ground
B3	SWDIO	Digital I/O	Serial wire debug I/O
B4	HOST_IRQ_BLE	Output signal	Reserved for future use
B5	3V3	Power	+3.3 V power supply connection
B6	GND	Ground pin	Connect to ground
B7	GND	Ground pin	Connect to ground
B8	nRESET	Input signal	Reset line (active low)
B9	GND	Ground pin	Connect to ground
B10	COEX_REQ	Input signal	Coexistence interface: Request
B11	UART_RTS	Output signal	Ready-to-send output to host controller
B12	UART_RX	Input signal	Serial data input from host controller
B13	SDIO_D3	Digital I/O	For SDIO specific terminals please refer to ⇨ SDIO Pin Functions.
C1	GND	Ground pin	Connect to ground

No.	Pin Name	Pin Type	Description
C2	GND	Ground pin	Connect to ground
C3	GND	Ground pin	Connect to ground
C4	GND	Ground pin	Connect to ground
C5	GND	Ground pin	Connect to ground
C6	GND	Ground pin	Connect to ground
C7	GND	Ground pin	Connect to ground
C8	RF_to_ANT	RF port	50 Ω antenna pad Wi-Fi/Bluetooth
C9	GND	Ground pin	Connect to ground
C10	GND	Ground pin	Connect to ground
C11	GND	Ground pin	Connect to ground
C12	GND	Ground pin	Connect to ground
C13	GND	Ground pin	Connect to ground

SDIO Pin Functions

No.	Pin Name	Pin Type	Description	
			4-Bit SDIO Mode	SPI Mode
A2	SDIO_CLK	Digital I/O	Clock	Clock
A1	SDIO_CMD	Digital I/O	Command Line	Command Line
A25	SDIO_D0	Digital I/O	Data Line bit [0]	Data Line
B1	SDIO_D1	Digital I/O	Data Line bit [1] or Interrupt (optional)	Interrupt
A24	SDIO_D2	Digital I/O	Data Line bit [2] or Read Wait (optional)	Read Wait (optional)
B13	SDIO_D3	Digital I/O	Data Line bit [3]	Not used

2.3 Host Interface

Type	Features
High-speed UART interface	The device supports a high-speed Universal Asynchronous Receiver/Transmitter (UART) interface. • Fully compliant to the Bluetooth HCI UART specification • Two flow control pins
SDIO interface / SPI interface	The device supports a SDIO device interface or a SPI device interface that allows a host controller using the SDIO or SPI bus protocol to access the device. • 4-bit SDIO transfer mode with clock range up to 52 MHz – Default speed with clock range up to 26 MHz – High speed with clock range up to 52 MHz • SPI transfer mode with clock range up to 26 MHz The SDIO interface can be used as a shared Wi-Fi and Bluetooth interface.

For further information please refer to ⇨ 4.6.1 Host Interface.

2.4 WLAN

2.4.1 Features

Type	Features
IEEE 802.11 Standards	• 802.11 data rates: 1 Mbps and 2 Mbps (DSSS) • 802.11b data rates: 5.5 Mbps and 11 Mbps (CCK) • 802.11a/g data rate: 6 / 9 / 12 / 18 / 24 / 36 / 48 / 54 Mbps (OFDM) • 802.11n with maximum data rates: up to 72 Mbps (20 MHz channel) • 802.11ax with maximum data rates: up to 86 Mbps (20 MHz channel) • 802.11ax 1x1 SU and MU-MIMO (Station mode only, Downlink only) / OFDMA (Station mode only) • 802.11e Medium Access Control (MAC): Quality of Service Enhancements
WLAN Extended Features	• OFDMA Trigger Frames • Basic Service Set (BSS) coloring • Target Wake Time (TWT) • Multirole support (e.g. concurrent Station and Access Point) • 802.11ac-compatible (20 MHz channel and max. MCS7 only)
WLAN MAC	• IEEE 802.11 a/b/g/n/ax support
WLAN Baseband	• 802.11ax 1x1 MU-MIMO baseband, backwards compatible with 802.11n/a/g/b technology • Bandwidth support – 20 MHz • Modulation and Coding Schemes (MCS) – 802.11ax: MCS0~7 – 802.11n: MCS0~7
WLAN Radio and Frontend	• 5 GHz and 2.4 GHz Wi-Fi band operation (PAN W602-2x only) • 2.4 GHz Wi-Fi band operation (PAN W602-1x only) • 802.11ax 1x1 MU-MIMO on-chip RF radio • Shared RF bottom pad for WLAN and Bluetooth
WLAN Encryption	• Supports WPA2 and WPA3 personal and enterprise – Personal (Access Point & Station): WPA3, WPA2-PSK, WPS PBC + PIN, open – Enterprise (Station only): WPA3 GCMP support + 192-bit keys, EAP Methods (TLS, TTLS, TTLS-MSCHAP, PEAPv0-MSCHAP, and PEAPv1-TLS)

2.5 Bluetooth

2.5.1 Features

Type	Features
General	• Supports Bluetooth 5.4 Low Energy features • Shared RF pad with Wi-Fi • Simultaneous receive with Wi-Fi • Coexistence with Wi-Fi

Type	Features
Bluetooth Low Energy (LE)	• Bluetooth 5.4 features • Supported Bluetooth Low Energy PHY data rates • 1 Mbps (GFSK) • 2 Mbps (GFSK) • Host controller interface (HCI) transport with option for UART or shared SDIO

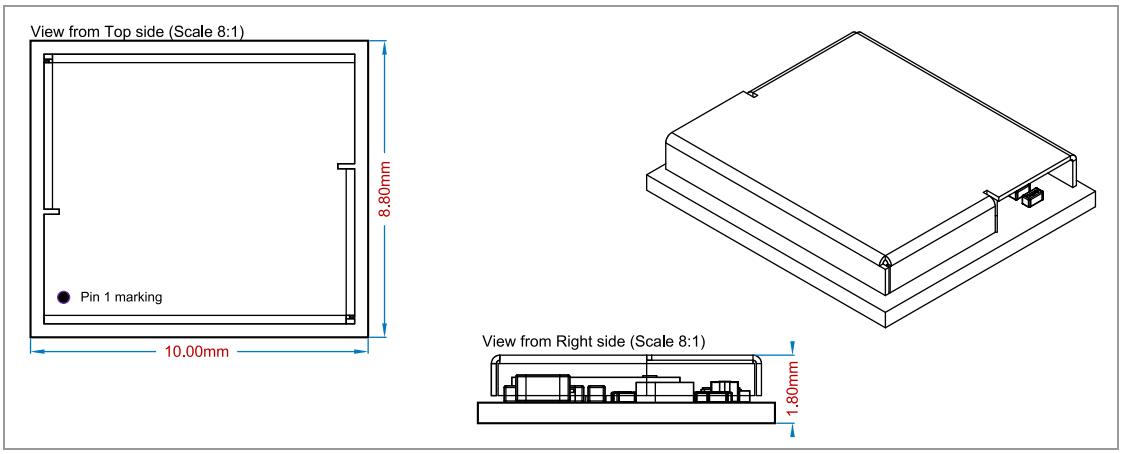
3 Detailed Description

3.1 Dimensions

3.1.1 PAN W602-xB

The dimensions are in millimeters.

Top View

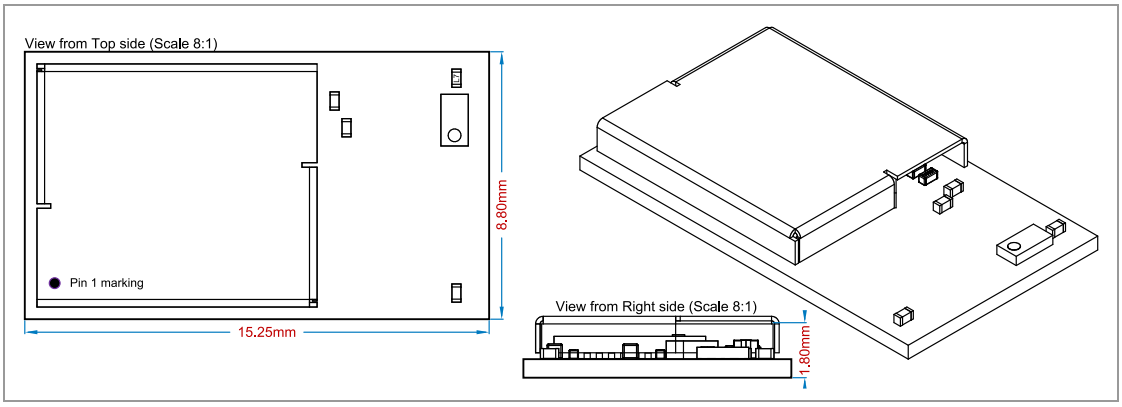


Item	Dimension	Tolerance	Remark
Width	8.80	±0.35	
Length	10.00	±0.35	
Height	1.80	±0.20	With case

3.1.2 PAN W602-xC

The dimensions are in millimeters.

Top View

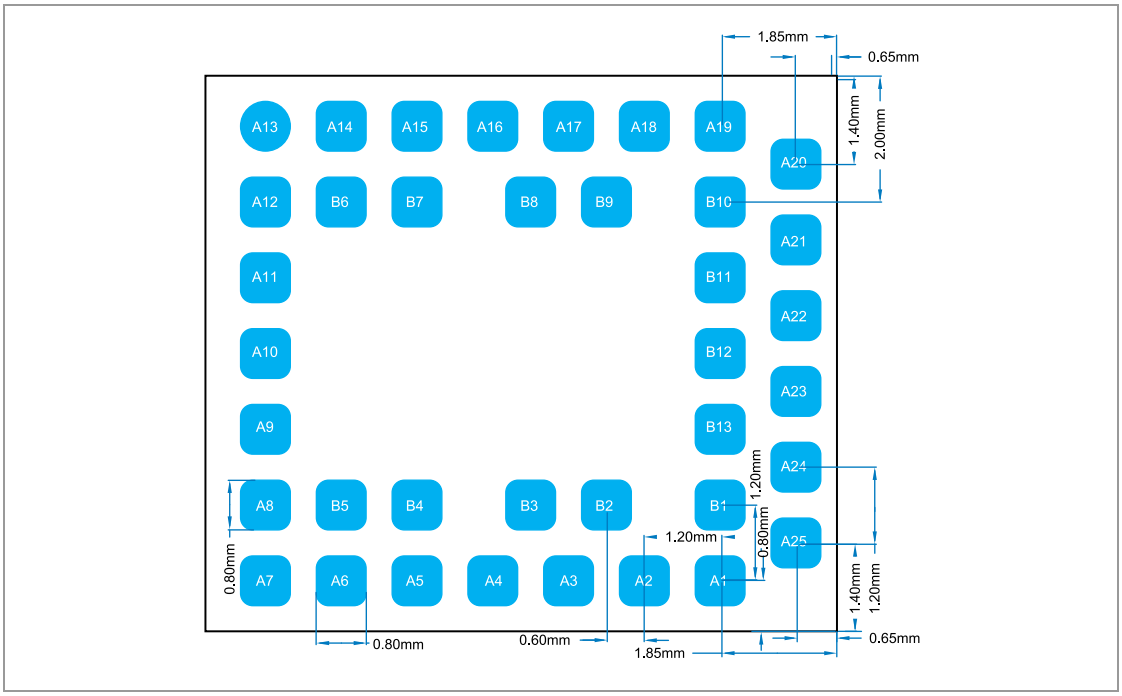


Item	Dimension	Tolerance	Remark
Width	8.80	±0.35	
Length	15.25	±0.35	
Height	1.80	±0.20	With case

3.2 Footprint

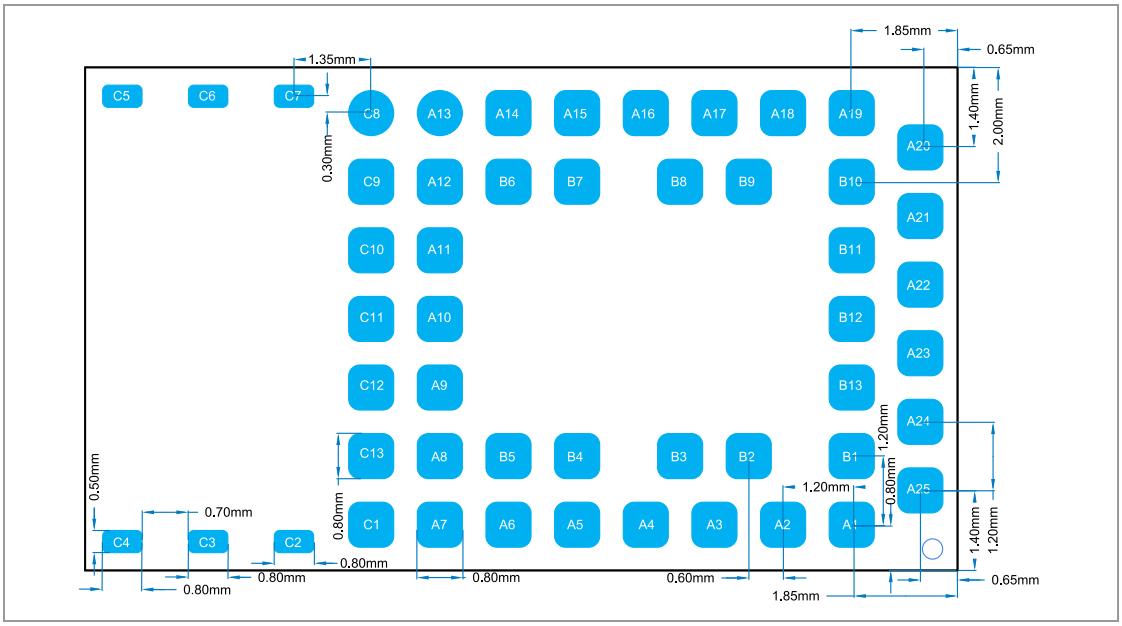
3.2.1 PAN W602-xB

Bottom View



3.2.2 PAN W602-xC

Bottom View

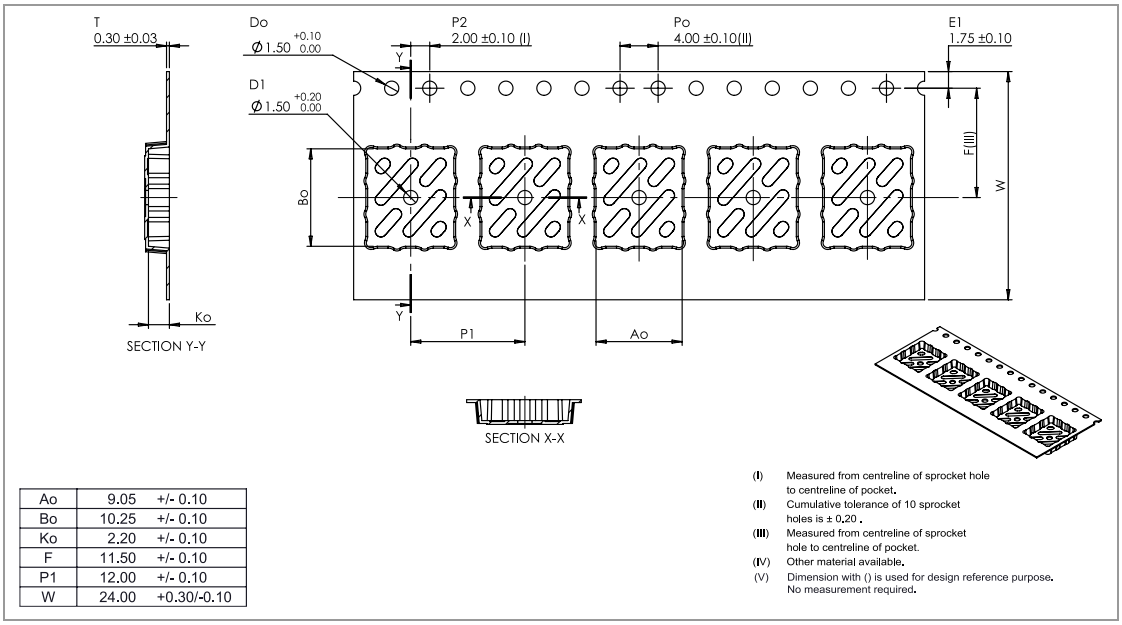


3.3 Packaging

The module is a mass production status product and will be delivered in the package described below.

3.3.1 Tape Dimensions

3.3.1.1 PAN W602-xB

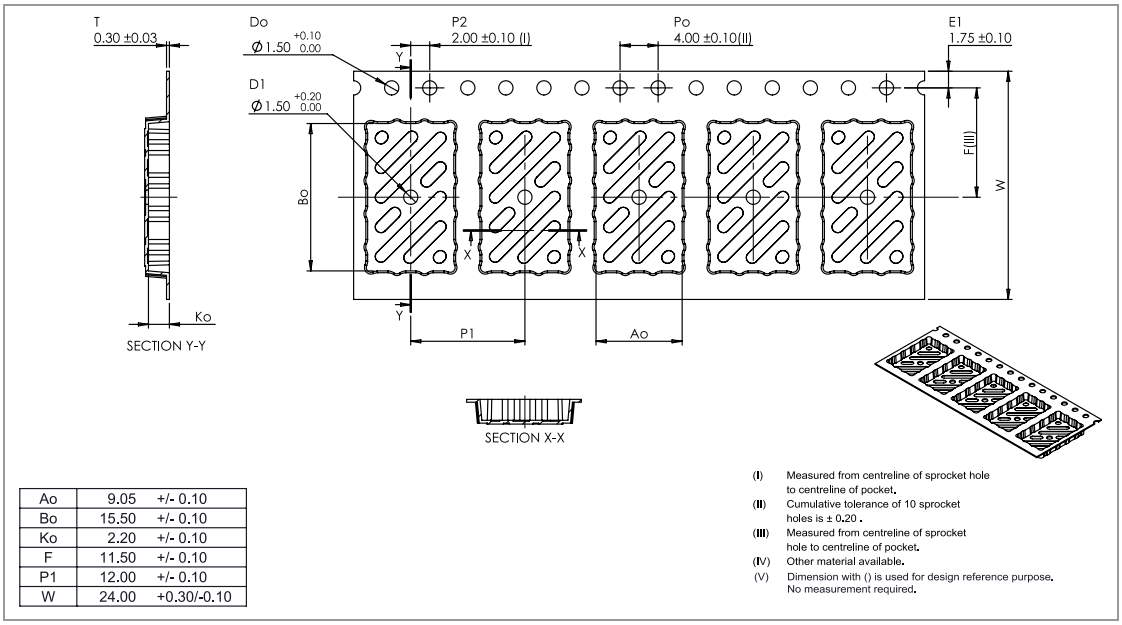


Ao	9.05	+/- 0.10
Bo	10.25	+/- 0.10
Ko	2.20	+/- 0.10
F	11.50	+/- 0.10
P1	12.00	+/- 0.10
W	24.00	+0.30/-0.10

(I) Measured from centreline of sprocket hole to centreline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
(III) Measured from centreline of sprocket hole to centreline of pocket.
(IV) Other material available.
(V) Dimension with () is used for design reference purpose. No measurement required.

All Dimensions are in millimeters unless otherwise stated.

3.3.1.2 PAN W602-xC

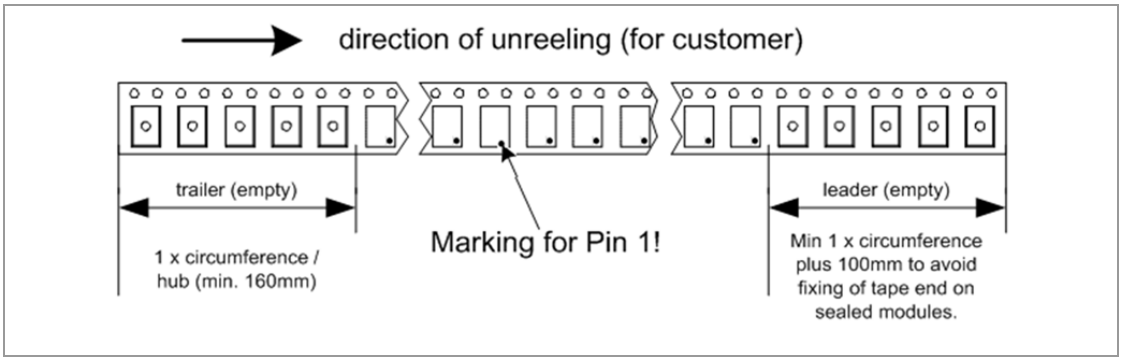


Ao	9.05	+/- 0.10
Bo	15.50	+/- 0.10
Ko	2.20	+/- 0.10
F	11.50	+/- 0.10
P1	12.00	+/- 0.10
W	24.00	+0.30/-0.10

(I) Measured from centreline of sprocket hole to centreline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
(III) Measured from centreline of sprocket hole to centreline of pocket.
(IV) Other material available.
(V) Dimension with () is used for design reference purpose. No measurement required.

All Dimensions are in millimeters unless otherwise stated.

3.3.2 Packing in Tape

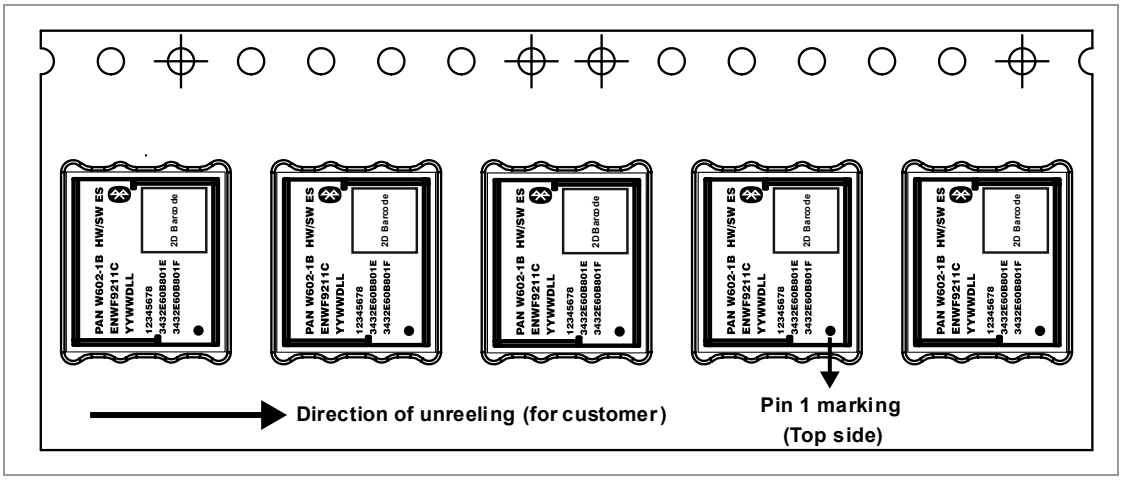


Empty spaces in the component packed area shall be less than two per reel and those spaces shall not be consecutive.

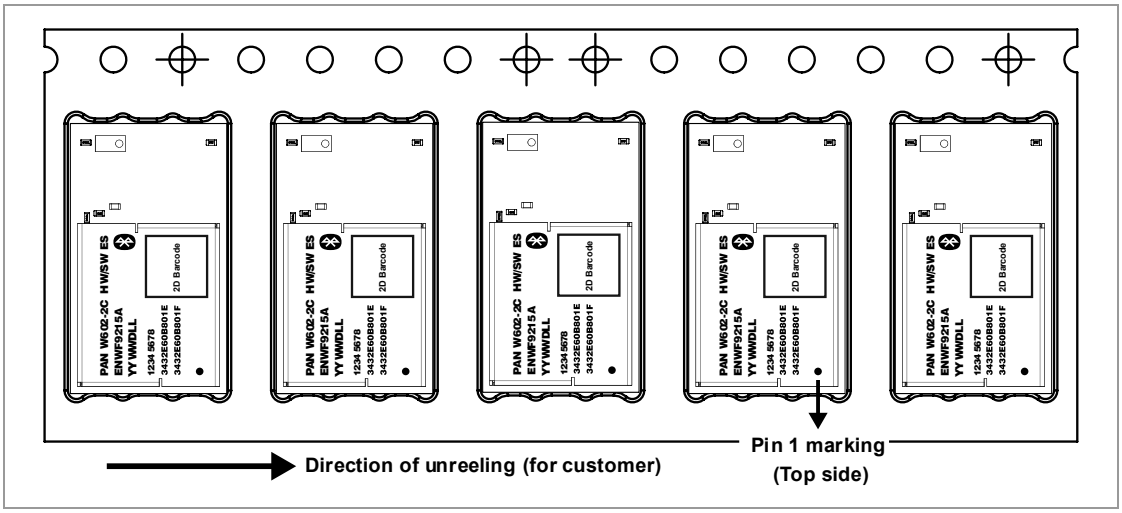
The top cover tape shall not be found on reel holes and it shall not stick out from the reel.

3.3.3 Component Direction

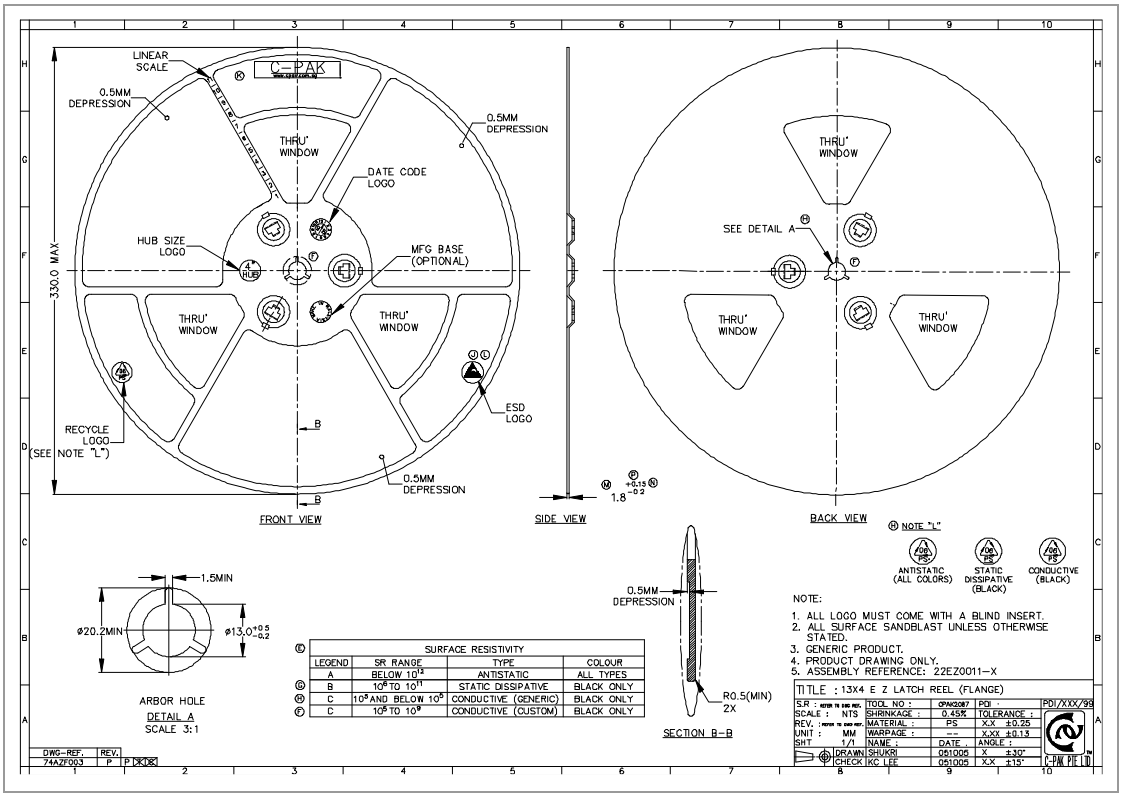
3.3.3.1 PAN W602-xB



3.3.3.2 PAN W602-xC



3.3.4 Reel Dimension



3.3.5 Package Label

Example:

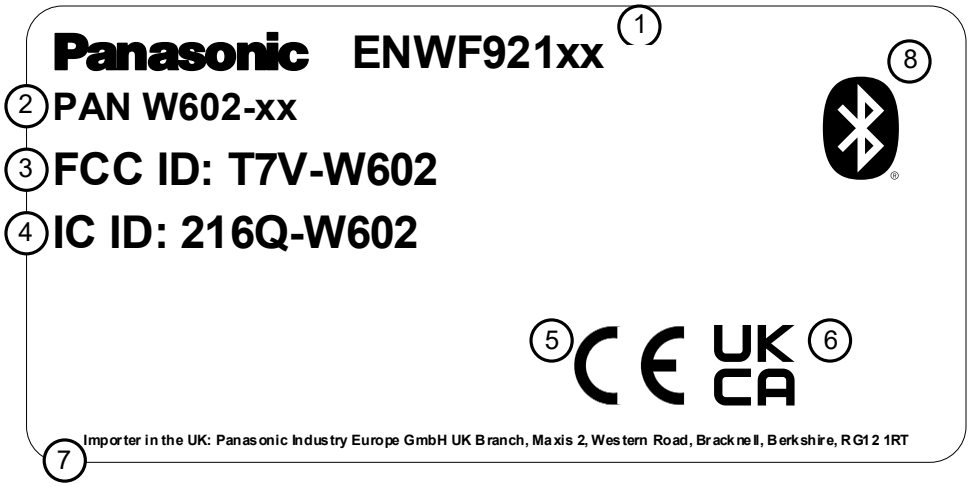


(1T)	Lot code
(1P)	Customer order number, if applicable
(2P)	Order number
(9D)	Date code
(Q)	Quantity
(HW/SW)	Hardware/software version

3.3.6 Regulatory Label

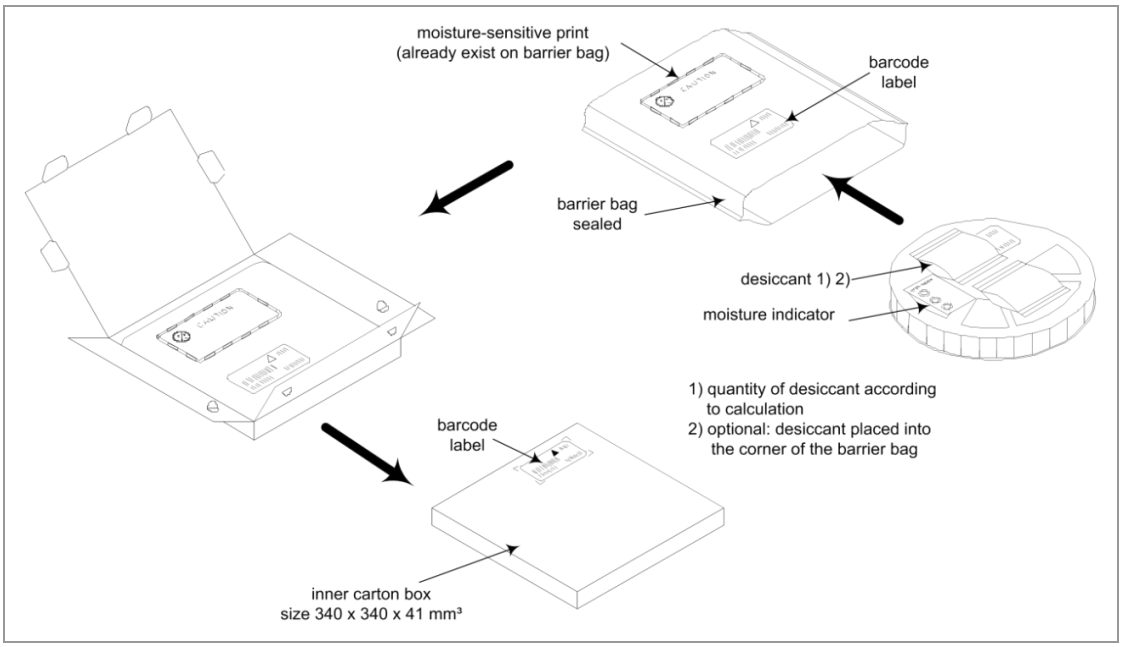
Please note that variants PAN W602-1B (ENWF9211C) and PAN W602-1C (ENWF9211A) are currently still in progress of regulatory certification for FCC (USA) and ISED (Canada).

Example:



1	Regulatory Product Number
2	Marketing Name
3	FCC ID
4	IC ID
5	CE Mark
6	UK-CA Mark
7	UK Importer Address
8	Bluetooth SIG Logo

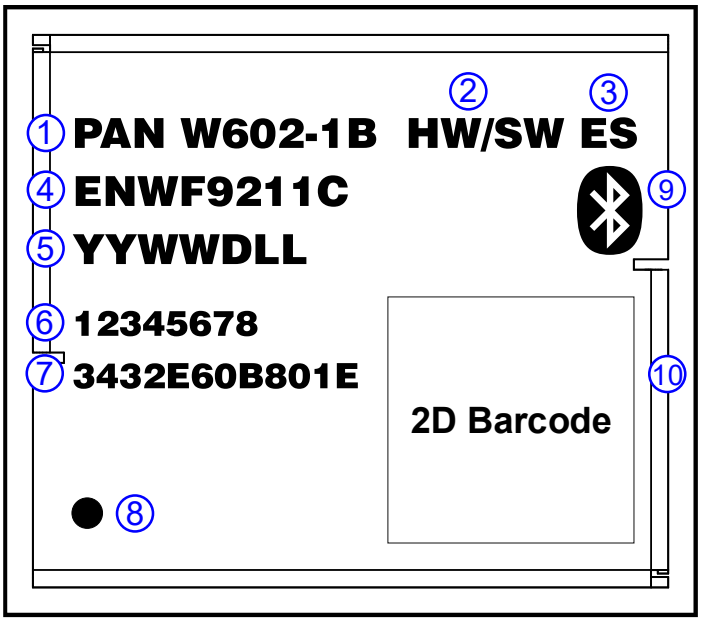
3.3.7 Total Package



3.4 Case Marking

3.4.1 ENWF9211C

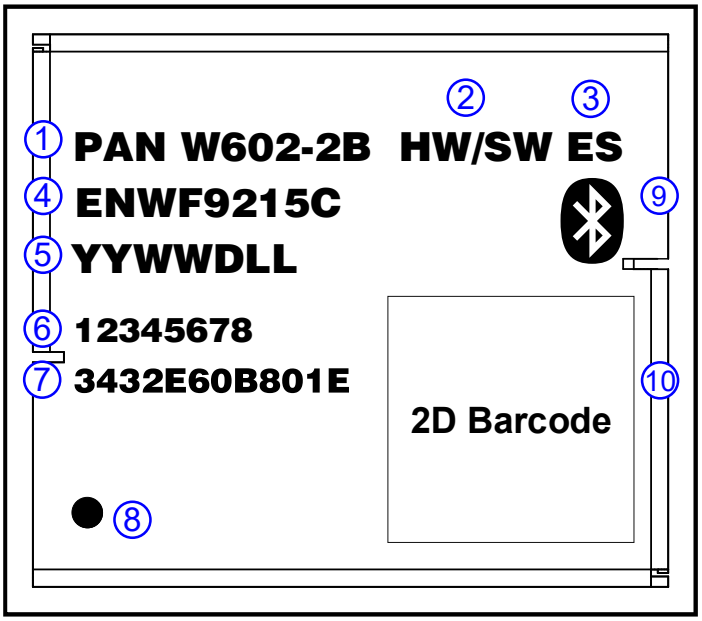
Example:



1	Brand name
2	Hardware/software version
3	Engineering Sample marking, if applicable
4	Regulatory product number
5	Lot code
6	Serial number
7	Wi-Fi MAC address
8	Marking for Pin 1
9	Bluetooth marking
10	2D barcode, for internal usage only

3.4.2 ENWF9215C

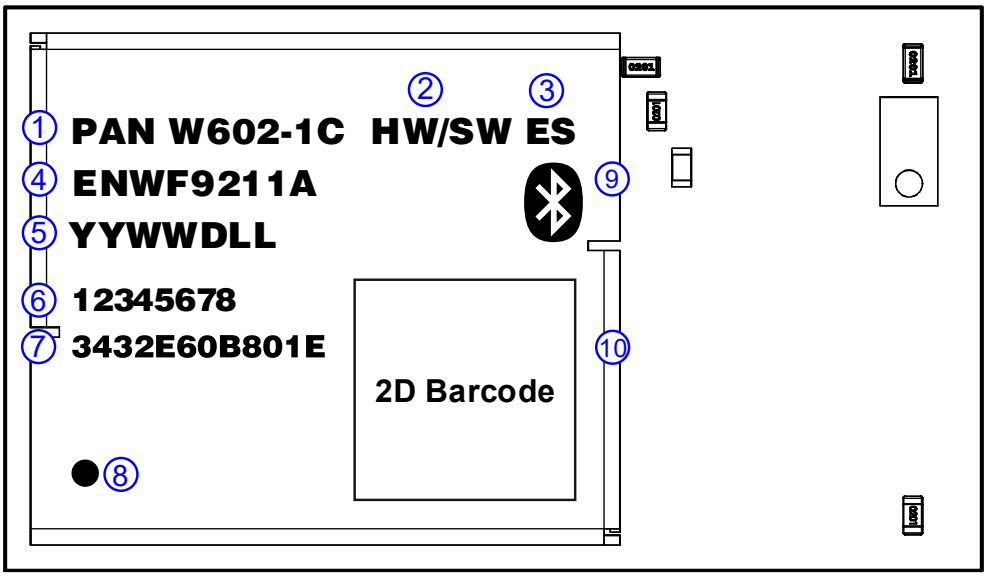
Example:



1	Brand name
2	Hardware/software version
3	Engineering Sample marking, if applicable
4	Regulatory product number
5	Lot code
6	Serial number
7	Wi-Fi MAC address
8	Marking for Pin 1
9	Bluetooth marking
10	2D barcode, for internal usage only

3.4.3 ENWF9211A

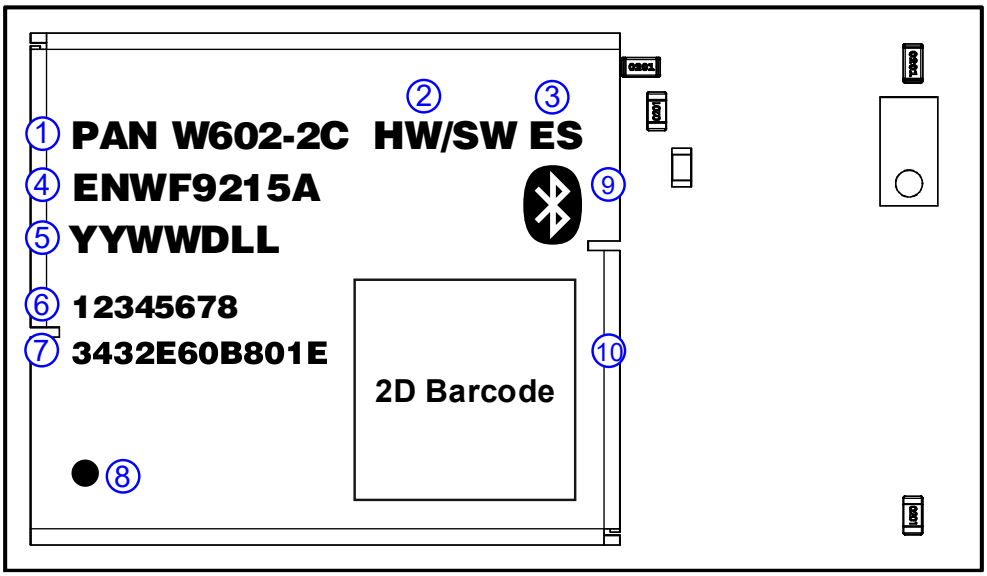
Example:



1	Brand name
2	Hardware/software version
3	Engineering Sample marking, if applicable
4	Regulatory product number
5	Lot code
6	Serial number
7	Wi-Fi MAC address
8	Marking for Pin 1
9	Bluetooth marking
10	2D barcode, for internal usage only

3.4.4 ENWF9215A

Example:



1	Brand name
2	Hardware/software version
3	Engineering Sample marking, if applicable
4	Regulatory product number
5	Lot code
6	Serial number
7	Wi-Fi MAC address
8	Marking for Pin 1
9	Bluetooth marking
10	2D barcode, for internal usage only

4 Specification

All specifications are over temperature and process, unless indicated otherwise.

4.1 Default Test Conditions

Temperature:	25 °C ± 10 °C
Humidity:	40 % to 85 % RH
Supply Voltage:	3V3 = 3.3 V and 1V8 = 1.8 V

4.2 Absolute Maximum Ratings

The maximum ratings may not be exceeded under any circumstances, not even momentarily or individually, as permanent damage to the module may result.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
T_{STOR}	Storage Temperature		-40		85	°C
V_{ESD}	ESD Robustness	All pads, according to human body model (HBM), JEDEC STD 22, method A114			1 000	V
P_{RF}	RF Input Level	Wi-Fi 802.11b DSSS			0	dBm
		Wi-Fi 802.11b CCK			-8.5	dBm
		Wi-Fi OFDM			-17.5	dBm
		Bluetooth Low Energy			0.2	dBm
V_{3V3}	Maximum Voltage		3.0	3.3	3.6	V
V_{1V8}			1.62	1.8	1.98	V
V_{GPIO}	Maximum Voltage Range for GPIO Pins		-0.5		V_{1V8} + 0.5	V

4.3 Recommended Operating Conditions



The maximum ratings may not be exceeded under any circumstances, not even momentarily or individually, as permanent damage to the module may result.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
T_A	Ambient Operating Temperature Range	Industrial grade	-40		85	°C
V_{3V3}	Recommended supply voltage		3.0	3.3	3.6	V
V_{1V8}			1.62	1.8	1.98	V

4.3.1 Digital Pin Characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
V_{IH}	High Level Input Voltage		0.65 x V_{1V8}		V_{1V8}	V
V_{IL}	Low Level Input Voltage		0		0.35 x V_{1V8}	V
V_{OH}	High Level Output Voltage	@ 4 mA	V_{1V8} - 0.45		V_{1V8}	V
V_{OL}	Low Level Output Voltage	@ 4 mA	0		0.45	V

4.3.2 Internal Operating Frequencies

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
f_{REFCLK}	Crystal fundamental frequency	Frequency tolerance < ±20 ppm over operating temperature and lifetime		40		MHz

4.3.3 External Sleep Clock Requirements

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
	Input slow clock frequency	Square wave		32.768		kHz
	Frequency accuracy	Initial + temperature drift + aging	-250		+250	ppm
	Input Duty cycle		30	50	70	%
T_r/T_f	Rise and fall time	10% to 90% (rise) and 90% to 10% (fall) of digital signal level			100	ns
V_{IL}	Input low level		0		0.35 x V_{1V8}	
V_{IH}	Input high level		0.65 x V_{1V8}			
	Input impedance		1			MΩ
	Input capacitance				5	pF

4.4 Power-up Sequence

For proper operation of the PAN W602 module, perform the recommended power-up sequencing as follows:

1. All supplies (3V3 and 1V8) shall be available before nRESET is released.
2. For an external slow clock, confirm that the clock is stable before nRESET is deasserted (high).
3. The nRESET pin must be held low for at least 10 µs after stabilization of the external power supplies.

4.5 Current Consumption

The current consumption depends on the user scenario and on the setup and timing in the power modes.

Assume 3V3 = 3.3 V, 1V8 = 1.8 V, T_{amb} = 25 °C, if nothing else stated.

Parameter	Condition	Typ. At 1.8 V	Typ. at 3.3 V	Unit
Shutdown	Device held in reset mode.	10	2	µA
Sleep	Firmware loaded and device set into sleep mode.	330	2	µA

4.5.1 WLAN Current Consumption

Parameter	Condition	Typ. At 1.8 V	Typ. at 3.3 V	Unit
Active Transmit	2.4 GHz, 802.11b, 20 MHz, 11 Mbps at 16 dBm	89	213	mA
	2.4 GHz, 802.11g, 20 MHz, 54 Mbps at 14dBm	93	164	mA
	2.4 GHz, 802.11n, 20 MHz, MCS7 at 14 dBm	93	170	mA
	2.4 GHz, 802.11ax SU, 20 MHz, MCS7 at 14 dBm	95	167	mA
	5 GHz, 802.11a, 20 MHz, 54 Mbps at 13 dBm	143	159	mA
	5 GHz, 802.11n, 20 MHz, MCS7 at 13 dBm	145	164	mA
	5 GHz, 802.11ax SU, 20 MHz, MCS7 at 13 dBm	145	163	mA
Active Receive	2.4 GHz	59	0	mA
	5 GHz	88	0	mA

4.5.2 Bluetooth Low Energy Current Consumption

Parameter	Condition	Typ. At 1.8 V	Typ. at 3.3 V	Unit
Active Transmit	1 Mbps at 5 dBm	86	86	mA
	1 Mbps at 10 dBm	86	106	mA
Active Receive	2.4 GHz	46	0	mA

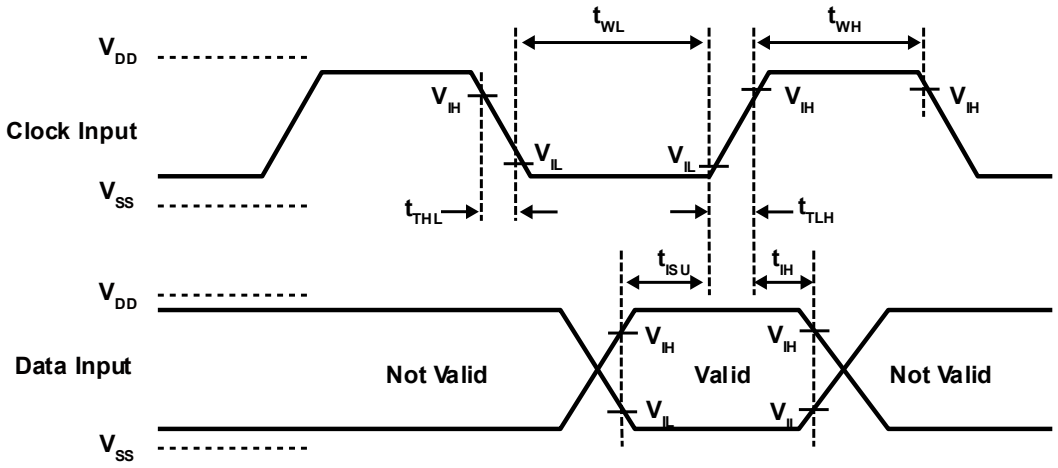
4.6 Interfaces

4.6.1 Host Interface

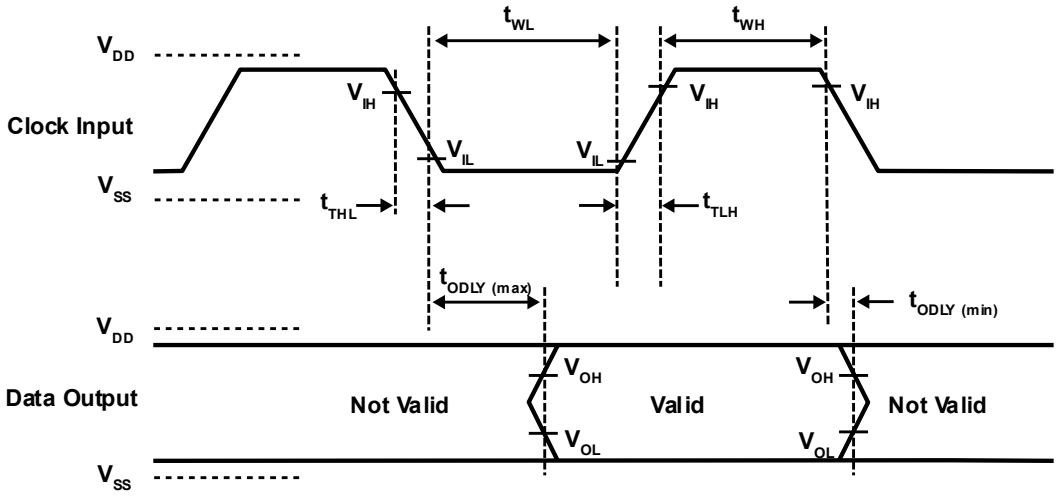
4.6.1.1 SDIO Interface

SDIO is the main host interface for WLAN.

SDIO Timing Diagram – Default Speed – Input Timing



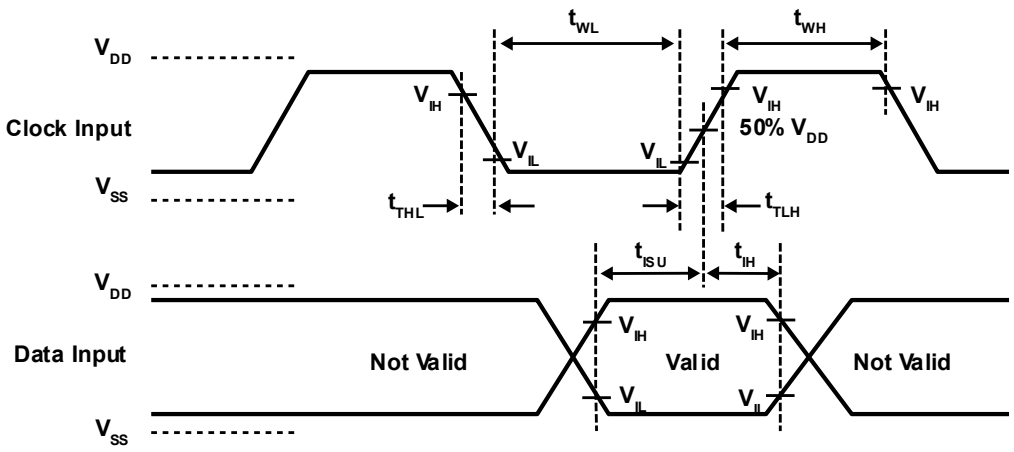
SDIO Timing Diagram – Default Speed – Output Timing



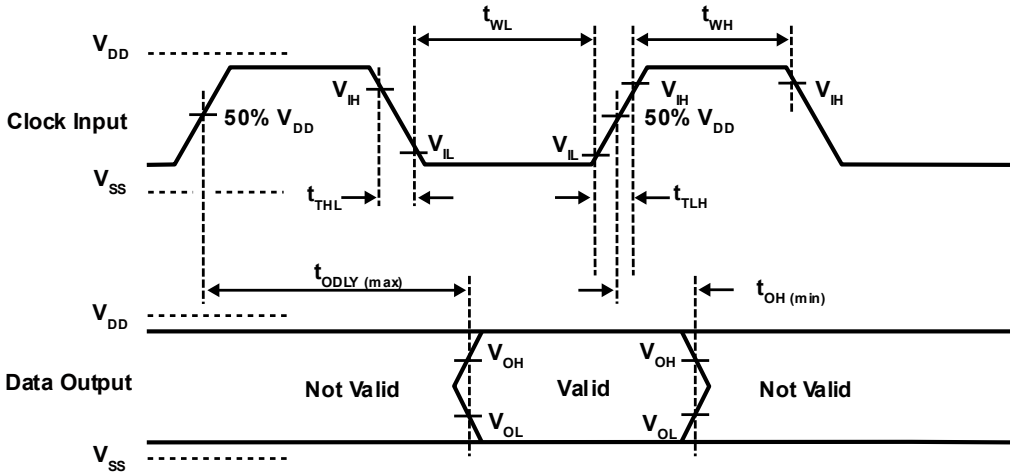
SDIO Timing Parameters – Default Speed

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
f_{Clock}	Clock frequency	Clock			26	MHz
t_{High}	High Period			10		ns
t_{Low}	Low Period			10		ns
t_{TLH}	Rise time	Clock			10	ns
t_{THL}	Fall time	Clock			10	ns
t_{ISU}	Setup time	Input valid before clock rise		5		ns
t_{IH}	Hold time	Input valid after clock rise		5		ns
t_{ODLY}	Delay time	Clock fall to output valid		2	14	ns
C_L	Capacitive load	On outputs		15	40	pF

SDIO Timing Diagram – High Speed – Input Timing



SDIO Timing Diagram – High Speed – Output Timing

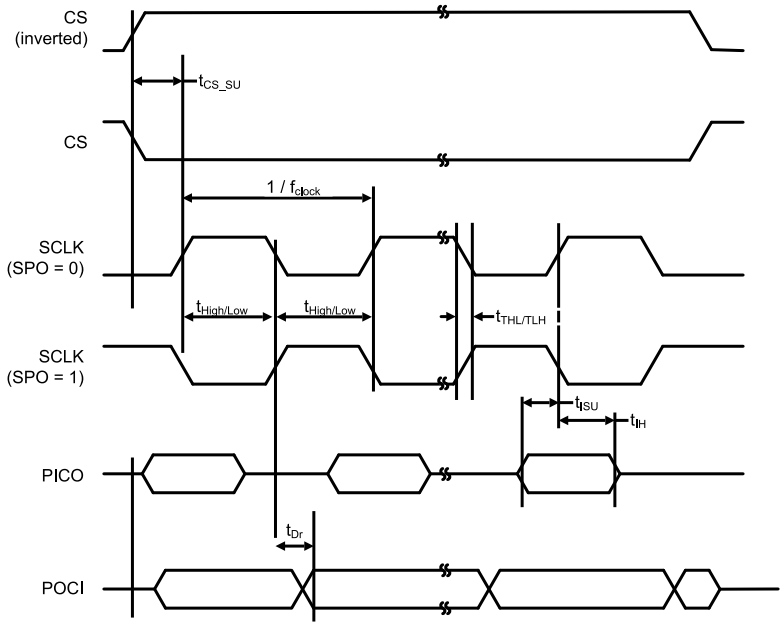


SDIO Timing Parameters – High Speed

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
f_{Clock}	Clock frequency	Clock			52	MHz
t_{High}	High Period			7		ns
t_{Low}	Low Period			7		ns
t_{TLH}	Rise time	Clock			3	ns
t_{THL}	Fall time	Clock			3	ns
t_{ISU}	Setup time	Input valid before clock rise		6		ns
t_{IH}	Hold time	Input valid after clock rise		2		ns
t_{ODLY}	Delay time	Clock fall to output valid		2	14	ns
C_L	Capacitive load	On outputs		15	40	pF

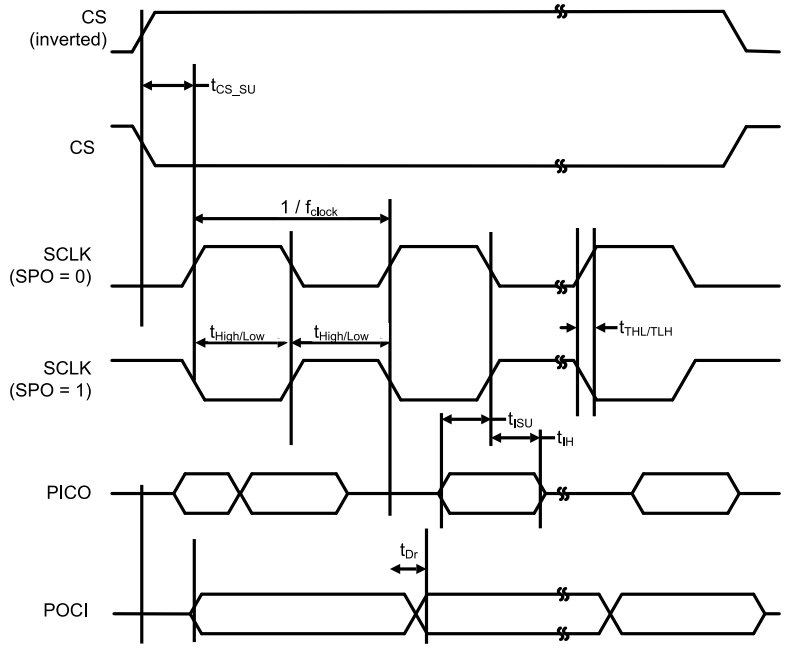
4.6.1.2 SPI Interface

SPI Timing Diagram – Peripheral Mode SPH = 0



Peripheral Mode, SPH = 0

SPI Timing Diagram – Peripheral Mode SPH = 0



Peripheral Mode, SPH = 1

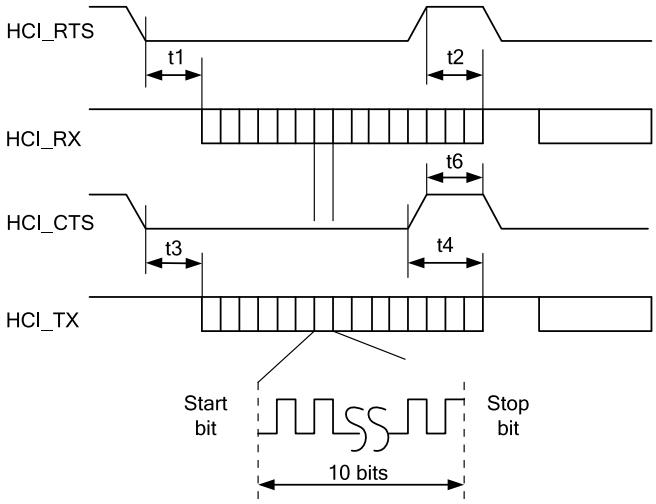
SPI Timing Parameters

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
f_{Clock}	Clock frequency	Clock			26	MHz
t_{High}	High Period			10		ns
t_{Low}	Low Period			10		ns
t_{TLH}	Rise time	Clock			3	ns
t_{THL}	Fall time	Clock			3	ns
t_{CSsu}	Setup time	CS valid before clock rise		3		ns
t_{ISU}	PICO	Input valid before clock rise		3		ns
t_{IH}	PICO hold time	Input valid after clock rise		3		ns
t_{Dr}, t_{Df}-Active	Delay time	Clock rise/fall to output valid		2	10	ns
t_{Dr}, t_{Df}-Sleep	Delay time	Clock rise/fall to output valid			12	ns
C_L	Capacitive load	On outputs		15	40	pF

4.6.1.3 High-Speed UART Interface

UART is the main host interface for Bluetooth Low Energy which supports the host controller interface (HCI) transport layer.

UART Timing Diagram



UART Timing Parameters

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
	Baud rate		37.5		4 364	kbps
	Baud rate accuracy per byte	Receive / Transmit	-2.5		+1.5	%
	Baud rate accuracy per bit	Receive / Transmit	-12.5		+12.5	%
	CTS low to TX_DATA on		0	2		ms
	CTS high to TX_DATA off	Hardware flow control			1	Byte
	CTS high pulse width		1			bit
	RTS low to TX_DATA on		0	2		ms
	RTS high to TX_DATA off	Interupt set to ¼ FIFO			16	Byte

4.7 RF Electrical Characteristics

4.7.1 WLAN Radio Specification

Parameter	Operation Mode				Specification
Standard Conformance	IEEE 802.11/IEEE 802.11b				
	IEEE 802.11a				
	IEEE 802.11g				
	IEEE 802.11n				
	IEEE 802.11ax				
Modulation	IEEE 802.11a				OFDM
	IEEE 802.11b				DSSS/CCK
	IEEE 802.11g				OFDM
	IEEE 802.11n				OFDM at MCS0~7
	IEEE 802.11ax				OFDM at MCS0~7 OFDMA at MCS0~7
Physical layer data rates	IEEE 802.11				1 Mbps, 2 Mbps at DSSS
	IEEE 802.11b				5.5 Mbps, 11 Mbps at DSSS/CCK
Supported data rates	IEEE 802.11g				[6, 9, 12, 18, 24, 36, 48, 54] Mbps
	IEEE 802.11a				[6, 9, 12, 18, 24, 36, 48, 54] Mbps
	IEEE 802.11n	MCS0~7	HT20	1.6 μs GI	[6.5, 13, 19.5, 26, 39, 52, 58.5, 65] Mbps
				0.8 μs GI	[7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65, 72.2] Mbps
	IEEE 802.11ax Single User HE_SU	MCS0~7	HE20	3.2 μs GI	[7.3, 14.6, 21.9, 29.3, 43.9, 58.5, 65.8, 73.1] Mbps
				1.6 μs GI	[8.1, 16.3, 24.4, 32.5, 48.8, 65, 73.1, 81.3] Mbps
				0.8 μs GI	[8.6, 17.2, 25.8, 34.4, 51.6, 68.8, 77.4, 86] Mbps
	IEEE 802.11ax OFDMA HE_TB (Tx only) HE_MU (Rx only)	MCS0~7	26-RU	3.2 μs GI	[0.8, 1.5, 2.3, 3.0, 4.5, 6.0, 6.8, 7.5] Mbps
				1.6 μs GI	[0.8, 1.7, 2.5, 3.3, 5.0, 6.7, 7.5, 8.3] Mbps
				0.8 μs GI	[0.9, 1.8, 2.6, 3.5, 5.3, 7.1, 7.9, 8.8] Mbps
			52-RU	3.2 μs GI	[1.5, 3.0, 4.5, 6.0, 9.0, 12.0, 13.5, 15.0] Mbps
				1.6 μs GI	[1.7, 3.3, 5.0, 6.7, 10.0, 13.3, 15.0, 16.7] Mbps
				0.8 μs GI	[1.8, 3.5, 5.3, 7.1, 10.6, 14.1, 15.9, 17.6] Mbps
			106-RU	3.2 μs GI	[3.2, 6.4, 9.6, 12.8, 19.1, 25.5, 28.7, 31.9] Mbps
				1.6 μs GI	[3.5, 7.1, 10.6, 14.2, 21.3, 28.3, 31.9, 35.4] Mbps
				0.8 μs GI	[3.8, 7.5, 11.3, 15.0, 22.5, 30.0, 33.8, 37.5] Mbps

Parameter	Operation Mode				Specification
			242-RU	3.2 µs GI	[7.3, 14.6, 21.9, 29.3, 43.9, 58.5, 65.8, 73.1] Mbps
				1.6 µs GI	[8.1, 16.3, 24.4, 32.5, 48.8, 65.0, 73.1, 81.3] Mbps
				0.8 µs GI	[8.6, 17.2, 25.8, 34.4, 51.6, 68.8, 77.4, 86.0] Mbps
Supported bandwidth	IEEE 802.11n				20 MHz (HT20)
	IEEE 802.11ax				20 MHz (HE20)
Supported Resource Units (RUs)	IEEE 802.11ax Multiuser OFDMA				26 tone RUs (26-RU), 52 tone RUs (52-RU), 106 tone RUs (106-RU), 242 tone Rus (242-RU)
Supported Guard Interval	IEEE 802.11n				0.4 µs (SGI), 0.8 µs (LGI)
	IEEE 802.11ax	1x HE-LTF 2x HE-LTF			0.8 µs, 1.6 µs
		4x HE-LTF			0.8 µs, 3.2 µs

Channels and Frequencies (without Regulatory Restrictions)

This section shows the general capabilities of the hardware. The implemented and supported channels may differ.

Please refer to ⇨ 7.1 Channels and Power Settings per Country for product specific information.

2.4 GHz Band - 20 MHz Channels		
Channel	**Frequency**	**Unit**
1	2 412	MHz
2	2 417	MHz
3	2 422	MHz
4	2 427	MHz
5	2 432	MHz
6	2 437	MHz
7	2 442	MHz
8	2 447	MHz
9	2 452	MHz
10	2 457	MHz
11	2 462	MHz
12	2 467	MHz
13	2 472	MHz

5 GHz Band - 20 MHz Channels		
Channel	**Frequency**	**Unit**
36	5 180	MHz
40	5 200	MHz
44	5 220	MHz
48	5 240	MHz
52	5 260	MHz
56	5 280	MHz
60	5 300	MHz
64	5 320	MHz
100	5 500	MHz
104	5 520	MHz
108	5 540	MHz
112	5 560	MHz
116	5 580	MHz
120	5 600	MHz
124	5 620	MHz
128	5 640	MHz
132	5 660	MHz
136	5 680	MHz
140	5 700	MHz
149	5 745	MHz
153	5 765	MHz
157	5 785	MHz
161	5 805	MHz
165	5 825	MHz

4.7.2 WLAN RF Characteristics

4.7.2.1 IEEE 802.11b (RF Characteristics)

Assume V_{3V3} = 3.3 V, V_{1V8} = 1.8 V, T_{amb} = +25 °C, if nothing else stated.

50 Ω terminal load connected to the RF connector.

Parameter		Condition	Min.	Typ.	Max.	Unit
RF Frequency Range			2 400		2 483.5	MHz
Carrier Frequency Tolerance			-25		+25	ppm
Transmit Output Power[1]				16		dBm
Spectrum Mask	f_C±11 MHz				-30	dBr
	f_C±22 MHz				-50	dBr
Power-on/Power-down Ramp					2	µs
RF Carrier Suppression					-15	dB
Error Vector Magnitude (EVM)	Peak				35	%
Minimum Receive Sensitivity	1 Mbps (DSSS)	PER ≤ 8 %		-96	-80	dBm
	11 Mbps (CCK)	PER ≤ 8 %		-88	-76	dBm
Maximum Input Level	1 Mbps (DSSS)	PER ≤ 8 %		0		dBm
Adjacent Channel Rejection		PER ≤ 8 %	35			dB

4.7.2.2 IEEE 802.11g (RF Characteristics)

Assume V_{3V3} = 3.3 V, V_{1V8} = 1.8 V, T_{amb} = +25 °C, if nothing else stated.

50 Ω terminal load connected to the RF connector.

Parameter		Condition	Min.	Typ.	Max.	Unit
RF Frequency Range			2 400		2 483.5	MHz
Carrier Frequency Tolerance			-25		+25	ppm
Transmit Output Power[1]	6 Mbps~54 Mbps			14		dBm
Spectrum Mask	f_C±11 MHz				-20	dBr

[1] Please note that the maximum transmit power depends on the country of operation. Details about the output power are provided in 7.1 Channels and Power Settings per Country.

Parameter		Condition	Min.	Typ.	Max.	Unit
	f_C±20 MHz				-28	dBr
	f_C±30 MHz				-40	dBr
Transmitter Center Frequency Leakage					-15	dB
Transmitter Spectral Flatness			-4		+4	dB
Constellation Error (EVM)	BPSK, CR 1/2 (6 Mbps)				-5	dB
	BPSK, CR 3/4 (9 Mbps)				-8	dB
	QPSK, CR 1/2 (12 Mbps)				-10	dB
	QPSK, CR 3/4 (18 Mbps)				-13	dB
	16-QAM, CR 1/2 (24 Mbps)				-16	dB
	16-QAM, CR 3/4 (36 Mbps)				-19	dB
	64-QAM, CR 2/3 (48 Mbps)				-22	dB
	64-QAM, CR 3/4 (54 Mbps)				-25	dB
Minimum Receive Sensitivity	BPSK, CR 1/2 (6 Mbps)	PER ≤ 10 %		-90	-82	dBm
	64-QAM, CR 3/4 (54 Mbps)	PER ≤ 10 %		-74	-65	dBm
Maximum Input Level	BPSK, CR 1/2 (6 Mbps)	PER ≤ 10 %		0		dBm
	64-QAM, CR 3/4 (54 Mbps)	PER ≤ 10 %		-9		dBm
Adjacent Channel Rejection	BPSK, CR 1/2 (6 Mbps)	PER ≤ 10 %	16			dB
	64-QAM, CR 3/4 (54 Mbps)	PER ≤ 10 %	-1			dB

4.7.2.3 IEEE 802.11n: BW 20 MHz (RF Characteristics at 2.4 GHz)

Assume V_{3V3} = 3.3 V, V_{1V8} = 1.8 V, T_{amb} = +25 °C, if nothing else stated.

50 Ω terminal load connected to the RF connector.

Parameter		Condition	Min.	Typ.	Max.	Unit
RF Frequency Range 2.4 GHz			2 400		2 483.5	MHz
Carrier Frequency Tolerance			-25		+25	ppm
Transmit Output Power[2]	MCS0~MCS7			14		dBm
Spectrum Mask	f_C±11 MHz				-20	dBr
	f_C ±20 MHz				-28	dBr
	f_C ±30 MHz				-45	dBr
Transmitter Center Frequency Leakage					-15	dB

[2] Please note that the maximum transmit power depends on the country of operation. Details about the output power are provided in 7.1 Channels and Power Settings per Country.

Parameter		Condition	Min.	Typ.	Max.	Unit
Transmitter Spectral Flatness			-4		+4	dB
Constellation Error (EVM)	BPSK, CR 1/2 (MCS0)				-5	dB
	QPSK, CR 1/2 (MCS1)				-10	dB
	QPSK, CR 3/4 (MCS2)				-13	dB
	16-QAM, CR 1/2 (MCS3)				-16	dB
	16-QAM, CR 3/4 (MCS4)				-19	dB
	64-QAM, CR 2/3 (MCS5)				-22	dB
	64-QAM, CR 3/4 (MCS6)				-25	dB
	64-QAM, CR 5/6 (MCS7)				-27	dB
Minimum Receive Sensitivity	MCS0	PER ≤ 10 %		-90	-82	dBm
	MCS7	PER ≤ 10 %		-71	-64	dBm
Maximum Input Level	MCS0	PER ≤ 10 %		0		dBm
	MCS7	PER ≤ 10 %		-9		dBm
Adjacent Channel Rejection	MCS0	PER ≤ 10 %	16			dB
	MCS7	PER ≤ 10 %	-2			dB

4.7.2.4 IEEE 802.11ax: BW 20 MHz (RF Characteristics at 2.4 GHz)

Assume V_{3V3} = 3.3 V, V_{1V8} = 1.8 V, T_{amb} = +25 °C, if nothing else stated.

50 Ω terminal load connected to the RF connector.

Parameter		Condition	Min.	Typ.	Max.	Unit
RF Frequency Range 2.4 GHz			2 400		2 483.5	MHz
Carrier Frequency Tolerance			-25		+25	ppm
Transmit Output Power[3]	MCS0~MCS7			14		dBm
Spectrum Mask	fC±10.5 MHz				-20	dBr
	f_C ±20 MHz				-28	dBr
	f_C ±30 MHz				-40	dBr
Transmitter Center Frequency Leakage					-32	dB
Transmitter Spectral Flatness			-4		+4	dB
Constellation Error (EVM)	BPSK, CR 1/2 (MCS0)				-5	dB
	QPSK, CR 1/2 (MCS1)				-10	dB
	QPSK, CR 3/4 (MCS2)				-13	dB

[3] Please note that the maximum transmit power depends on the country of operation. Details about the output power are provided in 7.1 Channels and Power Settings per Country.

Parameter		Condition	Min.	Typ.	Max.	Unit
	16-QAM, CR 1/2 (MCS3)				-16	dB
	16-QAM, CR 3/4 (MCS4)				-19	dB
	64-QAM, CR 2/3 (MCS5)				-22	dB
	64-QAM, CR 3/4 (MCS6)				-25	dB
	64-QAM, CR 5/6 (MCS7)				-27	dB
Minimum Receive Sensitivity[4]	MCS0	PER ≤ 10 %		-90	-82	dBm
	MCS7	PER ≤ 10 %		-71	-52	dBm
Maximum Input Level	MCS0	PER ≤ 10 %		0		dBm
	MCS7	PER ≤ 10 %		-9		dBm
Adjacent Channel Rejection[4]	MCS0	PER ≤ 10 %	16			dB
	MCS7	PER ≤ 10 %	-14			dB

4.7.2.5 IEEE 802.11a (RF Characteristics)

Assume V_{3V3} = 3.3 V, V_{1V8} = 1.8 V, T_{amb} = +25 °C, if nothing else stated.

50 Ω terminal load connected to the RF connector.

Parameter		Condition	Min.	Typ.	Max.	Unit
RF Frequency Range 5GHz			4 900		5 895	MHz
Carrier Frequency Tolerance			-20		+20	ppm
Transmit Output Power[5]	6 Mbps~54 Mbps			13		dBm
Spectrum Mask	f_C ±11 MHz				-20	dBr
	f_C ±20 MHz				-28	dBr
	f_C ±30 MHz				-40	dBr
Transmitter Center Frequency Leakage					-15	dB
Transmitter Spectral Flatness			-4		+4	dB
Constellation Error (EVM)	BPSK, CR 1/2 (6 Mbps)				-5	dB
	BPSK, CR 3/4 (9 Mbps)				-8	dB
	QPSK, CR 1/2 (12 Mbps)				-10	dB
	QPSK, CR 3/4 (18 Mbps)				-13	dB
	16-QAM, CR 1/2 (24 Mbps)				-16	dB
	16-QAM, CR 3/4 (36 Mbps)				-19	dB

[4] 4x long training field (LTF), guard time = 3.2 µs

[5] Please note that the maximum transmit power depends on the country of operation. Details about the output power are provided in 7.1 Channels and Power Settings per Country.

Parameter		Condition	Min.	Typ.	Max.	Unit
	64-QAM, CR 2/3 (48 Mbps)				-22	dB
	64-QAM, CR 3/4 (54 Mbps)				-25	dB
Minimum Receive Sensitivity	BPSK, CR 1/2 (6 Mbps)	PER ≤ 10 %		-90	-82	dBm
	64-QAM, CR 3/4 (54 Mbps)	PER ≤ 10 %		-74	-65	dBm
Maximum Input Level	MCS0	PER ≤ 10 %		-8.5		dBm
	MCS7	PER ≤ 10 %		-17.5		dBm
Adjacent Channel Rejection	BPSK, CR 1/2 (6 Mbps)	PER ≤ 10 %	16			dB
	64-QAM, CR 3/4 (54 Mbps)	PER ≤ 10 %	-1			dB

4.7.2.6 IEEE 802.11n: BW 20 MHz (RF Characteristics at 5 GHz)

Assume V_{3V3} = 3.3 V, V_{1V8} = 1.8 V, T_{amb} = +25 °C, if nothing else stated.

50 Ω terminal load connected to the RF connector.

Parameter		Condition	Min.	Typ.	Max.	Unit
RF Frequency Range 5 GHz			4 900		5 895	MHz
Carrier Frequency Tolerance			-20		+20	ppm
Transmit Output Power[6]	MCS0~MCS7			13		dBm
Spectrum Mask	f_C ±11 MHz				-20	dBr
	f_C ±20 MHz				-28	dBr
	f_C ±30 MHz				-40	dBr
Transmitter Center Frequency Leakage					-15	dB
Transmitter Spectral Flatness			-4		+4	dB
Constellation Error (EVM)	BPSK, CR 1/2 (MCS0)				-5	dB
	QPSK, CR 1/2 (MCS1)				-10	dB
	QPSK, CR 3/4 (MCS2)				-13	dB
	16-QAM, CR 1/2 (MCS3)				-16	dB
	16-QAM, CR 3/4 (MCS4)				-19	dB
	64-QAM, CR 2/3 (MCS5)				-22	dB
	64-QAM, CR 3/4 (MCS6)				-25	dB
	64-QAM, CR 5/6 (MCS7)				-27	dB
Minimum Receive Sensitivity	MCS0	PER ≤ 10 %		-90	-82	dBm
	MCS7	PER ≤ 10 %		-71	-64	dBm

[6] Please note that the maximum transmit power depends on the country of operation. Details about the output power are provided in 7.1 Channels and Power Settings per Country.

Parameter		Condition	Min.	Typ.	Max.	Unit
Maximum Input Level	MCS0	PER ≤ 10 %		-8.5		dBm
	MCS7	PER ≤ 10 %		-17.5		dBm
Adjacent Channel Rejection	MCS0	PER ≤ 10 %	16			dB
	MCS7	PER ≤ 10 %	-2			dB

4.7.2.7 IEEE 802.11ax: BW 20 MHz (RF Characteristics at 5 GHz)

Assume V_{3V3} = 3.3 V, V_{1V8} = 1.8 V, T_{amb} = +25 °C, if nothing else stated.

50 Ω terminal load connected to the RF connector.

Parameter		Condition	Min.	Typ.	Max.	Unit
RF Frequency Range 5 GHz			4 900		5 895	MHz
Carrier Frequency Tolerance			-20		+20	ppm
Transmit Output Power[7]	MCS0~MCS7			13		dBm
Spectrum Mask	f_C±10.5 MHz				-20	dBr
	f_C±20 MHz				-28	dBr
	f_C±30 MHz				-40	dBr
Transmitter Center Frequency Leakage					-32	dB
Transmitter Spectral Flatness			-4		+4	dB
Constellation Error (EVM)	BPSK, CR 1/2 (MCS0)				-5	dB
	QPSK, CR 1/2 (MCS1)				-10	dB
	QPSK, CR 3/4 (MCS2)				-13	dB
	16-QAM, CR 1/2 (MCS3)				-16	dB
	16-QAM, CR 3/4 (MCS4)				-19	dB
	64-QAM, CR 2/3 (MCS5)				-22	dB
	64-QAM, CR 3/4 (MCS6)				-25	dB
	64-QAM, CR 5/6 (MCS7)				-27	dB
Minimum Receive Sensitivity[8]	MCS0	PER ≤ 10 %		-90	-82	dBm
	MCS7	PER ≤ 10 %		-71	-52	dBm
Maximum Input Level	MCS0	PER ≤ 10 %		-8.5		dBm
	MCS7	PER ≤ 10 %		-17.5		dBm
	MCS0	PER ≤ 10 %	16			dB

[7] Please note that the maximum transmit power depends on the country of operation. Details about the output power are provided in 7.1 Channels and Power Settings per Country.

[8] 4x long training field (LTF), guard time = 3.2 µs

Parameter		Condition	Min.	Typ.	Max.	Unit
Adjacent Channel Rejection[8]	MCS7	PER ≤ 10 %	-14			dB

4.7.3 Bluetooth Radio Specification

4.7.4 Bluetooth RF Characteristics

Assume V_{3V3} = 3.3 V, V_{1V8} = 1.8 V, T_{amb} = +25 °C, if nothing else stated.

50 Ω terminal load connected to the RF connector.

4.7.4.1 Receiver Section RF Characteristics

Parameter	Condition		Min.	Typ.	Max.	Units
RF frequency range			2 400		2 483.5	MHz
Interference Performance (Low Energy) C/I Ratio	GFSK RSL = -67 dBm BER ≤ 0.1 % 1 Mbps	C/I (Co-channel)			21	dB
		C/I (1 MHz)			15	dB
		C/I (2 MHz)			-17	dB
		C/I (≥3 MHz)			-27	dB
		C/I (Image)			-9	dB
		C/I (Image ± 1 MHz)			-15	dB
	GFSK RSL = -67 dBm BER ≤ 0.1 % 2 Mbps	C/I (Co-channel)			21	dB
		C/I (2 MHz)			15	dB
		C/I (3 MHz)			-17	dB
		C/I (≥6 MHz)			-27	dB
		C/I (Image)			-9	dB
		C/I (Image ± 2 MHz)			-15	dB
	GFSK RSL = -67 dBm BER ≤ 0.1 % Long Range S = 8 (125 kbps)	C/I (Co-channel)			12	dB
		C/I (1 MHz)			6	dB
		C/I (2 MHz)			-26	dB
		C/I (≥3 MHz)			-36	dB
		C/I (Image)			-18	dB
		C/I (Image ± 1 MHz)			-24	dB
	GFSK RSL = -67 dBm BER ≤ 0.1 % Long Range S = 2 (500 kbps)	C/I (Co-channel)			17	dB
		C/I (1 MHz)			11	dB
		C/I (2 MHz)			-21	dB
		C/I (≥3 MHz)			-31	dB
		C/I (Image)			-13	dB
		C/I (Image ± 1 MHz)			-19	dB
Minimum Receive Sensitivity	LE, 1 Mbps	BER ≤ 0.1 %			-70	dBm
	LE, 2 Mbps	BER ≤ 0.1 %			-70	dBm

Parameter	Condition		Min.	Typ.	Max.	Units
	LE-LR, S = 2	BER ≤ 0.1 % Payload < 37 bytes			-75	dBm
	LE-LR, S = 8	BER ≤ 0.1 % Payload < 37 bytes			-82	dBm
Out-of-band blocking (Low Energy) Interfering Signal Power	GFSK RSL = -67 dBm BER ≤ 0.1 %	30 MHz to 2 000 MHz			-30	dB
		2 GHz to 2.399 GHz			-35	dB
		2.484 GHz to 3 GHz			-35	dB
		3 GHz to 12.75 GHz			-30	dB
Maximum Input Level					0	dBm

4.7.4.2 Transmitter Section RF Characteristics

Parameter	Condition		Min.	Typ.	Max.	Units
RF frequency range			2 400		2 483.5	MHz
Output power[9]	Low energy (LE)			10		dBm
Spurious emission (LE) (in-band)	1 Mbps LR S = 2 LR S = 8	± 2 MHz, |M-N| = 2			-20	dBm
		± 3 MHz or greater, |M-N| ≥ 3			-30	dBm
	2 Mbps	± 4 MHz, |M-N| = 4			-20	dBm
		± 5 MHz, |M-N| = 5			-20	dBm
		± 6 MHz or greater, |M-N| ≥ 6			-30	dBm

[9] Please note that the maximum output power depends on the country of operation.

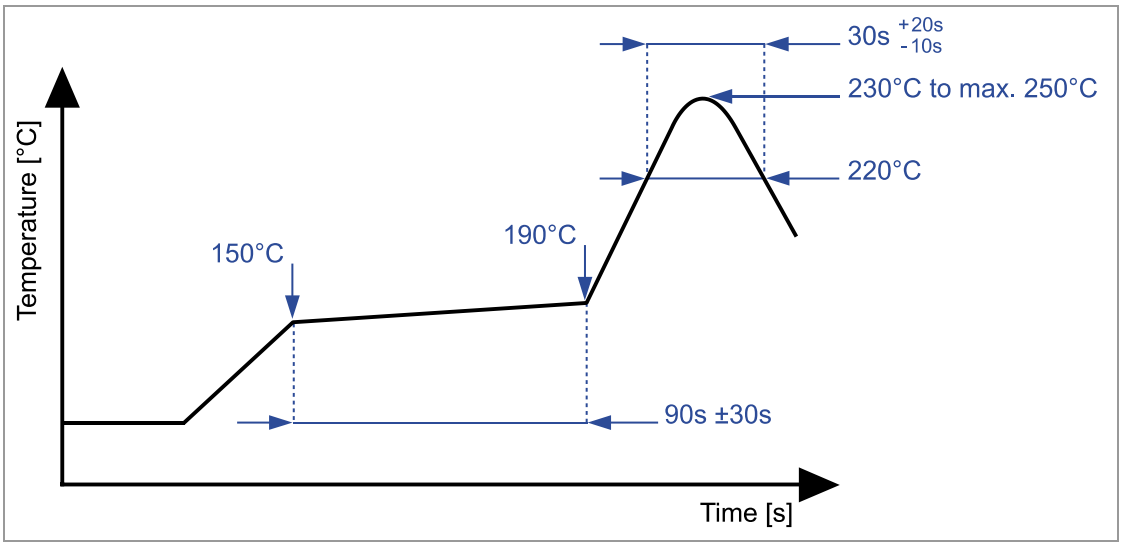
4.8 Reliability Tests

The measurement should be done after the test module has been exposed to room temperature and humidity for one hour.

No.	Item	Limit	Condition
1	Vibration Variable Frequency Test	Electrical parameters should be within specification	Freq.: 20~2 000 Hz, Acc.: 17-50 G, Sweep: 8 min, 2 hours, For: XYZ axis
2	Shock Drop Test		Drop parts on concrete from a height of 1 m for 3 times
3	Heat Shock-Resistance Test		At -40 °C and 85 °C Total = 300 cycles
4	Temperature Humidity Bias Test		At 60 °C, 85 % r.H., 300 h
5	Low Temperature Storage Life Test		At -40 °C, 300 h
6	High Temperature Storage Life Test		At 85 °C, 300 h
7	High Temperature Operating Life Test		At 85 °C, Voltage = V_{max}, 300 h

4.9 Recommended Soldering Profile

- Reflow permissible cycles: 2
- Opposite side reflow is prohibited due to module weight
- More than 75 percent of the soldering area shall be coated by solder
- The soldering profiles should be adhered to in order to prevent electrical or mechanical damage
- Soldering profile assumes lead-free soldering



5 Cautions



Failure to follow the guidelines set forth in this document may result in degrading of the module functions and damage to the module.

5.1 Design Notes

1. Follow the conditions written in this specification, especially the control signals of this module.
2. The supply voltage should abide by the maximum ratings (⇨ 4.2 Absolute Maximum Ratings).
3. The supply voltage must be free of AC ripple voltage (for example from a battery or a low noise regulator output). For noisy supply voltages, provide a decoupling circuit (for example a ferrite in series connection and a bypass capacitor to ground of at least 47 µF directly at the module).
4. This module should not be mechanically stressed when installed.
5. Keep this module away from heat. Heat is the major cause of decreasing the life time of these modules.
6. Avoid assembly and use of the target equipment in conditions where the module temperature may exceed the maximum tolerance.
7. Keep this module away from other high frequency circuits.
8. Refer to the recommended pattern when designing a board.

5.2 Installation Notes

1. Reflow soldering is possible twice based on the conditions set forth in ⇨ 4.9 Recommended Soldering Profile. Set up the temperature at the soldering portion of this module according to this reflow profile.
2. Carefully position the module so that the heat will not burn into printed circuit boards or affect other components that are susceptible to heat.
3. Carefully locate the module, to avoid an increased temperature caused by heat generated by neighboring components.
4. If a vinyl-covered wire comes into contact with the module, the wire cover will melt and generate toxic gas, damaging the insulation. Never allow contact between a vinyl cover and these modules to occur.
5. This module should not be mechanically stressed or vibrated when reflowed.
6. To repair the board by hand soldering, follow the conditions set forth in this chapter.
7. Do not wash this product.
8. Pressing on parts of the metal cover or fastening objects to the metal will cause damage to the module.

5.3 Usage Condition Notes

1. Take measures to protect the module against static electricity.
   If pulses or transient loads (a large load, which is suddenly applied) are applied to the modules, check and evaluate their operation before assembly of the final products.
2. Do not use dropped modules.
3. Do not touch, damage, or soil the pins.
4. Follow the recommended condition ratings about the power supply applied to this module.
5. Electrode peeling strength: Do not apply a force of more than 4.9 N in any direction on the soldered module.
6. Pressing on parts of the metal cover or fastening objects to the metal cover will cause damage.
7. These modules are intended for general purpose and standard use in general electronic equipment, such as home appliances, office equipment, information, and communication equipment.

5.4 Storage Notes

1. The module should not be stressed mechanically during storage.
2. Do not store these modules in the following conditions or the performance characteristics of the module, such as RF performance will be adversely affected:
   - Storage in salty air or in an environment with a high concentration of corrosive gas, such as Cl_2, H_2S, NH_3, SO_2, or NO_X,
   - Storage in direct sunlight,
   - Storage in an environment where the temperature may be outside the range of 5 °C to 35 °C, or where the humidity may be outside the 45 % to 85 % range,
   - Storage of the modules for more than one year after the date of delivery storage period: Please check the adhesive strength of the embossed tape and soldering after 6 months of storage.
3. Keep this module away from water, poisonous gas, and corrosive gas.
4. This module should not be stressed or shocked when transported.
5. Follow the specification when stacking packed crates (max. 10).

5.5 Safety Cautions

These specifications are intended to preserve the quality assurance of products and individual components.

Before use, check and evaluate the operation when mounted on your products. Abide by these specifications without deviation when using the products. These products may short-circuit. If

electrical shocks, smoke, fire, and/or accidents involving human life are anticipated when a short circuit occurs, provide the following failsafe functions as a minimum:

1. Ensure the safety of the whole system by installing a protection circuit and a protection device.
2. Ensure the safety of the whole system by installing a redundant circuit or another system to prevent a single fault causing an unsafe status.

5.6 Other Cautions

1. Do not use the module for other purposes than those listed in section ⇨ 5.3 Usage Condition Notes.
2. Be sure to provide an appropriate fail-safe function on your product to prevent any additional damage that may be caused by the abnormal function or the failure of the module.
3. This module has been manufactured without any ozone chemical controlled under the Montreal Protocol.
4. These modules are not intended for use under the special conditions shown below. Before using these modules under such special conditions, carefully check their performance and reliability under the said special conditions to determine whether or not they can be used in such a manner:
   - In liquid, such as water, salt water, oil, alkali, or organic solvent, or in places where liquid may splash,
   - In direct sunlight, outdoors, or in a dusty environment,
   - In an environment where condensation occurs,
   - In an environment with a high concentration of harmful gas (e. g. salty air, HCl, Cl_2, SO_2, H_2S, NH_3, and NO_X).
5. If an abnormal voltage is applied due to a problem occurring in other components or circuits, replace these modules with new modules, because they may not be able to provide normal performance even if their electronic characteristics and appearances appear satisfactory.



For further information please refer to the Panasonic website ⇨ 7.3.2 Product Information.

5.7 Restricted Use

5.7.1 Life Support Policy

This Panasonic Industrial Devices Europe GmbH product is not designed for use in life support appliances, devices, or systems where malfunction can reasonably be expected to result in a significant personal injury to the user, or as a critical component in any life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

Panasonic customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Panasonic Industrial Devices Europe GmbH for any damages resulting.

5.7.2 Restricted End Use

This Panasonic Industrial Devices Europe GmbH product is not designed for any restricted activity that supports the development, production, handling usage, maintenance, storage, inventory or proliferation of any weapons or military use.

Transfer, export, re-export, usage or reselling of this product to any destination, end user or any end use prohibited by the European Union, United States or any other applicable law is strictly prohibited.

6 Regulatory and Certification Information



Please note that variants PAN W602-1B (ENWF9211C) and PAN W602-1C (ENWF9211A) are currently still in progress of regulatory certification for the USA (FCC) and Canada (ISED).

For the device the following certifications are available:

Certification		Status	Reference
FCC	for USA	Available for: • PAN W602-2B (ENWF9215C) • PAN W602-2C (ENWF9215A)	⇨ 6.4 Federal Communications Commission (FCC) for US
ISED	for Canada	Available for: • PAN W602-2B (ENWF9215C) • PAN W602-2C (ENWF9215A)	⇨ 6.5 Innovation, Science, and Economic Development (ISED) for Canada
RED	for Europe	Available for all variants	⇨ 6.2 Conformity According to Radio Equipment Directive (RED-2014/53/EU) for Europe
UKCA	for United Kingdom	Available for all variants	⇨ 6.3 United Kingdom Conformity According to Statutory Instrument (SI-2017/1206)
RCM	for New Zealand	Up on Request	
	for Australia	Up on Request	



For regions “upon request”, please reach out to your Sales contact for the most recent status of the certification process ⇨ 7.3.1 Contact Us.

6.1 RoHS and REACH Declaration

The latest declaration of environmental compatibility (Restriction of Hazardous Substances, RoHS and Registration, Evaluation, Authorisation and Restriction of Chemicals, REACH) for supplied products can be found on the Panasonic website in the “Downloads” section of the respective product ⇨ 7.3.2 Product Information.

6.2 Conformity According to Radio Equipment Directive (RED-2014/53/EU) for Europe

All modules described in this Product Specification comply with the standards according to the following LVD (2014/35/EU), EMC-D (2014/30/EU) together with RED (2014/53/EU) articles:

3.1a	Safety/Health:	EN 62368-1: 2014/A11: 2017 EN 62311: 2008
3.1b	EMC:	EN 301 489-1 V2.2.3: 2019-11 EN 301 489-17 V3.3.1: 2024-09
3.2	Radio:	EN 300 328 V2.2.2: 2019-07 EN 301 893 V2.2.1: 2024-09
3.3	Common Security:	EN 18031-1:2024

- Due to the model size, the CE marking is displayed in the installation instruction only and it cannot be displayed conform to regulation (EU) No. 765/2008 in 5 mm height on the module's label due to the limited space.
- The RED EU Type Examination Certificate No. EU26-0059-01-TEC issued by the EU Notified Body 0682 can be used for the OEM end product conformity assessment. If a Notified Body has been contracted for the end product conformity assessment, it should be noted that this EU Type Examination Certificate should be used for conformance assessment.

This product is compliant with all relevant EU and UK legislation. In particular, it conforms with: UK PSTI, Data Act, RED, NIS 2.0, CRA and AI Act. Relevant statements of compliance can be found at https://www.ptc.panasonic.eu/compliance-documents. It is sole responsibility of integrators to ensure that the final product (i.e., one into which Panasonic product is integrated to) conforms with all relevant legislation.

This product does not support machine learning and is not using AI algorithms for its operation.

This product does not supports any interactive credential (i.e., it is not possible to log into it) and it is not storing any data, personal information, authentication tokens, keys, certificates or any kind of credentials.

For security updates and End-of-Support dates please consult https://www.ti.com/support-quality/quality-policies-procedures/product-life-cycle.html. Panasonic is not responsible for developing and distribution of security updates. It is responsibility of integrators and/or users of the products to verify that its support timeline meets their needs and to ensure to apply security updates in a timely fashion.

Users and integrators of the product are encouraged to report product vulnerabilities directly to https://www.ti.com/support-quality/quality-policies-procedures/report-product-security-vulnerabilities.html. If the report is sent to Panasonic, we will forward it to the original vendor.

Panasonic will not follow up on such reports but will connect the reporter directly to the vendor. Any subsequent actions and decisions (e.g., developing of the remedy, its distribution, disputing the report, etc.) will be done by the original vendor alone. Panasonic will have no part in this process.

Panasonic retains responsibility for all elements added by Panasonic.

As a result of the conformity assessment procedure described in 2014/53/EU Directive, the end customer equipment should be labelled as follows:

CE



The end customer has to assure that the device has a distance of more than 4 cm from the human body under all circumstances.

If the end customer application intends to use the PAN W602 in a distance smaller 4 cm from the human body, SAR evaluation has to be repeated by the OEM.

The end customer equipment must meet the actual Safety/Health/Security requirements according to RED. Further analysis must be conducted, as the addition of firmware and other functions requires the evaluation of additional threats and assets.

PAN W602 and its model versions in the specified reference design can be used in all countries of the European Economic Area (Member States of the EU, European Free Trade Association States [Iceland, Liechtenstein, Norway]), Monaco, San Marino, Andorra, and Turkey.

6.2.1 Manufacturer's Details

Name	Panasonic Industrial Devices Europe GmbH
Postal Address - Street	Zeppelinstr. 19
Postal Address - Postal Code and City	21337 Lüneburg
Postal Address - Country	Germany

6.2.2 Radio Equipment Directive

The Radio Equipment Directive 2014/53/EU (RED) establishes a regulatory framework for placing radio equipment on the market. It ensures a Single Market for radio equipment by setting essential requirements for safety and health, electromagnetic compatibility, and the efficient use of the radio spectrum.

The RED aligned the previous Directive, the Radio and Telecommunication Terminal Equipment Directive 1999/5/EC (R&TTED), with the new legislative framework for the marketing of

products. The RED is applicable as of 2016-06-13. It included a one-year transitional period, which ended on 2017-06-12 (Article 48). On 2017-06-20, the Commission Implementing Regulation (EU) 2017/1354 was adopted. This specifies how to present the information provided for in Article 10(10) of Directive 2014/53/EU.

Article 10(10) RED

In cases of restrictions on putting into service or of requirements for authorisation of use, information available on the packaging shall allow the identification of the Member States or the geographical area within a Member State where such restrictions apply. Additional information shall be included in the instructions accompanying the radio equipment. The Commission may adopt implementing acts specifying how to present that information. Those implementing acts shall be adopted in accordance with the advisory procedure referred to in Article 45(2).

- **Class 1:**
  Radio equipment that can be operated without any restriction in EU, EEA, and EFTA. According to Article 8(1)b of the RED, it is clarified that no national radio interfaces specifications are required to be notified under RED;
- **Other:**
  Radio equipment subject to restrictions in one or more EU, EEA and EFTA countries where the technical parameters are not harmonized through EU, EEA, and EFTA;

Radio equipment class means a class identifying particular categories of radio equipment which, under this Directive, are considered similar and those radio interfaces for which the radio equipment is designed.

Article 8 RED

Notification of radio interface specifications and assignment of radio equipment classes 1:

1) Member States shall notify, in accordance with the procedure set out in Directive 98/34/EC, the radio interfaces which they intend to regulate except:
   a) The radio interfaces which fully and without any deviation comply with the Commission decisions on the harmonized use of radio spectrum adopted pursuant to Decision No. 676/2002/EC; and
   b) The radio interfaces which, in accordance with implementing acts adopted pursuant to paragraph 2 of this Article, correspond to radio equipment which can be put into service and used without restrictions within the Union.
2) The Commission shall adopt implementing acts establishing the equivalence between notified radio interfaces and assigning a radio equipment class, details of which shall be published in the Official Journal of the European Union. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 45(3).

The Radio Interface Specifications Templates are provided for information in the EFIS database for applications which use is in harmonized radio spectrum, however with restrictions.

6.2.3 Equipment Classes

The PAN W602 is a radio module classified as class-1. This equipment class is passed on the end-product which integrates the module.

Class 1

Class 1 radio equipment can be placed on the market and put into service without restrictions according to Article 1(3) of Commission Decision 2000/299/EC (Version 2018-01).

This radio module is defined as Class 1 radio equipment when it is restricted to operate in the following frequency bands:

Annex		Application/Reference	Frequency Band (MHz)	Transmit Power/Power Density
3	b	Wideband Data Transmission Systems EN 300 328	2 400 to 2 483.5	100 mW e.i.r.p. and 100 mW/100 kHz e.i.r.p. density applies when frequency hopping modulation is used, 10 mW/MHz e.i.r.p. density applies when other types of modulation are used.
A	e1	Wireless Access Systems including Radio Local Area Networks (WAS/RLANs) **Restricted to indoor use** EN 301 893	5 150 to 5 350	Max. 200 mW mean e.i.r.p. and max. 10 mW/MHz mean e.i.r.p. density in any 1 MHz band.

Annex		Application/Reference	Frequency Band (MHz)	Transmit Power/Power Density
A	e2	Wireless Access Systems including Radio Local Area Networks (WAS/RLANs) EN 301 893	5 470 to 5 725	1 W e.i.r.p., 50 mW/MHz mean e.i.r.p. density in any 1 MHz band.
1	j	Wireless Access Systems including Radio Local Area Networks (WAS/RLANs) EN 301 893 *(Annex B: Equipment operating within the band 5 725 MHz to 5 850 MHz (sub-band 4))*	5 725 – 5 875	100 mW e.i.r.p., 5 mW/MHz mean e.i.r.p. density in any 1 MHz band. Note: *If TPC is used, the RF output power in sub-band 4 at the lowest power level of the TPC range in sub-band 4 ($P_{L,4}$) shall be at least 6 dB less than the applicable RF output power limit with TPC.*

Restricted Radio Equipment

Radio equipment is restricted in accordance with Article 1(3) of Commission Decision 2000/299/EC1 if the equipment falls not within the scope of Class 1.



The usage of PAN W602 module in a vehicular environment cannot be considered as **indoor use**.



Any use of the module outside the limitations specified in this document will result in the module no longer falling under Class 1 radio equipment in the end application.

Non-Class 1 radio equipment shall be marked with the pictogram specified in Annex I of Commission Implementing Regulation (EU) 2017/1354.

6.3 United Kingdom Conformity According to Statutory Instrument (SI-2017/1206)

All modules described in this Product Specification comply with the designated standards according to the following Regulations: Electrical Equipment (Safety) SI 2016/1101, EMC SI 2016/1091 together with Radio Equipment Regulation 2017 (RER) SI 2017/1206:

3.1a	Safety/Health:	EN 62368-1: 2014/A11: 2017 EN 62311: 2008
3.1b	EMC:	EN 301 489-1 V2.2.3: 2019-11 EN 301 489-17 V3.3.1: 2024-09
3.2	Radio:	EN 300 328 V2.2.2: 2019-07 EN 301 893 V2.2.1: 2024-09
3.3	Common Security:	EN 18031-1:2024

- Due to the model size, the UK marking is displayed in the installation instruction only and it cannot be displayed conform to SI 2017/1206 on the module's label due to the limited space.
- The RED EU Type Examination Certificate No. EU26-0059-01-TEC issued by the EU Notified Body 0682 can be used for the OEM end product conformity assessment. If a Notified Body has been contracted for the end product conformity assessment, it should be noted that this EU Type Examination Certificate should be used for conformance assessment.

This product is compliant with all relevant EU and UK legislation. In particular, it conforms with: UK PSTI, Data Act, RED, NIS 2.0, CRA and AI Act. Relevant statements of compliance can be found at https://www.ptc.panasonic.eu/compliance-documents. It is sole responsibility of integrators to ensure that the final product (i.e., one into which Panasonic product is integrated to) conforms with all relevant legislation.

This product does not support machine learning and is not using AI algorithms for its operation.

This product does not supports any interactive credential (i.e., it is not possible to log into it) and it is not storing any data, personal information, authentication tokens, keys, certificates or any kind of credentials.

For security updates and End-of-Support dates please consult https://www.ti.com/support-quality/quality-policies-procedures/product-life-cycle.html. Panasonic is not responsible for developing and distribution of security updates. It is responsibility of integrators and/or users of the products to verify that its support timeline meets their needs and to ensure to apply security updates in a timely fashion.

Users and integrators of the product are encouraged to report product vulnerabilities directly to https://www.ti.com/support-quality/quality-policies-procedures/report-product-security-vulnerabilities.html. If the report is sent to Panasonic, we will forward it to the original vendor. Panasonic will not follow up on such reports but will connect the reporter directly to the vendor. Any subsequent actions and decisions (e.g., developing of the remedy, its distribution, disputing the report, etc.) will be done by the original vendor alone. Panasonic will have no part in this process.

Panasonic retains responsibility for all elements added by Panasonic.

As a result of the conformity assessment procedure described in SI 2017/1206 Directive, the end customer equipment should be labelled as as specified on www.gov.uk.



Restrictions or Requirements in the UK

The end customer has to assure that the device has a distance of more than 4 cm from the human body under all circumstances.

If the end customer application intends to use the PAN W602 in a distance smaller 4 cm from the human body, SAR evaluation has to be repeated by the OEM.

The end customer equipment must meet the actual Safety/Health/Security requirements according to SI 2017/1206.

PAN W602 and its model versions in the specified reference design can be used in the UK.

6.4 Federal Communications Commission (FCC) for US



The single band variants PAN W602-1B (ENWF9211C) and PAN W602-1C (ENWF9211A) are still undergoing the certification process and are therefore not yet included in the FCC certification grant.

6.4.1 FCC Notice



The PAN W602-2B (ENWF9215C) and PAN W602-2C (ENWF9215A) including the antennas, which are listed in ⇨ 6.4.5 Approved Antenna List, comply with Part 15 of the FCC Rules.

The device meets the requirements for modular transmitter approval as detailed in FCC public Notice DA00-1407. The transmitter 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.

6.4.2 Caution



The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Panasonic Industrial Devices Europe GmbH may void the user's authority to operate the equipment.



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.

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.

6.4.3 Label Requirements



The OEM must ensure that FCC labelling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate Panasonic FCC identifier for this product as well as the FCC Notice above.

The FCC identifier is **FCC ID: T7V-W602**.

This FCC identifier is valid for the PAN W602. The end product must in any case be labelled on the exterior with:

"Contains FCC ID: T7V-W602".

6.4.4 Antenna Warning

The device is tested with a standard MHF4 connector and with the antenna listed below. When integrated into the OEM's product, these fixed antennas require installation preventing end users from replacing them with non-approved antennas. Any antenna not in the following table must be tested to comply with FCC Section 15.203 for unique antenna connectors and with Section 15.247 for emissions. The FCC identifier for the device with the antenna listed in ⇨ 6.4.5 Approved Antenna List is the same (**FCC ID: T7V-W602**).

6.4.5 Approved Antenna List

6.4.5.1 Chip Antennas

The PAN W602-xC versions ENWF9211A and ENWF9215A integrate the listed chip antenna. Using one of these module variants requires the integrator to follow special design rules on the carrier PCB. The rules and their application are described in the PAN W602 Integration Guide.

Part Number	Vendor	Type	Max. Gain (2.4 GHz band)	Max. Gain (5 GHz band)	Cable Variants
ANT162442DT-2001A2	TDK	Chip Antenna	2.1 dBi	2.3 dBi	50 Ohm trace Min. length: 15 mm

6.4.5.2 PCB Antennas

Part Number	Vendor	Type	Max. Gain (2.4 GHz band)	Max. Gain (5 GHz band)	Cable Options[10]
2108792	TE Connectivity	Flex PCB	4.9 dBi	3.5 dBi	-6 (50 mm) -7 (100 mm) -8 (150 mm) -9 (200 mm)
2504615	TE Connectivity	Flex PCB	2.7 dBi	3.5 dBi	-1 (50 mm) -2 (100 mm) -3 (150 mm) -4 (200 mm)
2JF1002P	2J	Flex PCB	4.2 dBi	8 dBi	-005MC137-MHF4L (50 mm) -010MC137-MHF4L (100 mm) -015MC137-MHF4L (150 mm) -020MC137-MHF4L (200 mm) -025MC137-MHF4L (250 mm) -030MC137-MHF4L (300 mm)
2JF0102P	2J	Flex PCB	2.2 dBi	3.8 dBi	-005MC137-MHF4L (50 mm) -010MC137-MHF4L (100 mm) -015MC137-MHF4L (150 mm) -020MC137-MHF4L (200 mm) -025MC137-MHF4L (250 mm) -030MC137-MHF4L (300 mm)
FXP830	Taoglas	Flex PCB	2.5 dBi	4.7 dBi	.54.0055C (55 mm) .54.0100C (100 mm) .54.0150C (150 mm) .54.0200C (200 mm)
W3P35X8W04	Kyocera AVX	PCB	2.3 dBi	5 dBi	-H050D3B0A (50 mm) -H100D3B0A (100 mm) -H150D3B0A (150 mm)
W3F35X8W01	Kyocera AVX	Flex PCB	2.3 dBi	5 dBi	-H050D3B0C (50 mm) -H100D3B0C (100 mm) -H150D3B0C (150 mm)
1001932PT	Kyocera AVX	Flex PCB	2.0 dBi	4.5 dBi	-AC10L0050 (50 mm) -AC10L0100 (100 mm)

6.4.5.3 Terminal Mount Antennas

Part Number	Vendor	Type	Max. Gain (2.4 GHz band)	Max. Gain (5 GHz band)	Cables[11]
2108923-3 (black) 2108923-4 (white)	TE Connectivity	Terminal Mount (RP-SMA)	2.5 dBi	3.2 dBi	2583737-1 (100 mm) 2583737-2 (200 mm) 2583737-3 (300 mm)
					2016695-1 (50 mm) 2016695-2 (100 mm) 2016695-3 (150 mm) 2016695-4 (200 mm) 2016695-5 (250 mm) 2016695-6 (300 mm)
2108923-1 (black) 2108923-2 (white)	TE Connectivity	Terminal Mount (SMA)	2.5 dBi	3.2 dBi	2492541-1 (100 mm) 2492541-2 (200 mm) 2492541-3 (300 mm)
GW.51.5153	Taoglas	Terminal Mount	5.2 dBi	5.5 dBi	CAB.S140 (50 mm) CAB.S119 (100 mm) CAB.S141 (150 mm) CAB.S142 (200 mm) CAB.S143 (300 mm)
2JW1102-C943B	2J	Terminal Mount	4.1 dBi	3.9 dBi	C213GST-005MC137-MHF4L (50 mm) C213GST-010MC137-MHF4L (100 mm) C213GST-015MC137-MHF4L (150 mm) C213GST-020MC137-MHF4L (200 mm) C213GST-025MC137-MHF4L (250 mm) C213GST-030MC137-MHF4L (300 mm)
X9000294-W3DRMB	Kyocera AVX	Terminal Mount	3.2 dBi	4.5 dBi	ACM13-04LB030SAR00 (30 mm) ACM13-04LB050SAR00 (50 mm) ACM13-04LB100SAR00 (100 mm)

[10] Cable option with MHF4L connector; Product number: [Part Number][Cable Option]

[11] MHF4L to RP-SMA (female) cable

Part Number	Vendor	Type	Max. Gain (2.4 GHz band)	Max. Gain (5 GHz band)	Cables[11]
					ACM13-04LB150SAR00 (150 mm) ACM13-04LB200SAR00 (200 mm) ACM13-04LB300SAR00 (300 mm)
X9001748-W3DRMB	Kyocera AVX	Terminal Mount	3.2 dBi	3.6 dBi	ACM13-04LB030SAR00 (30 mm) ACM13-04LB050SAR00 (50 mm) ACM13-04LB100SAR00 (100 mm) ACM13-04LB150SAR00 (150 mm) ACM13-04LB200SAR00 (200 mm) ACM13-04LB300SAR00 (300 mm)
X9003019-W3DRMB (Black) X9003019-W3DRMW (White)	Kyocera AVX	Terminal Mount	2.8 dBi	4.9 dBi	ACM13-04LB030SAR00 (30 mm) ACM13-04LB050SAR00 (50 mm) ACM13-04LB100SAR00 (100 mm) ACM13-04LB150SAR00 (150 mm) ACM13-04LB200SAR00 (200 mm) ACM13-04LB300SAR00 (300 mm)

6.4.6 RF Exposure

To comply with FCC RF Exposure requirements, the OEM must ensure that only antennas from the Approved Antenna List are installed ⇨ 6.4.5 Approved Antenna List.

The preceding statement must be included as a “CAUTION” statement in manuals for products operating with the approved antennas in the previous table to alert users on FCC RF Exposure compliance.

Any notification to the end user of installation or removal instructions about the integrated radio module is not allowed.

The radiated output power of the PAN W602 with one of the listed antennas (**FCC ID: T7V-W602**) is below the FCC radio frequency exposure limits. The PAN W602 shall be used in such a manner that the potential for human contact during normal operation is minimized.

End users may not be provided with the module installation instructions. OEM integrators and end users must be provided with transmitter operating conditions for satisfying RF exposure compliance.

6.4.7 Integration Instructions

This chapter gives integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01.

Section	Topic and Comment	
2.2	**List of applicable FCC rules**	
	47 CFR Section	Part 15C
	Frequency Band (MHz)	2 400 to 2 483.5
	Systems	Digital Transmission Systems operating within the 2 400 MHz to 2 483.5 MHz Band
	Reference/Requirement	15.247(a)(2), 15.247(b)(1), 15.207, 15.247(d), 15.247(e)
	Complied Module M/N	ENWF9215C, ENWF9215A
	47 CFR Section	Part 15E
	Systems	Unlicensed National Information Infrastructure Devices in the 5 GHz Bands
	Reference Method	KDB 905462 D02 v02
	Reference/Requirement	15E.407(h)(2)
	Complied Module M/N	ENWF9215C, ENWF9215A
2.3	**Summarize the specific operational use conditions**	
	Please refer to sections ⇨ 5 Cautions, ⇨ 5.3 Usage Condition Notes, and ⇨ 6.4.5 Approved Antenna List.	
2.4	**Limited module procedures**	
	Not applicable, the module has a single-modular transmitter approval.	
2.5	**Trace antenna designs**	
	Not applicable, a chip antenna can be integrated on the carrier board or external antennas as listed in ⇨ 6.4.5 Approved Antenna List can be used. For guidance regarding the PCB layout requirements for module integration refer to the module integration guide linked in ⇨ 7.3.2 Product Information.	
2.6	**RF exposure considerations**	
	Mobile application, the end customer has to assure that the device has a distance of more than 20 cm from the human body under all circumstances.	
2.7	**Antennas**	
	Please refer to sections ⇨ 6.4.4 Antenna Warning and ⇨ 6.4.5 Approved Antenna List.	
2.8	**Label and compliance information**	
	Please refer to section ⇨ 6.4.3 Label Requirements.	
2.9	**Information on test modes and additional testing requirements**	
	The documents for integration guidance and compliance testing are available here ⇨ 7.3.2 Product Information.	
2.10	**Additional testing, Part 15 Subpart B disclaimer**	

	The single-modular transmitter is FCC authorized for the specific rule parts listed at section 2.2 “List of applicable FCC rules“. The host product manufacturer needs to also consider the FCC requirements for certified modular transmitter being used in the host product and maintain documentation on how the host product with the certified modular transmitter complies with the FCC rules. Host product manufacturers are responsible to follow the integration guidance and to perform a limited set of transmitter module verification testing, to ensure the end product is in compliance with the FCC rules. Also host product manufacturers are responsible for all additional equipment authorization and testing for technical requirements not covered by the module grant (e.g., unintentional radiator Part 15 Subpart B requirements, or transmitters used in the host that are not certified modules).

6.5 Innovation, Science, and Economic Development (ISED) for Canada



The single band variants PAN W602-1B (ENWF9211C) and PAN W602-1C (ENWF9211A) are still undergoing the certification process and are therefore not yet included in the ISED certification grant.

English

The PAN W602 is licensed to meet the regulatory requirements of ISED.

License ID: **IC: 216Q-W602**

Manufacturers of mobile, fixed or portable devices incorporating this module are advised to clarify any regulatory questions and ensure compliance for SAR and/or RF exposure limits. Users can obtain Canadian information on RF exposure and compliance from www.ic.gc.ca.

This device has been designed to operate with the antennas listed in ⇨ 6.4.5 Approved Antenna List, having a maximum gain of 5.2 dBi for 2.4 GHz and 8 dBi for 5 GHz. Antennas not included in this list or having a gain greater than 5.2 dBi for 2.4 GHz and 8 dBi for 5 GHz are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Due to the model size, the IC identifier is displayed in the installation instruction only and it cannot be displayed on the module’s label due to the limited size.

French

PAN W602 est garanti conforme aux dispositions règlementaires d' Innovation, Sciences et Développement économique Canada (ISDE).

License: **IC: 216Q-W602**

Il est recommandé aux fabricants d'appareils fixes, mobiles ou portables de consulter la réglementation en vigueur et de vérifier la conformité de leurs produits relativement aux limites d'exposition aux rayonnements radiofréquence ainsi qu'au débit d'absorption spécifique maximum autorisé.

Des informations pour les utilisateurs sur la réglementation Canadienne concernant l'exposition aux rayonnements RF sont disponibles sur le site www.ic.gc.ca.

Ce produit a été développé pour fonctionner spécifiquement avec les antennes listées dans le tableau ⇨ 6.4.5 Approved Antenna List, présentant un gain maximum de 5.2 dBi pour 2.4 GHz et 8 dBi pour 5 GHz. Des antennes autres que celles listées ici, ou présentant un gain supérieur à 5.2 dBi pour 2.4 GHz et 8 dBi pour 5 GHz ne doivent en aucune circonstance être utilisées en combinaison avec ce produit. L'impédance des antennes compatibles est 50 Ohm. L'antenne utilisée avec ce produit ne doit ni être située à proximité d'une autre antenne ou d'un autre émetteur, ni être utilisée conjointement avec une autre antenne ou un autre émetteur.

En raison de la taille du produit, l'identifiant IC est fourni dans le manuel d'installation.

6.5.1 Radio Standards Specification RSS-247 Issue 4

The Radio Standards Specification RSS-247, Issue 4, RSS-247 — Digital Transmission Systems, Frequency Hopping Systems and Licence-Exempt Local Area Network Devices in 902-928 MHz, 2400-2483.5 MHz, 5150-5350 MHz, and 5470-5895 MHz bands, replaces RSS-247, Issue 3, dated August 2023. It sets out certification requirements for radio apparatus operating in the bands 2 400 MHz to 2 483.5 MHz and 5 725 MHz to 5 850 MHz employing frequency hopping, digital modulation and/or a combination (hybrid) of both techniques. It also includes license exempt local area network (LE-LAN) devices operating in the bands 5 150 MHz to 5 250 MHz, 5 250 MHz to 5 350 MHz, 5 470 MHz to 5 725 MHz and 5 725 MHz to 5 850 MHz as specified in SP-5 150 MHz.

6.5.1.1 General

Equipment covered by the standard RSS-247 is classified as Category I equipment. Either a technical acceptance certificate (TAC) issued by the Certification and Engineering Bureau of Innovation, Science and Economic Development Canada (ISED) or a certificate issued by a certification body (CB) is required.

6.5.1.2 Certification Requirements

RSS-247 shall be used in conjunction with RSS-Gen, General Requirements for Compliance of Radio Apparatus, for general specifications and information relevant to the equipment for which this standard applies. Equipment certified under the standard is required to comply with the

provisions in RSS‑Gen with respect to emissions falling within restricted frequency bands. These restricted frequency bands are listed in RSS‑Gen.

6.5.1.3 Measurement Method

In addition to the requirements in RSS-Gen and the requirements of the standard RSS-247, the method for measuring DTS devices is provided in ANSI C63.10.

6.5.1.4 Requirements for LE-LAN and DTS Operating in the 5 GHz Band

The section provides standards for Licence-Exempt Local Area Network (LE-LAN) devices operating in the bands:

- 5 150 to 5 250 MHz
- 5 250 to 5 350 MHz
- 5 470 to 5 600 MHz
- 5 600 to 5 650 MHz
- 5 650 to 5 725 MHz
- 5 725 to 5 850 MHz

For DTSs operating in the band 5 725 MHz to 5 850 MHz that employ digital modulation technology, but are not designed for LE-LAN operation.

Devices with occupied bandwidths which overlap different bands shall comply with all operational requirements for each band.

RSS-247 Section	6.2.1
Frequency Band (MHz)	5 150 to 5 250
Device Type	LE-LAN devices are restricted to **indoor operation** only.
Devices out of Scope	OEM devices installed in vehicles.
Power Limits	Maximum e.i.r.p. shall not exceed 200 mW or 10+10 $\log_{10}$B dBm, whichever power is less. B is the 99 % emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1 MHz band.
Unwanted Emission Limits	For transmitters with operating frequencies in the band 5 150 MHz to 5 250 MHz, all emissions outside the band 5 150 MHz to 5 350 MHz shall not exceed -27 dBm/MHz e.i.r.p. Any unwanted emissions that falls into the band 5 250 MHz to 5 350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 % and 5 % of the occupied bandwidth (i.e. 99 % bandwidth), above 5 250 MHz. The 26 dB bandwidth may fall into the 5 250 MHz to 5 350 MHz band; if the occupied bandwidth also falls within the 5 250 MHz to 5 350 MHz band, the transmission is considered as intentional and the devices shall comply with all requirements in the band 5 250 MHz to 5 350 MHz including implementing dynamic frequency selection (DFS) and transmit power control (TPC), on the portion of the emission that resides in the 5 250 MHz to 5 350 MHz band.
Complied Module M/N	ENWF9215C, ENWF9215A

RSS-247 Section	6.2.2
Frequency Band (MHz)	5 250 to 5 350
Device Type	For devices, other than devices installed in vehicles.
Devices out of Scope	OEM devices installed in vehicles, outdoor fixed devices, and other devices having an e.i.r.p. grater than 200 mW.
Power Limits	The maximum conducted output power shall not exceed 250 mW or 11+10 $\log_{10}$B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1 MHz band.
Unwanted Emission Limits	All emissions outside the band 5 250 MHz to 5 350 MHz shall not exceed -27 dBm/MHz e.i.r.p.; or: All emissions outside the band 5 150 MHz to 5 350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and its power shall comply with the spectral power density for operation within the band 5 150 MHz to 5 250 MHz. The device shall be labelled or include in the user manual the following text “For indoor use only.”.
Complied Module M/N	ENWF9215C, ENWF9215A

RSS-247 Section	6.2.3
Frequency Band (MHz)	5 470 to 5 600 and 5 650 to 5 725
Device Type	Devices shall not be capable of transmitting in the band 5 600 MHz to 5 650 MHz. This restriction is for the protection of Environment Canada's weather radars operating in this band.
Devices out of Scope	N/A
Power Limits	The maximum conducted output power shall not exceed 250 mW or 11+10 $\log_{10}$B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1 MHz band.
Unwanted Emission Limits	Emissions outside the band 5 470 MHz to 5 725 MHz shall not exceed -27 dBm/MHz e.i.r.p. Devices with bandwidth overlapping the band edge of 5 725 MHz can meet the emission limit of -27 dBm/MHz e.i.r.p. at 5 850 MHz instead of 5 725 MHz.
Complied Module M/N	ENWF9215C, ENWF9215A

RSS-247 Section	6.2.4
Frequency Band (MHz)	5 725 to 5 850
Device Type	For equipment operating in the band 5 725 MHz to 5 850 MHz
Devices out of Scope	Fixed point-to-point devices and devices with antenna gain greater than 6 dBi.
Power Limits	The minimum 6 dB bandwidth shall be at least 500 kHz. The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band.
Unwanted Emission Limits	Devices shall have e.i.r.p. of unwanted emissions comply with the following: • 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges • 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges • 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges • -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges
Complied Module M/N	ENWF9215C, ENWF9215A



For further information about module variants and its supported channel table please refer to ⇨ 7.1 Channels and Power Settings per Country.

6.5.2 IC Notice

English

The device PAN W602 (⇨ 7.2 Ordering Information), including the antennas (⇨ 6.4.5 Approved Antenna List), complies with Canada RSS-GEN Rules. The device meets the requirements for modular transmitter approval as detailed in RSS-Gen.

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.

French

Le présent appareil PAN W602 (⇨ 7.2 Ordering Information), les antennes y compris (⇨ 6.4.5 Approved Antenna List), est conforme aux CNR-Gen d'Industrie 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, et
2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

6.5.3 Labeling and Documentation Requirements

English

Labeling Requirements

The OEM must ensure that IC labelling requirements are met. This includes a clearly visible label on the outside of the OEM's product enclosure and inside the user manual specifying the appropriate Panasonic IC identifier for this product as well as the IC Notice above.

The IC identifier is IC: 216Q-W602.

This IC identifier is valid for all PAN W602 modules ⇨ 7.2 Ordering Information. In any case, the end product must be labelled on the exterior with:

"Contains IC: 216Q-W602".

In any case, the user manual must include following statement:

"This device contains IC: 216Q-W602.

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."

French

Obligations d'étiquetage

Les fabricants d'équipement d'origine (FEO) – en anglais Original Equipment Manufacturer (OEM) – doivent s'assurer que les obligations d'étiquetage IC du produit final sont remplies. Ces obligations incluent une étiquette clairement visible à l'extérieur de l'emballage externe et dans le manuel de l'utilisateur, comportant l'identifiant IC du module Panasonic inclus, ainsi que la notification ci-dessus.

L' identifiant IC est IC: 216Q-W602.

Cet identifiant est valide pour tous les modules PAN W602 ⇨ 7.2 Ordering Information. Dans tous les cas les produits finaux doivent indiquer sur leur emballage externe la mention suivante:

"Contient IC: 216Q-W602".

Dans tous les cas les produits finaux doivent indiquer dans le manuel de l'utilisateur la mention suivante:

"Contient IC: 216Q-W602.

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."

6.6 Bluetooth Special Interest Group (SIG)

The final Bluetooth end product listing needs to be created by using the following IDs:

Core Configuration	Design Name	DID/DN	QDID(s) and Included DN(s)
LE Core-Controller	PAN W602-xx	Q392027	Q386756

If the module is combined with a host stack that is Bluetooth qualified as "Host Subsystem" it is possible to list an "End Product" without any further qualification tests.

Bluetooth Marks

According to the Bluetooth SIG, the PAN W602 fulfills the criteria to label your product as a Bluetooth device:



For further information please refer to the Bluetooth website www.bluetooth.com.

7 Appendix

7.1 Channels and Power Settings per Country

7.1.1 World Wide (WW)

Radio	Bandwidth	Channels	Modulation	Power (dBm)
Wi-Fi 2.4 GHz	20 MHz	Single User		
		1-11	11b: 1-11 Mbit/s	12.0
			11g: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		12-14	Not supported	-
		OFDMA Multi-User		
		1-11	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		12-13	Not supported	-
Wi-Fi 5 GHz	20 MHz	Single User		
		36	11a: 6-54 Mbit/s	12.0
			11n/ac/ax: MCS 0-7	12.0
		40-60	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		64	11a: 6-54 Mbit/s	12.0
			11n/ac/ax: MCS 0-7	12.0
		OFDMA Multi-User		
		36	11ax MCS 0-7 OFDMA: 26-tone RU	2.0
			11ax MCS 0-7 OFDMA: 52-tone RU	5.0
			11ax MCS 0-7 OFDMA: 106-tone RU	8.0
			11ax MCS 0-7 OFDMA: 242-tone RU	12.0
		40-60	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		64	11ax MCS 0-7 OFDMA: 26-tone RU	2.0
			11ax MCS 0-7 OFDMA: 52-tone RU	5.0
			11ax MCS 0-7 OFDMA: 106-tone RU	8.0
			11ax MCS 0-7 OFDMA: 242-tone RU	12.0

7.1.2 European Union (EU)

Radio	Bandwidth	Channels	Modulation	Power (dBm)
Wi-Fi 2.4 GHz	20 MHz	Single User		
		1-12	11b: 1-11 Mbit/s	12.0
			11g: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		13	11b: 1-11 Mbit/s	12.0
			11g: 6-54 Mbit/s	12.0
			11n/ac/ax: MCS 0-7	12.0
		14	Not supported	-
		OFDMA Multi-User		
		1-12	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		13	11ax MCS 0-7 OFDMA: 26-tone RU	2.0
			11ax MCS 0-7 OFDMA: 52-tone RU	5.0
			11ax MCS 0-7 OFDMA: 106-tone RU	8.0
			11ax MCS 0-7 OFDMA: 242-tone RU	12.0
Wi-Fi 5 GHz	20 MHz	Single User		
		36-48	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		52-64	11a: 6-54 Mbit/s	12.0
			11n/ac/ax: MCS 0-7	12.0
		100-140	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		144	Not supported	-
		149-165	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		169	Not supported	-
		OFDMA Multi-User		
		36-48	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		52-64	11ax MCS 0-7 OFDMA: 26-tone RU	2.0

Radio	Bandwidth	Channels	Modulation	Power (dBm)
			11ax MCS 0-7 OFDMA: 52-tone RU	5.0
			11ax MCS 0-7 OFDMA: 106-tone RU	8.0
			11ax MCS 0-7 OFDMA: 242-tone RU	12.0
		100-140	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		144	Not supported	-
		149-165	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		169	Not supported	-

7.1.3 United States of America (US)

Radio	Bandwidth	Channels	Modulation	Power (dBm)
Wi-Fi 2.4 GHz	20 MHz	Single User		
		1-2	11b: 1-11 Mbit/s	15.0
			11g: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		3-9	11b: 1-11 Mbit/s	16.0
			11g: 6-54 Mbit/s	14.0
			11n/ac/ax: MCS 0-7	14.0
		10-11	11b: 1-11 Mbit/s	15.0
			11g: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		12-14	Not supported	-
		OFDMA Multi-User		
		1-2	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		3-9	11ax MCS 0-7 OFDMA: 26-tone RU	4.0
			11ax MCS 0-7 OFDMA: 52-tone RU	7.0
			11ax MCS 0-7 OFDMA: 106-tone RU	10.0
			11ax MCS 0-7 OFDMA: 242-tone RU	14.0

Radio	Bandwidth	Channels	Modulation	Power (dBm)
		10-11	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		12-13	Not supported	-
Wi-Fi 5 GHz	20 MHz	Single User		
		36	11a: 6-54 Mbit/s	12.0
			11n/ac/ax: MCS 0-7	12.0
		40-60	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		64	11a: 6-54 Mbit/s	12.0
			11n/ac/ax: MCS 0-7	12.0
		100	11a: 6-54 Mbit/s	12.0
			11n/ac/ax: MCS 0-7	12.0
		104-140	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		144	Not supported	-
		149-165	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		169	Not supported	-
		OFDMA Multi-User		
		36	11ax MCS 0-7 OFDMA: 26-tone RU	2.0
			11ax MCS 0-7 OFDMA: 52-tone RU	5.0
			11ax MCS 0-7 OFDMA: 106-tone RU	8.0
			11ax MCS 0-7 OFDMA: 242-tone RU	12.0
		40-60	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		64	11ax MCS 0-7 OFDMA: 26-tone RU	2.0
			11ax MCS 0-7 OFDMA: 52-tone RU	5.0
			11ax MCS 0-7 OFDMA: 106-tone RU	8.0
			11ax MCS 0-7 OFDMA: 242-tone RU	12.0
		100	11ax MCS 0-7 OFDMA: 26-tone RU	2.0
			11ax MCS 0-7 OFDMA: 52-tone RU	5.0
			11ax MCS 0-7 OFDMA: 106-tone RU	8.0
			11ax MCS 0-7 OFDMA: 242-tone RU	12.0

Radio	Bandwidth	Channels	Modulation	Power (dBm)
		104-140	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		149-165	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		169	Not supported	-

7.1.4 Canada (CA)

Radio	Bandwidth	Channels	Modulation	Power (dBm)
Wi-Fi 2.4 GHz	20 MHz	Single User		
		1-2	11b: 1-11 Mbit/s	15.0
			11g: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		3-9	11b: 1-11 Mbit/s	16.0
			11g: 6-54 Mbit/s	14.0
			11n/ac/ax: MCS 0-7	14.0
		10-11	11b: 1-11 Mbit/s	15.0
			11g: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		12-14	Not supported	-
		OFDMA Multi-User		
		1-2	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		3-9	11ax MCS 0-7 OFDMA: 26-tone RU	4.0
			11ax MCS 0-7 OFDMA: 52-tone RU	7.0
			11ax MCS 0-7 OFDMA: 106-tone RU	10.0
			11ax MCS 0-7 OFDMA: 242-tone RU	14.0
		10-11	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0

Radio	Bandwidth	Channels	Modulation	Power (dBm)
		12-13	Not supported	-
Wi-Fi 5 GHz	20 MHz	Single User		
		36	11a: 6-54 Mbit/s	12.0
			11n/ac/ax: MCS 0-7	12.0
		40-60	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		64	11a: 6-54 Mbit/s	12.0
			11n/ac/ax: MCS 0-7	12.0
		100	11a: 6-54 Mbit/s	12.0
			11n/ac/ax: MCS 0-7	12.0
		104-116	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		120-128	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		132-140	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		144	Not supported	-
		149-165	11a: 6-54 Mbit/s	13.0
			11n/ac/ax: MCS 0-7	13.0
		169	Not supported	-
		OFDMA Multi-User		
		36	11ax MCS 0-7 OFDMA: 26-tone RU	2.0
			11ax MCS 0-7 OFDMA: 52-tone RU	5.0
			11ax MCS 0-7 OFDMA: 106-tone RU	8.0
			11ax MCS 0-7 OFDMA: 242-tone RU	12.0
		40-60	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		64	11ax MCS 0-7 OFDMA: 26-tone RU	2.0
			11ax MCS 0-7 OFDMA: 52-tone RU	5.0
			11ax MCS 0-7 OFDMA: 106-tone RU	8.0
			11ax MCS 0-7 OFDMA: 242-tone RU	12.0
		100	11ax MCS 0-7 OFDMA: 26-tone RU	2.0
			11ax MCS 0-7 OFDMA: 52-tone RU	5.0
			11ax MCS 0-7 OFDMA: 106-tone RU	8.0
			11ax MCS 0-7 OFDMA: 242-tone RU	12.0

Radio	Bandwidth	Channels	Modulation	Power (dBm)
		104-116	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		120-128	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		132-140	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		149-165	11ax MCS 0-7 OFDMA: 26-tone RU	3.0
			11ax MCS 0-7 OFDMA: 52-tone RU	6.0
			11ax MCS 0-7 OFDMA: 106-tone RU	9.0
			11ax MCS 0-7 OFDMA: 242-tone RU	13.0
		169	Not supported	-

7.2 Ordering Information

Variants and Versions



Please note that variants PAN W602-1B (ENWF9211C) and PAN W602-1C (ENWF9211A) are currently still in progress of regulatory certification for the USA (FCC) and Canada (ISED).

Order Number	Brand Name	Description	Minimum Packaging Quantity [12]
ENWF9211C1KF[13]	PAN W602-1B	Wi-Fi Single-Band 2.4 GHz and Bluetooth® Low Energy Module	500
ENWF9211A1KF[13]	PAN W602-1C	Wi-Fi Single-Band 2.4 GHz and Bluetooth® Low Energy Module with integrated Antenna	500
ENWF9215C1KF[13]	PAN W602-2B	Wi-Fi Dual-Band 2.4/5 GHz and Bluetooth® Low Energy Module	500
ENWF9215A1KF[13]	PAN W602-2C	Wi-Fi Dual-Band 2.4/5 GHz and Bluetooth® Low Energy Module with integrated Antenna	500
ENWF9215CMKF[14]	PAN W602-2B EVD	M.2 Key E card with the PAN W602-2B module mounted. It can be used for evaluation of the 1B and 2B variants.	1
ENWF9215AMKF[14]	PAN W602-2C EVD	M.2 Key E card with the PAN W602-2C module mounted. It can be used for evaluation of the 1C and 2C variants.	1

[12] The default Minimum Packaging Quantity for mass production is 500 pieces. Lower quantities are only available on customer demand. Samples for evaluation can be delivered at any quantity via the distribution channels.

[13] Samples are available on customer demand.

[14] The M.2 Key E cards are for evaluation only. They must not be used in any end product.

7.3 Contact Details

7.3.1 Contact Us

For any technical inquiries, please use our dedicated contact form https://pideu.panasonic.de/en/contact/?subject=Wireless%20Connectivity.

For information on worldwide sales channels and authorized distributors, please visit our distribution overview https://pideu.panasonic.de/en/wireless-connectivity#distributors.

7.3.2 Product Information

For the latest product information, documentation, and updates, please visit our product overview https://pideu.panasonic.de/en/all-products/.

For access to evaluation tools, schematics, software resources, and additional development support, please visit the “Panasonic Wireless Connectivity Development Hub” https://pideu.panasonic.de/development-hub/.