Panasonic
INDUSTRY

# PAN9028

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

## Module Integration Guide

Rev. 1.0


Wireless Connectivity

## Overview

The PAN9028 is a 2.4 GHz/5 GHz ISM band Wi-Fi and Bluetooth radio module, which includes a wireless radio and a power management IC for easy integration of Wi-Fi and Bluetooth connectivity into various electronic devices.

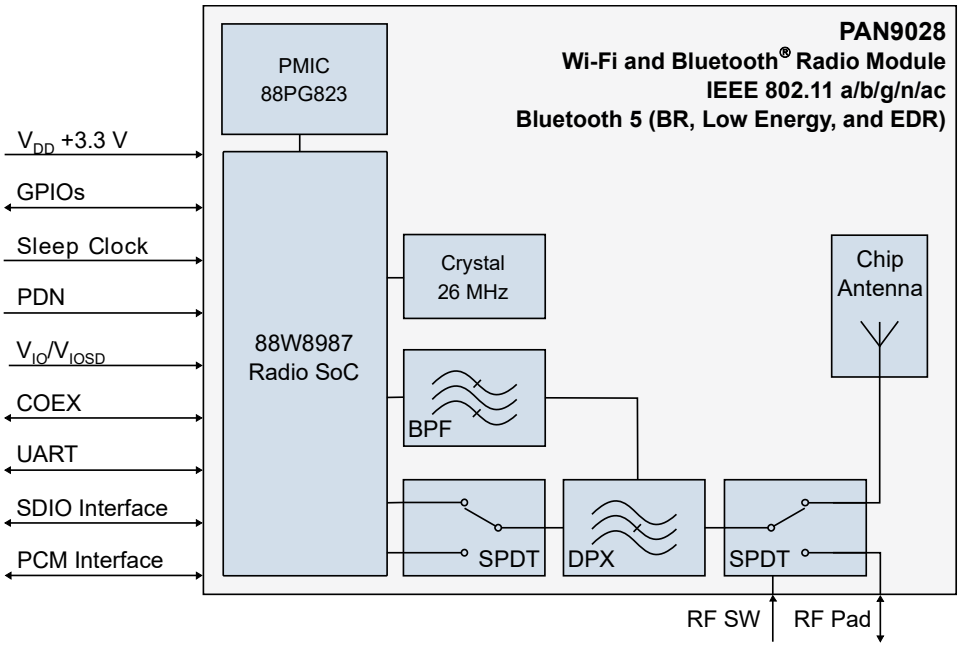
## Features

- Dual band 2.4 GHz/5 GHz 802.11 a/b/g/n/ac Wi-Fi and Bluetooth combo module
- Supports 802.11i security standards through AES, CCMP, and more security mechanism
- 802.11e Quality of Service is supported for multimedia application
- IEEE 802.11ac (Wave 2), 1×1 spatial stream with data rates up to 433 Mbps (MCS9, 80 MHz channel bandwidth)
- IEEE 802.11ac MU-MIMO beamformee
- Bluetooth 5 (includes Low Energy)
- Dual simultaneous and independent WLAN and Bluetooth operation
- Dynamic Rapid Channel Switching (DRCS) for simultaneous operation in 2.4 GHz and 5 GHz bands
- Indoor location and navigation with IEEE 802.11mc
- Coexistence interface for arbitration of co-located WLAN, Bluetooth, or mobile wireless system (e.g. LTE or ZigBee®)
- Generic interfaces include SDIO 3.0 and high speed UART for host processor connection
- Software driver Linux®

## Characteristics

- Surface Mount Type (SMT)
  24 mm × 12 mm × 2.8 mm
- NXP® 88W8987 WLAN 2.4 GHz/5 GHz and Bluetooth single-chip solution inside
- Single power supply: 3.3 V with Marvell® 88PG823 Power Management IC (optional)
- Tx power: 16 dBm at 802.11b
- Rx sensitivity: -97 dBm at 802.11b DSSS 1 Mbps
- IEEE 802.11ac 20 MHz, 40 MHz, 80 MHz channel bandwidth
- Long and Short Guard Interval support
- Current consumption Wi-Fi typical 320 mA (at Tx) and 70 mA (at Rx)
- SDIO 1 bit or 4 bit
- Wide temperature range of -30 °C to 85 °C

## Block Diagram



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# Table of Contents

# 1 About This Document

## 1.1 Purpose and Audience

This Module Integration Guide is intended to support the easy integration of the PAN9028 into a product and to ensure the compliance with regulatory requirements.

This guide gives an overview about the hardware design requirements by providing a reference design, which is the evaluation board of the PAN9028.

It is intended for hardware design and Original Equipment Manufacturers (OEM) engineers.

The product is referred to as “the PAN9028” or “the module” within this document.

## 1.2 Revision History

| Revision | Date | Modifications/Remarks |
|---|---|---|
| 0.1 | 2018-05-08 | First preliminary version |
| 0.2 | 2021-03-15 | Changed SDIO stick to mSD stick. New design. Updated formatting. Changed document type and structure (“Design Guide” into “Module Integration Guide”). Corrected current consumption. Corrected cutout area. Updated chapter “Power Supply”. Removed chapter “Power Configuration Examples for ENWF940[x]A1EF”. Updated chapter “Placement”. Updated picture “Solder Mask Layout”. Updated chapter “Functional Blocks”. |
| 1.0 | 2021-08-26 | Updated pictures: “Block Diagram” and “Land Pattern”. Updated features.<br>Added regulatory chapter. Changed mSD Reference Design to mSD-U |

## 1.3 Use of Symbols

| Symbol | Description |
|---|---|
|  | **Note**<br>Indicates important information for the proper use of the product. Non-observance can lead to errors. |
|  | **Attention**<br>Indicates important notes that, if not observed, can put the product’s functionality at risk. |
|  | **Tip**<br>Indicates useful information designed to facilitate working with the module and software. |

| Symbol | Description |
|---|---|
| ⇨ [chapter number] [chapter title] | **Cross Reference**<br>Indicates cross references within the document.<br>**Example:**<br>Description of the symbols used in this document ⇨ 1.3 Use of Symbols. |
| ✓ | **Requirement**<br>Indicates a requirement that must be met before the corresponding tasks can be completed. |
| ➔ | **Result**<br>Indicates the result of a task or the result of a series of tasks. |
| **This font** | **GUI Text**<br>Indicates fixed terms and text of the graphical user interface.<br>**Example:**<br>Click **Save**. |
| **Menu** > **Menu item** | **Path**<br>Indicates a path, e.g. to access a dialog.<br>**Example:**<br>In the menu, select **File** > **Setup page**. |
| `This font` | **File Names, Messages, User Input**<br>Indicates file names or messages and information displayed on the screen or to be selected or entered by the user.<br>**Examples:**<br>`pan1760.c` contains the actual module initialization.<br>The message `Failed to save your data` is displayed.<br>Enter the value `Product 123`. |
| **Key** | **Key**<br>Indicates a key on the keyboard, e.g. **F10**. |

## 1.4 Related Documents

For related documents please refer to the Panasonic website ⇨ 11.2 Product Information.

# 2 Overview

The PAN9028 is a dual band 2.4 GHz and 5 GHz 802.11 a/b/g/n/ac Wi-Fi radio module with integrated Bluetooth BR/EDR/Low Energy (LE), specifically designed for highly integrated and cost-effective applications. The simultaneous and independent operation of the two standards enables very high data rates (802.11ac) and low-power operation (Bluetooth LE). Integrated power management, a fast dual-core CPU, 802.11i security standard support, and high-speed data interfaces deliver the performance for the speed, reliability, and quality requirements of next generation products. Tx power calibration data, Wi-Fi, and Bluetooth system parameters are pre-stored on the One Time Programmable memory of the PAN9028 during production at Panasonic. This simplifies passing the certification process for PAN9028 customers. Furthermore, the module reduces design, test, and calibration effort resulting in reduced time-to-market compared to discrete solutions.

Integrating Wi-Fi and Bluetooth wireless connectivity allows high throughput applications for industrial devices and appliances. The combination of Wi-Fi and Bluetooth provides the highest flexibility for connectivity.

This Module Integration Guide applies to the PAN9028 WLAN/Bluetooth combo module and the PAN9028 mSDIO Adapter development platform.

This document is structured into two main parts:

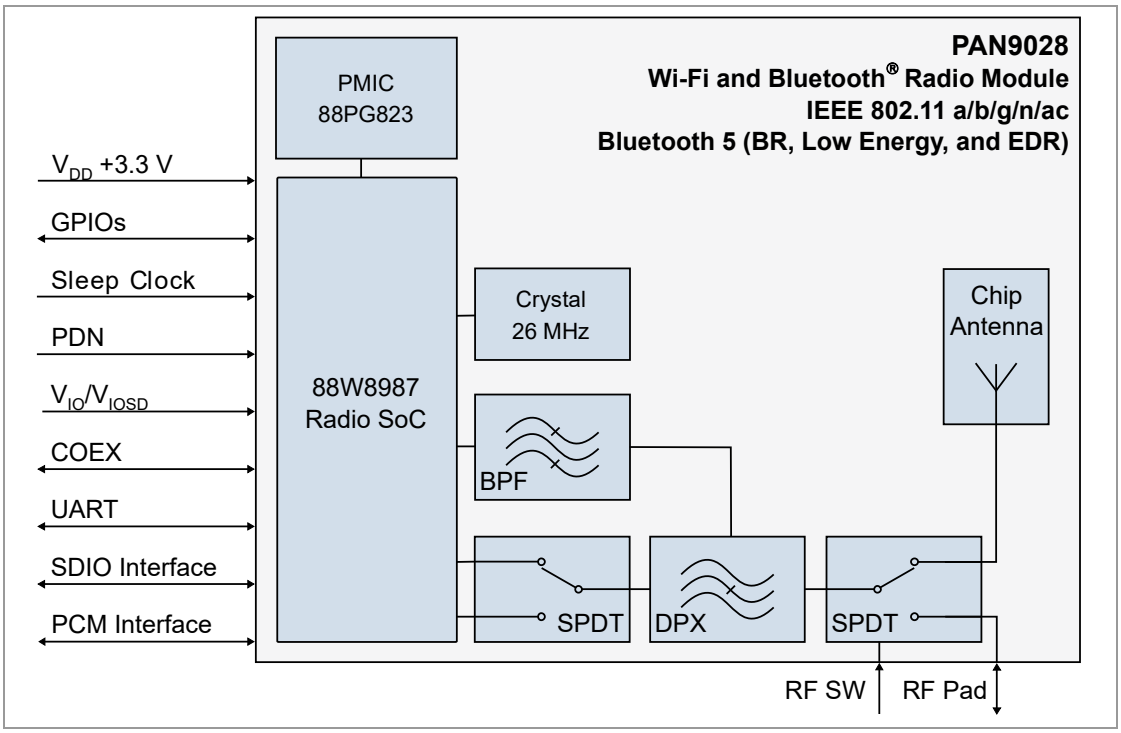
- The hardware integration of the PAN9028 module.
- The PAN9028 mSDIO Adapter as an example for the module integration.

For related documents please refer to ⇨ 11.2 Product Information.

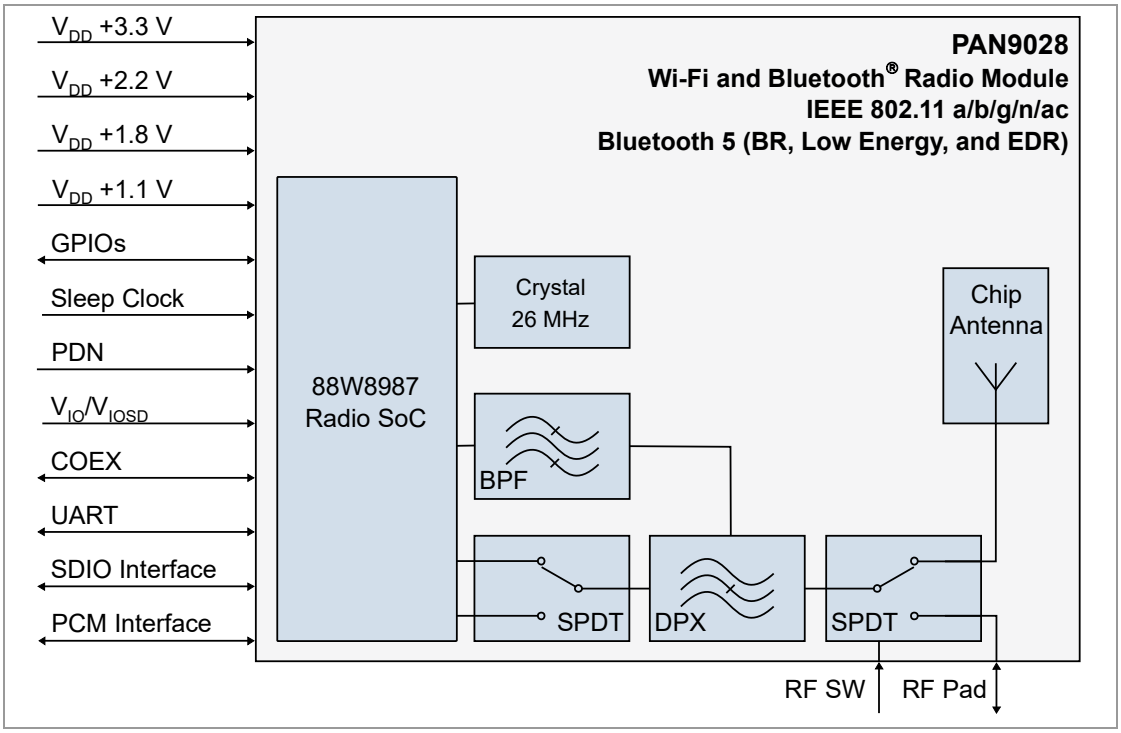
# 3 PAN9028 Module

## 3.1 Block Diagram

**For Module Variant ENWF940[x]A1EF:**




**For Module Variant ENWF940[x]A2EF:**



## 3.2 Land Pattern

**For Module Variant ENWF940[x]A1EF:**

Top View

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G | VOUT 2.2V | VOUT 2.2V | VIO | VOUT 1.8V | SD_CLK | SD_CMD | SD_DAT0 | SD_DAT1 | SD_DAT2 | SD_DAT3 | GND | RF | G |
| F | GND | VDD 3.3V | VDD 3.3V | VIO_SD | GPIO | GPIO | GPIO | GPIO | GPIO | GPIO | GND | GND | F |
| E | GPIO | EP 1 | | EP 2 | | SLEEP CLOCK IN | EP 1 | | EP 2 | | GND | GND | E |
| D | PG2 | | | | | CONFIG HOST[0] | | | | | GND | GND | D |
| C | PGLDO | | | | | CONFIG AUTO REF DET | | | | | GND | GND | C |
| B | PG1 | GPIO | DNC | GPIO | PDN | UART | UART | UART | GPIO | GPIO | RF_SW1 | GND | B |
| A | GND | EN PMIC | VOUT 1.1 V | GPIO | DNC | UART | UART | UART | DNC | GPIO | RF_SW2 | GND | A |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |

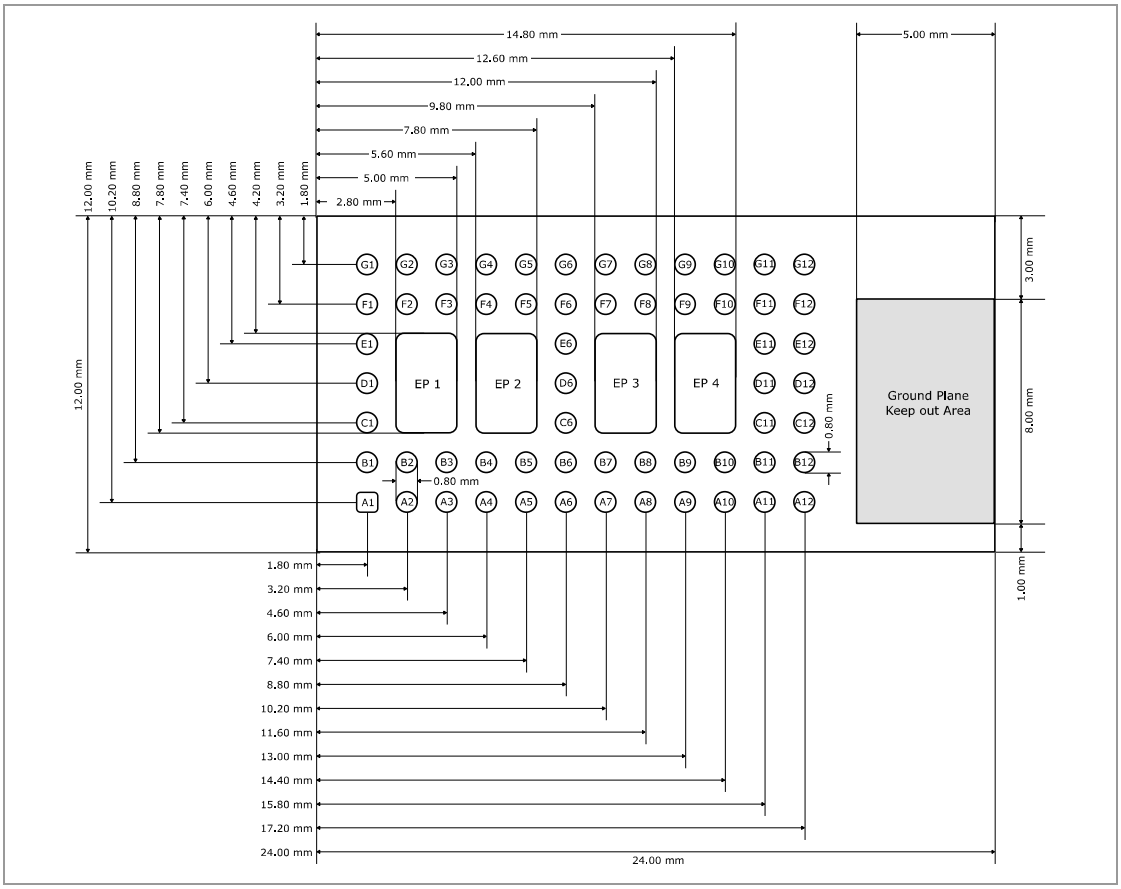
**For Module Variant ENWF940[x]A2EF:**

Top View

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G | VDD 2.2V | VDD 2.2V | VIO | VDD 1.8V | SD_CLK | SD_CMD | SD_DAT0 | SD_DAT1 | SD_DAT2 | SD_DAT3 | GND | RF | G |
| F | GND | VDD 3.3V | VDD 3.3V | VIO_SD | GPIO | GPIO | GPIO | GPIO | GPIO | GPIO | GND | GND | F |
| E | GPIO | EP 1 | | EP 2 | | SLEEP CLOCK IN | EP 1 | | EP 2 | | GND | GND | E |
| D | DNC | | | | | CONFIG HOST[0] | | | | | GND | GND | D |
| C | DNC | | | | | CONFIG AUTO REF DET | | | | | GND | GND | C |
| B | DNC | GPIO | DNC | GPIO | PDN | UART | UART | UART | GPIO | GPIO | RF_SW1 | GND | B |
| A | GND | DNC | VDD 1.1 V | GPIO | DNC | UART | UART | UART | DNC | GPIO | RF_SW2 | GND | A |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |

## 3.3 Footprint

The outer dimensions have a tolerance of ±0.35 mm.

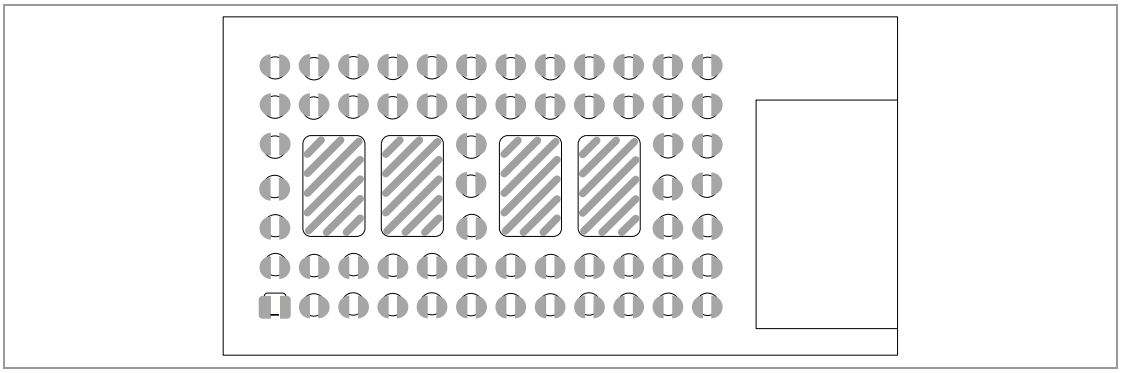


## 3.4 Solder Mask

It is recommended to use the following layout for the soldering mask to reduce voids on the thermal pads. Use the dimensions:

- ✓ The Resist Mask should be 50 µm bigger than the pad size (⇨ 3.3 Footprint).
- ✓ The Solder Mask should be 50 µm smaller than the pad size (⇨ 3.3 Footprint); they are separated in two semi circles with 300 µm distance and a shifting about 150 µm.

Layout



## 3.5 Placement

**Antenna "Keep out Area"**

Do not place any ground plane under the marked restricted antenna area in any layer! This would be affecting the performance of the chip antenna in a critical manner.

**Impact of Placement on the Antenna Radiation Pattern**

The placement of the module, surrounding material, and customer components has an impact on the radiation pattern of the antenna.

The recommendation for the ground plane is based on a FR4 4-Layer PCB.

The following requirements must be met:

- ✓ Keep this product away from heat. Heat is the major cause of decreasing the life of these products.
- ✓ Keep this product away from other high frequency circuits.

The antenna requires a cutout area of 8 mm x 5 mm under the PAN9028 module. This “Keep out Area” shall be located in every layer under the module antenna. Note for example the “Keep out Area” in all four layers of the PAN9028 evaluation board.

It is recommended to verify the perfect position of the module in the target application before fixing the design.

## Antenna Placement Recommendation

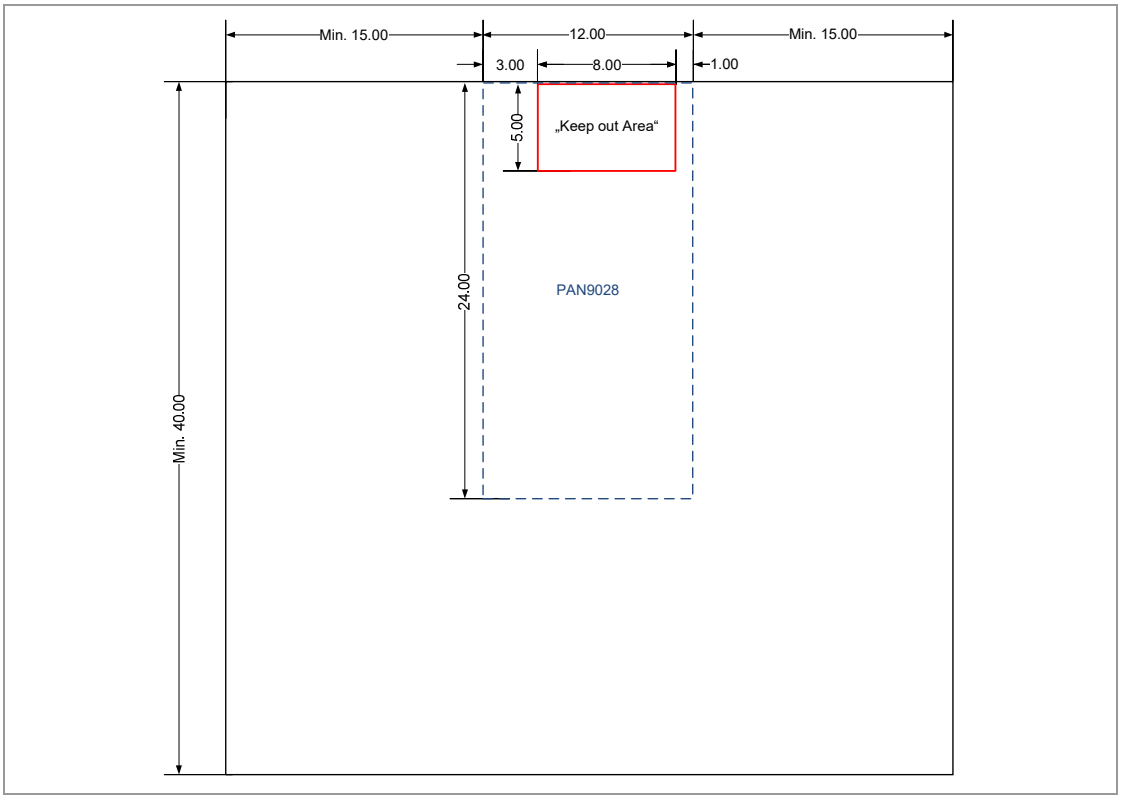
Use a ground plane in the area surrounding the module wherever possible.

All dimensions are in millimeters.

It is recommended to place the module:

- In the center (horizontal) of mother PCB.
- At the edge (horizontal) of mother PCB.

Top View



# 4 Power Supply

The following conditions must be met:

- ✓ 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).
- ✓ The supply voltage should not be exceedingly high or reversed. It should not carry noise and/or spikes.

ENWF940[x]A1EF: The $V_{OUT1V1}$, $V_{OUT1V8}$ and $V_{OUT2V2}$ power supply pins are only for internal purpose. Do not use them to power external curcuits.

Take care to follow correct power-up sequence of module which is specified in PAN9028 product specification.

# 5 RF Path

## 5.1 External Antenna

**Antenna Warning**

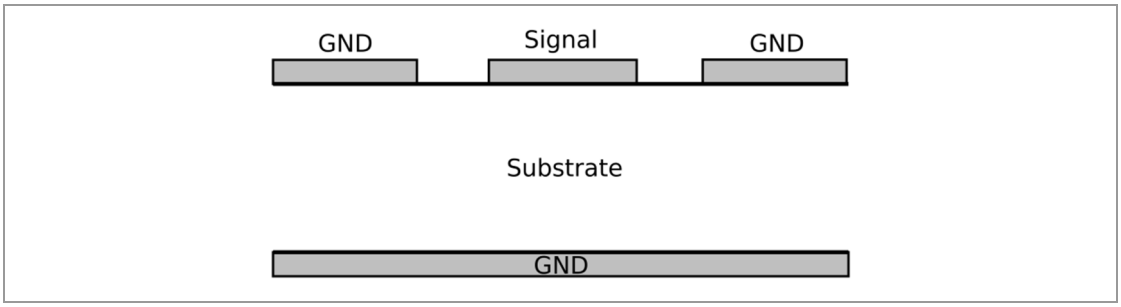
The PAN9028 is tested with a standard U.FL connector and with the antenna listed in the regulatory and certification chapter of the “PAN9028 Product Specification”. When integrated into the OEM’s product, these fixed antennas require installation preventing end users from replacing them with non-approved antennas.

Any antenna not in the regulatory and certification chapter of the “PAN9028 Product Specification” must be tested to comply with FCC Section 15.203 for unique antenna connectors and with Section 15.247 for emissions.

The PAN9028 module has a 50 ohm RF pin (SMD pad). Connect an external antenna directly or via a connector (e.g. U.FL) with RF trace to this RF pin. This RF trace shall be matched to 50 ohm ⇨ 5.2 RF Trace.

## 5.2 RF Trace

Ensure that the RF trace impedance is nearly 50 ohm. It is recommended to use a Coplanar Waveguide with Ground (CPWG) design. The impedance is related to the trace width, the distances of the trace to the ground layers and the material of the PCB.

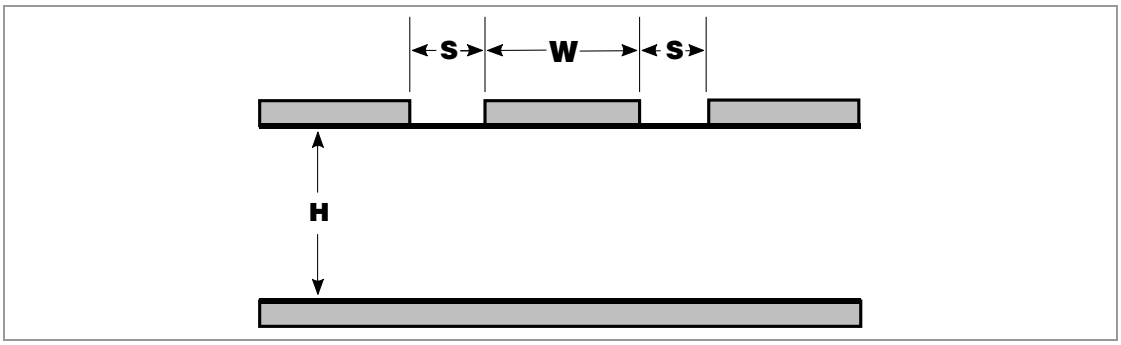


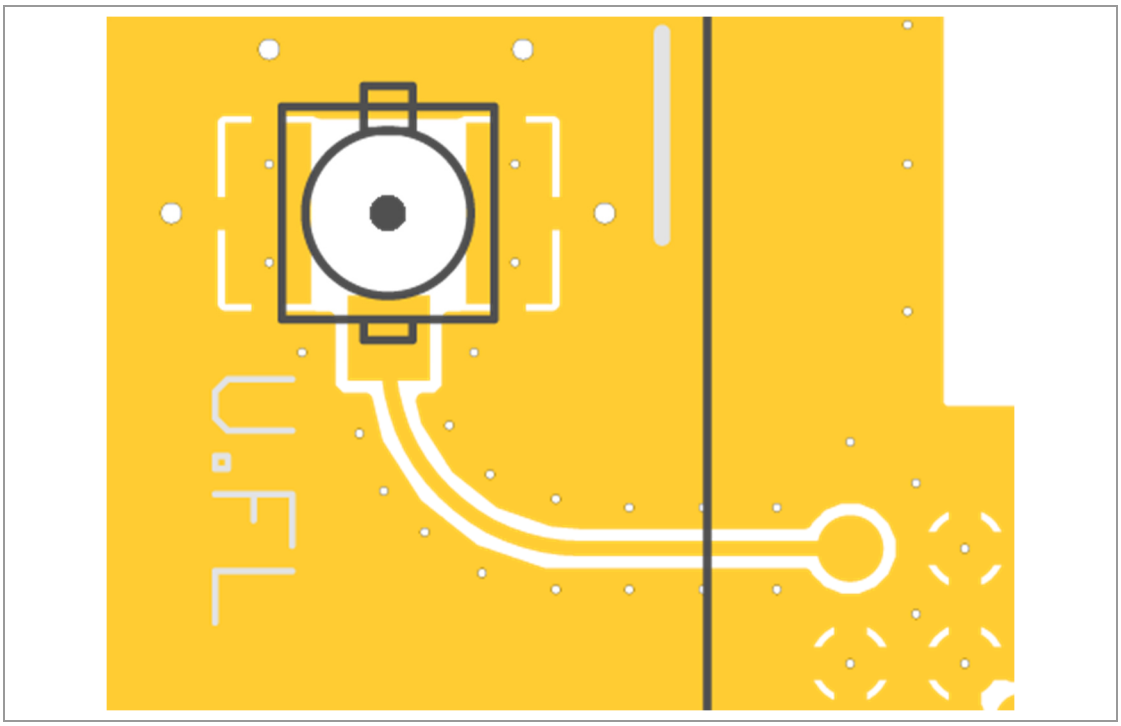

The following design recommendation shall be met:

- ✓ Trace impedance of 50 ohm
- ✓ Trace length shall not exceed 2 cm
- ✓ Via fence around the trace
- ✓ Crossing no other lines (power supply, interfaces or clock traces)

### Example 1: 50 ohm Coplanar Waveguide with Ground on mSDIO Adapter

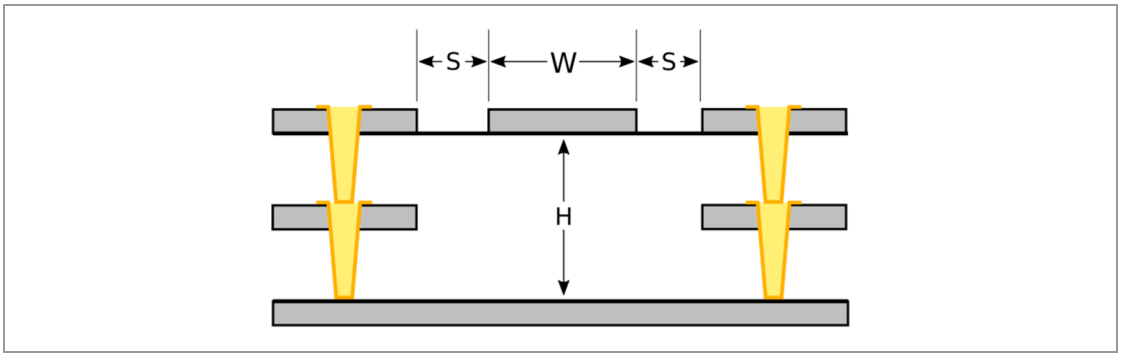
| | |
|---|---|
| Trace width | W = 180 µm |
| Trace distance to ground | S = 150 µm |
| Substrate thickness | H = 80 µm |
| Effective permittivity | $\varepsilon_r$ = 3.9 |
| Loss tangent | $\tan\delta$ = 0.015 |

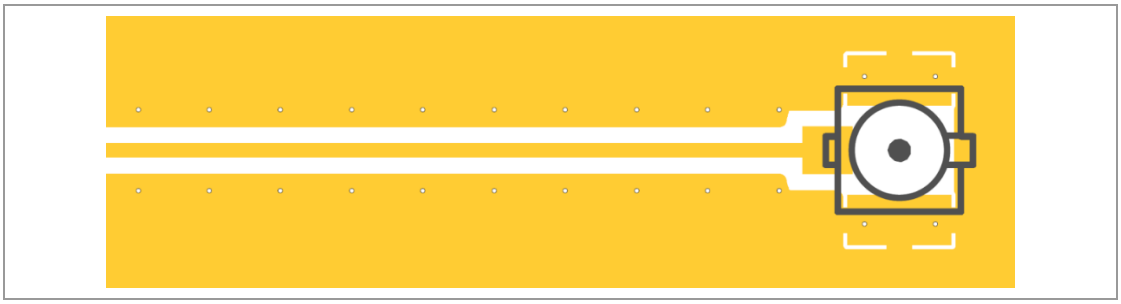


### Example 2: 50 ohm Coplanar Waveguide with Ground and Micro Vias

| | |
|---|---|
| Trace width | W = 300 µm |
| Trace distance to ground | S = 300 µm |
| Substrate thickness | H = 160 µm |
| Effective permittivity | $\varepsilon_r$ = 4.2 |
| Loss tangent | $\tan\delta$ = 0.006 |

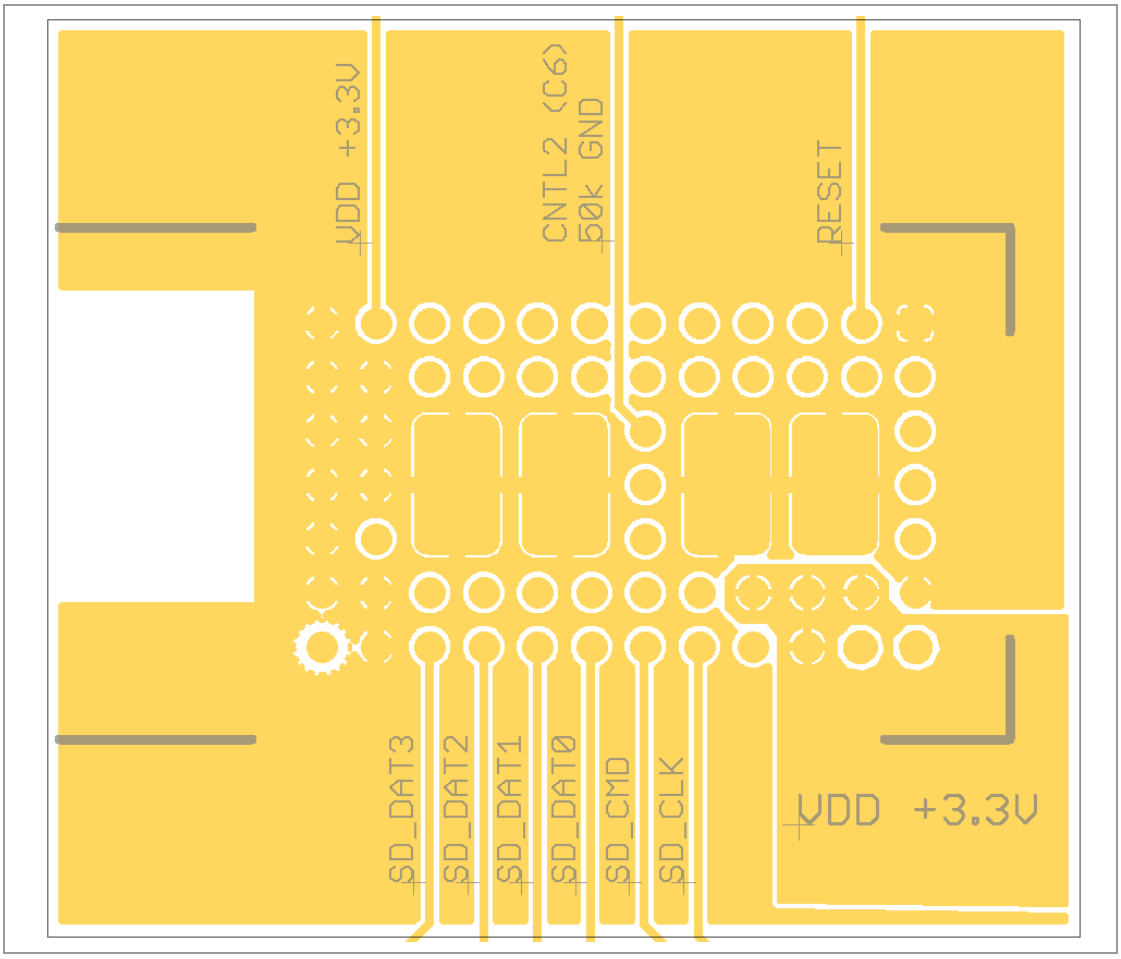


# 6 One-Layer Example for Module Variant ENWF940[x]A1EF

### Functionality

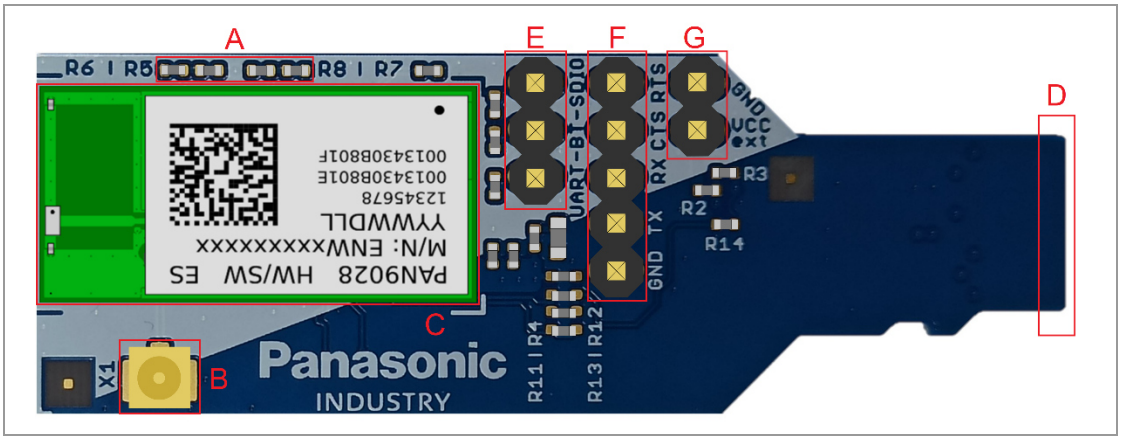
- WLAN interface: SDIO with 3.3 V
- Bluetooth interface: SDIO with 3.3 V
- On-board antenna
- No GPIOs connected
- Reset available



# 7 mSDIO Adapter

## 7.1 Functional Blocks

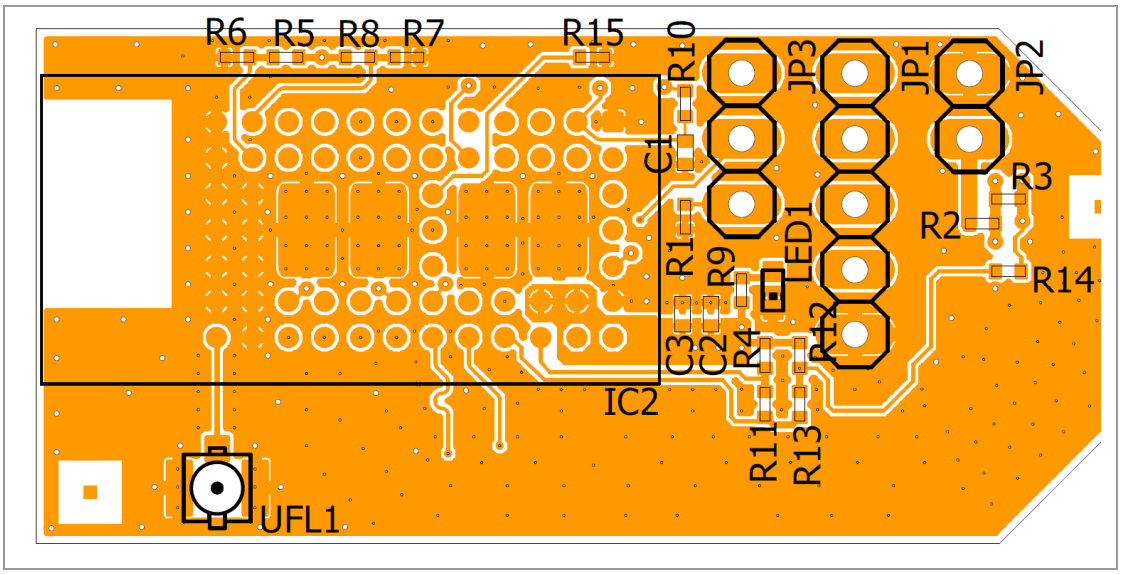
| Functional Block | Description | Interface |
|---|---|---|
| A | On-board antenna or bottom pad selection | |
| B | U.FL connector | X1 |
| C | PAN9028 module | |
| D | SDIO interface | |
| E | Bluetooth data over UART or SDIO | |
| F | Bluetooth Interface | |
| G | External supply voltage can be connected | |




## 7.2 Resistor Jumper Configuration

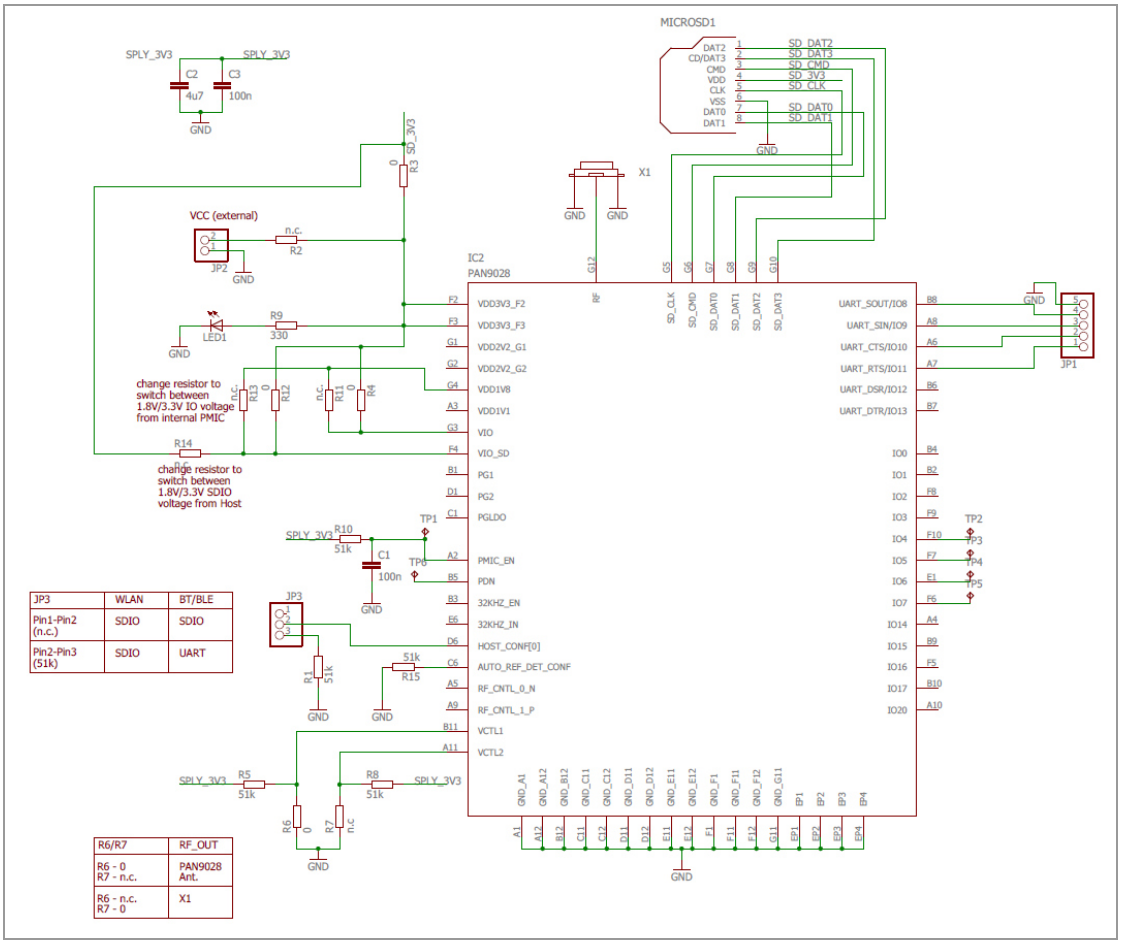
| R6 | R7 | RF-Out |
|---|---|---|
| 0R | n.c. | PAN9028 chip antenna |
| n.c. | 0R | RF-UFL X1 connector |

## 7.3 Part Placement



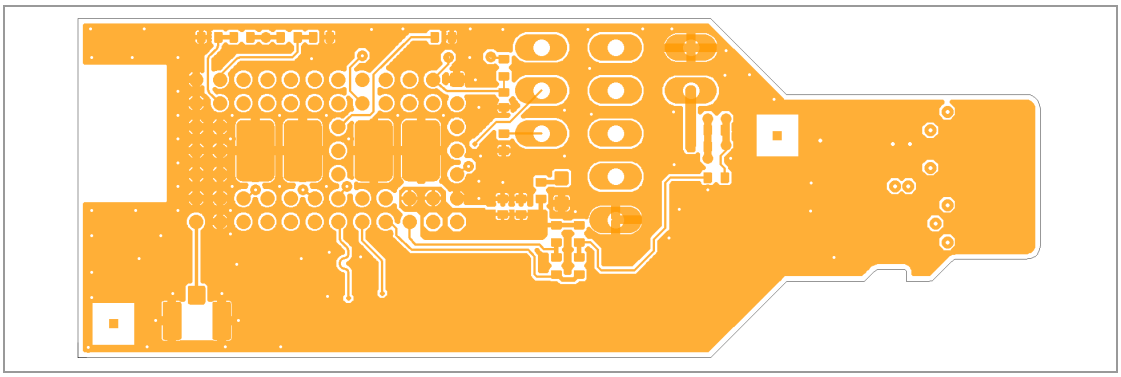
# 8 Reference Design

## 8.1 Schematic

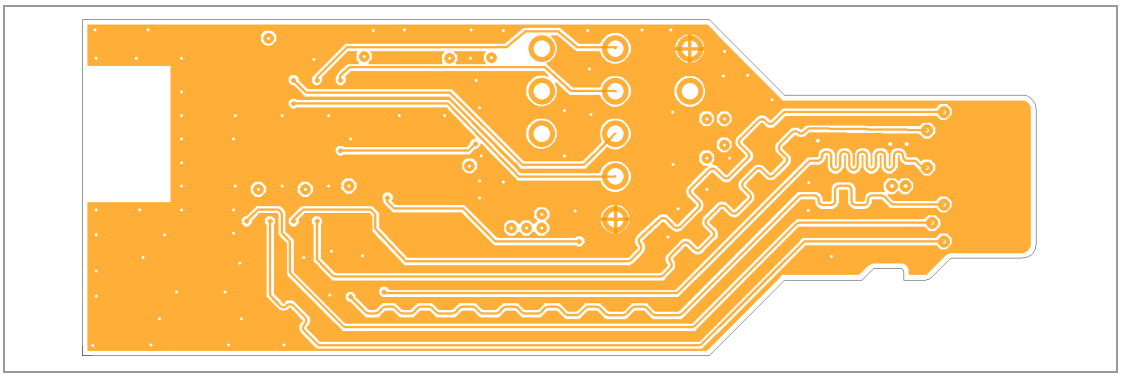



## 8.2 PCB Layout

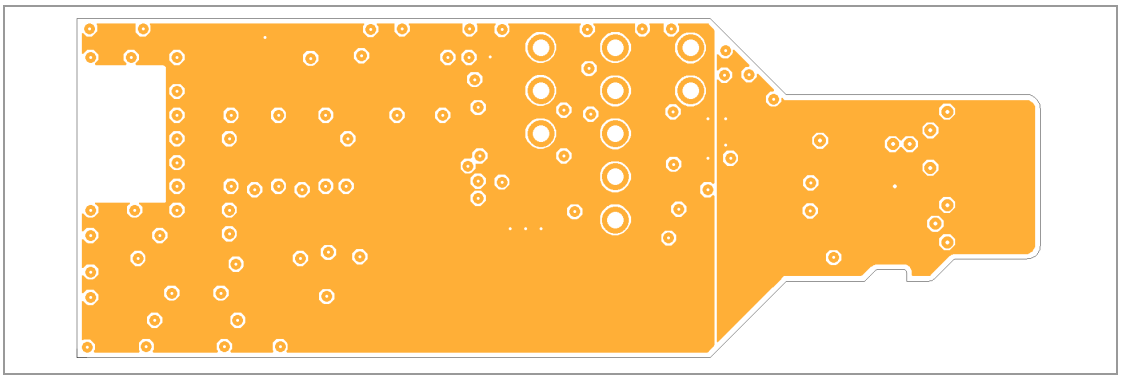
### 8.2.1 Top Layer



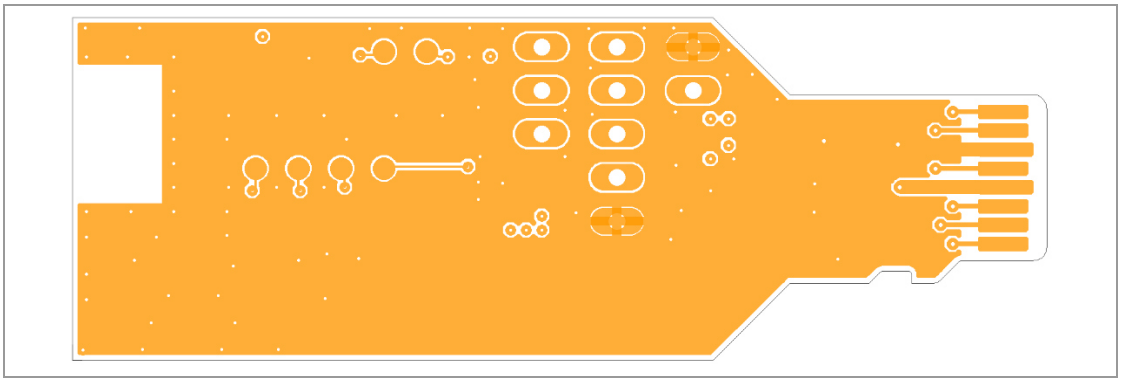
### 8.2.2 Second Layer



### 8.2.3 Third Layer (3.3V Power Plane)



### 8.2.4 Bottom Layer



# 9 Cautions

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

## 9.1 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 (⇨ Refer to PAN9028 Product Specification for 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.

## 9.2 Installation Notes

1. Reflow soldering is possible twice based on the conditions set forth in ⇨ PAN9028 Product Specification. 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.

## 9.3 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.

## 9.4 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 Cl2, H2S, NH3, SO2, or NOX,
   - 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).

## 9.5 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.

## 9.6 Other Cautions

1. Do not use the module for other purposes than those listed in section ⇨ 9.3 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, Cl2, SO2, H2S, NH3, and NOX).
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 ⇨ 11.2 Product Information.

## 9.7 Restricted Use

### 9.7.1 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.

### 9.7.2 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.

# 10 Regulatory and Certification Information

## 10.1 Federal Communications Commission (FCC) for US

### 10.1.1 FCC Notice

The PAN9028, including the ceramic antenna (ENWF9408A1EF and ENWF9408A2EF), and the antennas, which are listed in ⇨ 10.1.5 Approved Antenna List, complies with Part 15 of the FCC Rules.

The device meets the requirements for modular transmitter approval as detailed in FCC public Notice DA00-1407. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

The FCC identifier for ENWF9408A1EF is **FCC ID: T7V9028**.

The FCC identifier for ENWF9408A2EF is **FCC ID: T7V9028**.

### 10.1.2 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.

It is recommended 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.

### 10.1.3 Label Requirements

The OEM must ensure that FCC labelling requirements are met. This includes a clearly visible label (laser marking) 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 for model ENWF9408A1EF is **FCC ID: T7V9028**.

The FCC identifier for model ENWF9408A2EF is **FCC ID: T7V9028**.

This FCC identifier is valid for the PAN9028. The end product must in any case be labelled on the exterior with:

“Contains FCC ID: T7V9028”.

Due to the PAN9028 model size, the FCC identifier is displayed in the installation instruction only and it cannot be displayed readable on the module’s label due to the limited size.

### 10.1.4 Antenna Warning

This antenna warning refers to the test device with the model number ENWF9408A1EF and ENWF9408A2EF in bottom pad mode (⇨ Refer to PAN9028 Product Specification for RF-Switch Pin Function).

The device is tested with a standard SMA 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 ⇨10.1.5 Approved Antenna List is the same (**FCC ID: T7V9028**).

### 10.1.5 Approved Antenna List

| Item | Part Number | Manufacturer | Type | Polarization | Frequency Band | Gain (dBi) |
|---|---|---|---|---|---|---|
| 1 | ANT162442DT-2001A2 | TDK | Chip Antenna | Linear | 2.400 - 2.484 GHz | 2.1 |
| | | | | | 5.150 - 5.850 GHz | 1.5 |

### 10.1.6 RF Exposure

To comply with FCC RF Exposure requirements, the OEM must ensure that only antennas from the Approved Antenna List are installed ⇨ 10.1.5 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 PAN9028 with a mounted ceramic chip antenna (**FCC ID: T7V9028** for model ENWF9408A1EF and ENWF9408A2EF) are fulfilled for mobile configuration. The installation of the module is restricted to mobile host devices. The PAN9028 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.

### 10.1.7 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 - 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 | ENWF9408A1EF, ENWF9408A2EF |
| | | |

| | | |
|---|---|---|
| | 47 CFR Section | Part 15C |
| | Frequency Band (MHz) | 2 400 to 2 483.5 |
| | Systems | Frequency Hopping Systems operating within the 2 400 - 2 483.5 MHz Band |
| | Reference / Requirement | 15.247(a)(1), 15.247(a)(1)(iii), 15.247(b)(1), 15.207, 15.247(d) |
| | Complied Module M/N | ENWF9408A1EF, ENWF9408A2EF |
| | | |
| | 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 | ENWF9408A1EF, ENWF9408A2EF |
| **2.3** | **Summarize the specific operational use conditions** | |
| | Please refer to sections ⇨ 9 Cautions, 9.3 Usage Condition Notes, and 10.1.5 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, the module has a ceramic chip antenna. For guidance regarding the PCB layout requirements for module integration refer to the Design Guide ⇨ 11.2 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 ⇨ 10.1.4 Antenna Warning and 10.1.5 Approved Antenna List. | |
| **2.8** | **Label and compliance information** | |
| | Please refer to section ⇨ 10.1.3 Label Requirements. | |
| **2.9** | **Information on test modes and additional testing requirements** | |
| | The documents for integration guidance and compliance testing are available here ⇨ 11.2 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 ⇨ List of applicable FCC rules.<br>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). | |

## 10.2 Innovation, Science, and Economic Development (ISED) for Canada

### English

PAN9028 and versions are licensed to meet the regulatory requirements of ISED.

License for M/N: ENWF9408A1EF: **IC: 216Q-9028**

License for M/N: ENWF9408A2EF: **IC: 216Q-9028**

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 ⇨ 10.1.5 Approved Antenna List, having a maximum gain of 2.1 dBi for 2.4 GHz and 1.5 dBi for 5 GHz. Antennas not included in this list or having a gain greater than 2.1 dBi for 2.4 GHz and 1.5 dBi for 5 GHz are strictly prohibited for use with this device. The required antenna impedance is 50 Ω. The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

### French

PAN9028 (et ses versions) est garanti conforme aux dispositions règlementaires d'Innovation, Sciences et Développement économique (ISDE).

Licence pour M/N: ENWF9408A1EF: **IC: 216Q-9028**

Licence pour M/N: ENWF9408A2EF: **IC: 216Q-9028**

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 ⇨ 10.1.5 Approved Antenna List, présentant un gain maximum de 2.1 dBi pour 2.4 GHz et 1.5 dBi pour 5 GHz. Des antennes autres que celles listées ici, ou présentant un gain supérieur à 2.1 dBi pour 2.4 GHz et 1.5 dBi pour 5 GHz ne doivent en aucune circonstance être utilises en combinaison avec ce produit. L'impédance des antennes compatibles est 50 Ω. 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.

### 10.2.1 Radio Standards Specification RSS-247 Issue 2

The Radio Standards Specification RSS-247, Issue 2, Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices, replaces RSS-247, Issue 1, dated May 2015. 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.

#### 10.2.1.1 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.

#### 10.2.1.2 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.

#### 10.2.1.3 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.

#### 10.2.1.4 FHS and DTS operating in the bands 2 400 MHz to 2 483.5 MHz

This section applies to frequency hopping systems (FHSs) in the bands 2 400 MHz to 2 483.5 MHz and 5 725 MHz to 5 850 MHz and digital transmission systems (DTSs) in the band 2 400 MHz to 2 483.5 MHz. Systems in these bands can be frequency hopping, digital transmission and/or a combination (hybrid) of both types. The digital transmission technology of DTSs or hybrid systems operating in the band 5 725 MHz to 5 850 MHz shall comply with the requirement in section Technical requirements for license-exempt local area network devices and digital transmission systems operating in the 5 GHz band.

| | |
|---|---|
| **RSS-247 Section** | 5.1 |
| **Frequency Band (MHz)** | 2 400 to 2 483.5 |
| **Systems** | Frequency Hopping Systems |
| **Systems out of Scope** | FHS operating in the band 5 725 MHz to 5 850 MHz<br>Fixed point-to-point systems |
| **Requirements** | The maximum peak conducted output power shall not exceed  W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. |
| **Complied Module M/N** | ENWF9408A1EF, ENWF9408A2EF |

| | |
|---|---|
| **RSS-247 Section** | 5.2 |
| **Frequency Band (MHz)** | 2 400 to 2 483.5 |
| **Systems** | Digital Transmission Systems |
| **Systems out of Scope** | - |
| **Requirements** | The minimum 6 dB bandwidth shall be 500 kHz.<br>The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.<br>The maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W. |
| **Complied Module M/N** | ENWF9408A1EF, ENWF9408A2EF |

| | |
|---|---|
| **RSS-247 Section** | 5.3 |
| **Frequency Band (MHz)** | 2 400 to 2 483.5 |
| **Systems** | Hybrid Systems |
| **Systems out of Scope** | Hybrid devices operating in the band 5 725 MHz to 5 850 MHz. |
| **Requirements** | With the digital transmission operation of the hybrid system turned off, the frequency hopping operation shall have an average time of occupancy on any frequency not exceeding 0.4 seconds within a duration in seconds equal to the number of hopping frequencies multiplied by 0.4.<br>With the frequency hopping turned off, the digital transmission operation shall comply with the power spectral density requirements for digital modulation systems set out in section “5.2” ⇨ RSS-247 Section. |
| **Complied Module M/N** | ENWF9408A1EF, ENWF9408A2EF |

| | |
|---|---|
| **RSS-247 Section** | 5.4 |
| **Frequency Band (MHz)** | 2 400 to 2 483.5 |
| **Systems** | FHSs operating in the band 2 400 to 2 483.5 MHz.<br>DTSs employing digital modulation techniques operating in the band 2 400 MHz to 2 483.5 MHz. |
| **Systems out of Scope** | FHSs operating in the band 902 MHz to 928 MHz and 5 725 MHz to 5 850 MHz.<br>DTSs employing digital modulation techniques operating in the bands 902 MHz to 928 MHz.<br>Fixed point-to-point systems in the bands 2 400 MHz to 2 483.5 MHz and 5 725 MHz to 5 850 MHz.<br>Transmitters operating in the band 2 400 MHz to 2 483.5 MHz, may employ antenna systems that emit multiple directional beams simultaneously or sequentially. |
| **Requirements** | Transmitter Output Power:<br>The maximum peak conducted output power shall not exceed 1 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W.<br>For DTSs employing digital modulation techniques operating in the band 2 400 MHz to 2 483.5 MHz, the maximum peak conducted output power shall not exceed  W. The e.i.r.p. shall not exceed 4 W. |
| **Complied Module M/N** | ENWF9408A1EF, ENWF9408A2EF |

| | |
|---|---|
| **RSS-247 Section** | 5.5 |
| **Frequency Band (MHz)** | 2 400 to 2 483.5 |
| **System** | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating … |
| **System out of Scope** | - |
| **Requirements** | Unwanted Emissions:<br>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required. |
| **Complied Module M/N** | ENWF9408A1EF, ENWF9408A2EF |

#### 10.2.1.5 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,
- 5 725 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 log10B, 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 fall 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 TPC, on the portion of the emission that resides in the 5 250 MHz to 5 350 MHz band. |
| **Complied Module M/N** | ENWF9408A1EF, ENWF9408A2EF |

| | |
|---|---|
| **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:<br>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<br>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<br>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<br>-27 dBm/MHz at frequencies more than 75 MHz above or below the band edges |
| **Complied Module M/N** | ENWF9408A1EF, ENWF9408A2EF |

### 10.2.2 IC Notice

#### English

The device PAN9028 and versions (⇨ see PAN9028 Product Specification for ordering information), including the antennas (⇨ 10.1.5 Approved Antenna List), comply 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 inference received, including interference that may cause undesired operation.

#### French

Le présent appareil PAN9028 (⇨ voir PAN9028 Product Specification pour informations de commande), les antennes y compris (⇨ 10.1.5 Approved Antenna List), est conforme aux CNR-Gen d'ISDE 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.

### 10.2.3 Labeling 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 enclosure specifying the appropriate Panasonic IC identifier for this product as well as the IC Notice above.

The IC identifiers are:

**IC: 216Q-9028** (for M/N: ENWF9408A1EF)

**IC: 216Q-9028** (for M/N: ENWF9408A2EF)

These IC identifiers are valid for all PAN9028 modules ⇨ see PAN9028 Product Specification for ordering information. In any case, the end product must be labelled on the exterior with:

“Contains IC: 216Q-9028”.

#### French

**Obligations d’étiquetage**

Les fabricants d’équipements 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, comportant l’identifiant IC du module Panasonic inclus, ainsi que la notification ci-dessus.

L’ identifiant IC est:

**IC: 216Q-9028** (pour M/N: ENWF9408A1EF)

**IC: 216Q-9028** (pour M/N: ENWF9408A2EF)

Cet identifiant est valide pour tous les modules PAN9028 ⇨ voir PAN9028 Product Specification pour informations de commande. Dans tous les cas les produits finaux doivent indiquer sur leur emballage externe la mention suivante:

“Contient IC: 216Q-9028”.

## 10.3 European Conformity According to RED (2014/53/EU)

The PAN9028 modules with model number ENWF9408A1EF and ENWF9408A2EF 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 |
| | EN 62311:2008 |
| 3.1b EMC: | EN 301 489-1 V2.2.3 |
| | EN 301 489-3 V2.1.2 (Draft) |
| | EN 301 489-17 V3.2.4 |
| 3.2 Radio: | EN 300 328 V2.2.2 |
| | EN 301 893 V2.1.1 |
| | EN 300 440 V2.1.1 |

- Due to the model size, the CE marking is displayed in the installation instruction only andit cannot be displayed conform to regulation (EU) No 765/2008 in 5mm height on the module's label due to the limited space.
- The RED EU Type Examination Certificate No. G0M-2010-9377-V01 issued by the Notified Body 0608 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.

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 20 cm from the human body under all circumstances.

The end customer equipment must meet the actual Safety/Health requirements according to RED.

PAN9028 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, and Norway]), Monaco, San Marino, Andorra, and Turkey.

### 10.3.1 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 restrictions on putting into service or requirements for authorisation of use exist. Such information shall be completed 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;
- **Class 2:**
  Radio equipment subject to restrictions in one or more EU, EEA and EFTA countries where:
  - The technical parameters are not harmonised through EU, EEA, and EFTA;
  - The technical parameters are harmonised through EU, EEA and EFTA, and do not fall in above class 1 definition.

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 harmonised 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 harmonised radio spectrum, however with restrictions.

### 10.3.2 Equipment Classes

The PAN9028 is a radio module classified as class-1 or class-2 radio equipment depending on the frequency band in which it can operate. 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:

| Sub-class of Class 1 | Application/Reference | Frequency Band (MHz) | Transmit Power/Power Density |
|---|---|---|---|
| 22 | Wideband Data Transmission Systems<br>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. |
| 43 | Non-Specific Short Range Devices<br>EN 300 440 | 5 725 to 5 875 | 25 mW e.i.r.p. |

#### Class 2

Class 2 radio equipment are restricted in accordance with Article 1(3) of Commission Decision 2000/299/EC1 if the equipment falls within the scope of Class 2.

This radio module is also defined as Class 2 radio equipment when it is restricted to operate in the following frequency bands:

| Sub-class of Class 2 | Application/Reference | Frequency Band (MHz) | Transmit Power/Power Density |
|---|---|---|---|
| H01 | Wireless Access Systems including Radio Local Area Networks (WAS/RLANs)<br>**Restricted to indoor use**<br>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. |

The usage of PAN9028 module in a vehicular environment cannot be considered as **indoor use**.

## 10.4 Bluetooth Qualification

The PAN9028 series modules are Bluetooth qualified as "Controller Subsystem". Following the qualified design ID's listed for the module:

| Bluetooth Product | Project Name | Power Class | Model | Declaration ID | QDID |
|---|---|---|---|---|---|
| Controller Subsystem | PAN9028 | 1 | ENWF940xAxEF | D052581 | 172842 |

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.

The OpenSynergy Bluetooth software is commercially available and is delivered in source code format. Applications that are built using the Blue SDK are executed in Linux user space making development easy. The stack software and profiles are qualified components and are listed on the Bluetooth SIG website.

- Blue SDK v6.x and Low Energy SDK v3.x: QDID 120439
- Bluetooth traditional profiles: QDID 117748

### Bluetooth Marks

According to the Bluetooth SIG, the PAN9028 fulfills the criteria to label your product as a Bluetooth device:

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

## 10.5 RoHS And REACH Declaration

The latest declaration of environmental compatibility (RoHS and REACH) for supplied products can be found on the Panasonic website in the "Downloads" section of the respective product ⇨ 11.2 Product Information.

# 11 Contact Details

## 11.1 Contact Us

Please contact your local Panasonic Sales office for details on additional product options and services:

For Panasonic Sales assistance in the **EU**, visit

https://eu.industrial.panasonic.com/about-us/contact-us

Email: wireless@eu.panasonic.com

For Panasonic Sales assistance in **North America**, visit the Panasonic website "Sales & Support" to find assistance near you at

https://na.industrial.panasonic.com/distributors

Please visit the **Panasonic Wireless Technical Forum** to submit a question at

https://forum.na.industrial.panasonic.com

## 11.2 Product Information

Please refer to the Panasonic Wireless Connectivity website for further information on our products and related documents:

For complete Panasonic product details in the **EU**, visit

http://pideu.panasonic.de/products/wireless-modules.html

For complete Panasonic product details in **North America**, visit

http://www.panasonic.com/rfmodules