



# Data Sheet: JN5168-001-Myy

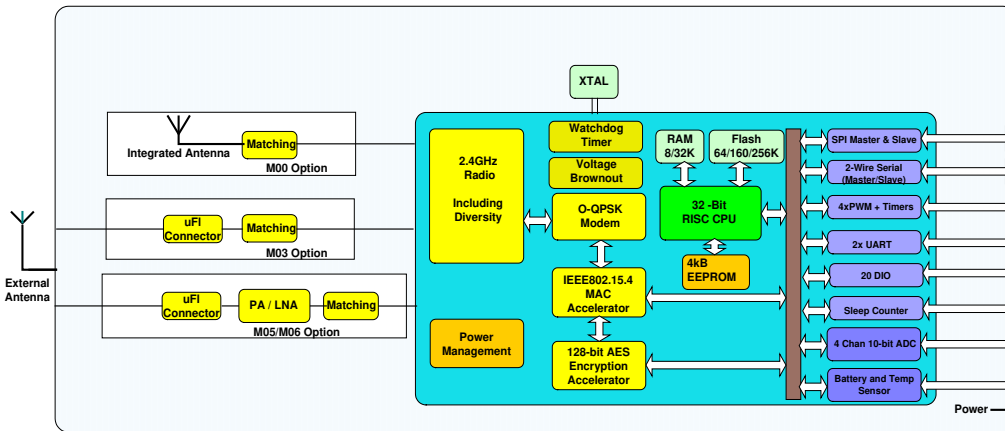
## JenNet-IP, ZigBee PRO and IEEE802.15.4 Module

### Overview

The JN5168-001-Myy family is a range of ultra low power, high performance surface mount modules targeted at IEEE 802.15.4, JenNet-IP, ZigBee Light Link, ZigBee Smart Energy and RF4CE networking applications, enabling users to realise products with minimum time to market and at the lowest cost. They remove the need for expensive and lengthy development of custom RF board designs and test suites. The modules use NXP's JN5168 wireless microcontroller to provide a comprehensive solution with large memory, high CPU and radio performance and all RF components included. All that is required to develop and manufacture wireless control or sensing products is to connect a power supply and peripherals such as switches, actuators and sensors, considerably simplifying product development.

Four module variants are available: JN5168-001-M00 with an integrated antenna, JN5168-001-M03 with an antenna connector and the JN5168-001-M05 and M06 with an antenna connector, power amplifier and LNA for extended range. The JN5168-001-M05 output power has been optimised for use in Europe and Asia.

### Module Block Diagram



### Benefits

- Microminiature module solutions
- Ready to use in products
- Minimises product development time
- No RF test required for systems
- Compliant with
  - FCC 47CFR Part 15C
  - IC Canada RSS 210 Issue 8 - Annex 8,
  - ETSI EN 300-328 V1.7.1
  - EN 301-489-17 V2.1.1
  - EN60950-1-2006 +A1, A11, A12

### Applications

- Robust and secure low power wireless applications
- ZigBee and JenNet-IP networks
- Home and commercial building automation
- Utilities metering (e.g. AMR)
- Location Aware services (e.g. Asset Tracking)
- Toys and gaming peripherals
- Industrial systems
- Telemetry
- Remote Control

### Features: Module

- 2.4GHz IEEE 802.15.4, JenNet-IP, ZigBee Light Link, ZigBee Smart Energy and RF4CE compatible
- **JN5168-001-M00/03**
  - up to 1km range (Ext antenna)
  - M00: integral antenna 16x30mm
  - M03: uFl connector 16x21mm
    - TX power +2.5dBm
    - Receiver sensitivity -95dBm
    - TX current 15.3mA
    - RX current 17mA
    - 2.0-3.6V operation
- **JN5168-001-M05**
  - up to 2km range (Ext 2dBi Antenna)
    - 9.5 dBm TX Power
    - Receiver sensitivity -96dBm
    - uFl connector
    - TX current 35mA
    - RX current 22mA
    - 16x30mm
    - 2.0-3.6V operation
- **JN5168-001-M06**
  - up to 6km range (Ext 2 dBi Antenna)
    - 22dBm TX Power
    - Receiver sensitivity -100dBm
    - uFl connector
    - TX current 175mA
    - RX current 22mA
    - 16x30mm
    - 2.0-3.6V operation

### Features: Microcontroller

- 32-bit RISC CPU, up to 32MIPs with low power
- Data EEPROM with guaranteed 100k write operations
- RF4CE, JenNet-IP, ZigBee Smart Energy stacks
- JTAG debug interface
- 4-input 10-bit ADC, 1 comparator
- 5 x PWM (4 x timer, 1 x timer/counter)
- 2 UARTs
- SPI Master & Slave port with 3 selects
- 2-wire serial interface
- Battery and Temperature Sensor
- Watchdog timer and BOR
- Up to 20 DIO

**Industrial temp (-40°C to +85°C)**

**Lead-free and RoHS compliant**

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# 1. Introduction

The JN5168-001-Myy module family provides designers with a ready-made component that provides a fully integrated solution for applications, using the IEEE802.15.4 standard in the 2.4-2.5GHz ISM frequency band [1], including JenNet-IP and ZigBee Smart Energy, and can be quickly and easily included in product designs. The modules integrate all of the RF components required, removing the need to perform expensive RF design and test. Products can be designed by simply connecting sensors and switches to the module IO pins. The modules use NXP's single chip IEEE802.15.4 Wireless Microcontroller, allowing designers to make use of the extensive chip development support material. Hence, this range of modules allows designers to bring wireless applications to market in the minimum time with significantly reduced development effort and cost.

Four variants are available: JN5168-001-M00, JN5168-001-M03, JN5168-001-M05 and JN5168-001-M06. All modules have FCC and Industry Canada modular approvals. All modules other than the JN5168-001-M06 are also CE compliant and subject to a Notified Body Opinion.

The variants available are described below.

## 1.1. Variants

| Variant        | Description                        | FCCID       | Industry Canada ID |
|----------------|------------------------------------|-------------|--------------------|
| JN5168-001-M00 | Standard Power, integrated antenna | TYOJN5168M0 | 7438A-CYO5168M0    |
| JN5168-001-M03 | Standard Power, uFL connector      | TYOJN5168M3 | 7438A-CYO5168M3    |
| JN5168-001-M05 | Medium Power, uFL connector        | TYOJN5168M5 | 7438A-CYO5168M5    |
| JN5168-001-M06 | High Power, uFL connector          | TYOJN5168M6 | 7438A-CYO5168M6    |

## 1.2. Regulatory Approvals

The JN5168-001-M00, M03 and M05 have been tested against the requirements of the following European standards.

- Radio EN 300 328 v1.7.1.
- EMC, EN 301 489-17 v2.1.1
- Basic Safety Assessment (BSA) EN 60950-1:2006

A Notified Body statement of opinion for this standard is available on request.

The High Power module with M06 suffix is not approved for use in Europe, instead the JN5168-001-M05 module may be used with an antenna with up to 2.2dBi; 10mW/MHz power spectral density e.i.r.p is the maximum permitted in Europe.

Additionally, all module types have received FCC "Modular Approval", in compliance with CFR 47 FCC part 15 regulations and in accordance to FCC Public notice DA00-1407. Appendix 0 contains details on the conditions applying to this modular approval. The modules are approved for use with a range of different antennas; further details of which can be found in section Appendix A.9.1. The modular approvals notice and test reports are available on request.

All modules are compliant with Industry Canada RSS210 (Issue 8, Annex 8) and have Industry Canada modular approval.

The JN5168-001-M06 module is subject to user proximity restrictions under FCC and Industry Canada regulations; more specific information is available in A.9.2.

## 2. Specifications

Most specification parameters for the modules are specified in the chip datasheet – JN-DS-JN5168 Wireless Microcontroller Datasheet [2]. Where there are differences, the parameters are defined here.

VDD=3.0V @ +25°C

| Typical DC Characteristics                                     |                   |                |                | Notes  |
|--|-------------------|----------------|----------------|--|
|  | JN5168-001-M00/03 | JN5168-001-M06 | JN5168-001-M05 |  |
| Deep sleep current   | 100nA             | 100nA          | 100nA          |  |
| Sleep current  | 0.70uA            | 0.70uA         | 0.70uA         | With active sleep timer  |
| Radio transmit current   | 15.3mA            | 175mA          | 35mA           | CPU in doze, radio transmitting  |
| Radio receive current  | 17mA              | 22mA           | 22mA           | CPU in doze, radio receiving   |
| Centre frequency accuracy                                      | +/-25ppm          | +/-25ppm       | +/-25ppm       | Additional +/-15ppm allowance for temperature and ageing               |
| Typical RF Characteristics                                     |                   |                |                | Notes  |
| Receive sensitivity  | -95dBm            | -100dBm        | -96dBm         | Nominal for 1% PER, as per 802.15.4 section 6.5.3.3 (Note 1)           |
| Transmit power   | 2.5dBm            | 22dBm          | 9.5 dBm        | Nominal  |
| Maximum input signal   | 10dBm             | 5dBm           | 10dBm          | For 1% PER, measured as sensitivity                                    |
| RSSI range   | -95 to -10dBm     | -105 to -20dBm | -102 to -17dBm |  |
| RF Port impedance – uFL connector                              | 50 ohm            | 50 ohm         | 50 ohm         | 2.4 - 2.5GHz   |
| Rx Spurious Emissions  | -61dBm            | -69dBm         | -69dBm         | Measured conducted into 50ohms   |
| Tx Spurious Emissions  | -40dBm            | -49dBm         | -45dBm         | Measured conducted into 50ohms   |
| VSWR (max)   | 2:1               | 2:1            | 2:1            | 2.4 - 2.5GHz   |
| Peripherals  |                   |                |                | Notes  |
| Master SPI port  | 3 selects         | 3 selects      | 3 selects      | 250kHz - 16MHz   |
| Slave SPI port   | ✓                 | ✓              | ✓              | 250kHz - 4MHz  |
| Two UARTs  | ✓                 | ✓              | ✓              | 16550 compatible   |
| Two-wire serial I/F (compatible with SMBus & I <sup>2</sup> C) | ✓                 | ✓              | ✓              | Up to 400kHz   |
| 5 x PWM (4 x timer, 1 x timer/counter)                         | ✓                 | ✓              | ✓              | 16MHz clock  |
| Two programmable Sleep Timers                                  | ✓                 | ✓              | ✓              | 32kHz clock  |
| Digital IO lines (multiplexed with UARTs, timers and           | 20                | 18             | 18             | DIO2 & DIO3 not available on JN5168-001-M05 and JN5168-001-M06 modules |

|   |   |   |   |                                |
|---|---|---|---|--------------------------------|
| SPI selects)                                    |   |   |   |                                |
| Four channel Analogue-to-Digital converter      | ✓ | ✓ | ✓ | 10-bit, up to 100ks/s          |
| Programmable analogue comparators               | ✓ | ✓ | ✓ | Ultra low power mode for sleep |
| Internal temperature sensor and battery monitor | ✓ | ✓ | ✓ |                                |

The performance of all peripherals is defined in the JN-DS-JN5168 Wireless Microcontroller Datasheet [2].

Note 1: Sensitivity is defined for conducted measurements on connectorised modules. Modules with an integrated antenna have approximately 1.5 dB less e.i.r.p and reciprocal receive sensitivity.

NXP supplies all the development tools and networking stacks needed to enable end-product development to occur quickly and efficiently. These are all freely available from the NXP Wireless Connectivity TechZone: [www.nxp.com/techzones/wireless-connectivity](http://www.nxp.com/techzones/wireless-connectivity). A range of evaluation/developer kits is also available, allowing products to be quickly bread boarded. Efficient development of software applications is enabled by the provision of a complete, unlimited, software developer kit. Together with the available libraries for the IEEE802.15.4 MAC and the JenNet-IP and ZigBee PRO network stacks, this package provides everything required to develop application code and to trial it with hardware representative of the final module.

The modules can be user programmed both in development and in production using software supplied by NXP. Access to the on-chip peripherals, MAC and network stack software is provided through specific APIs. This information is available on the NXP support website, together with many example applications, user guides, reference manuals and application notes.

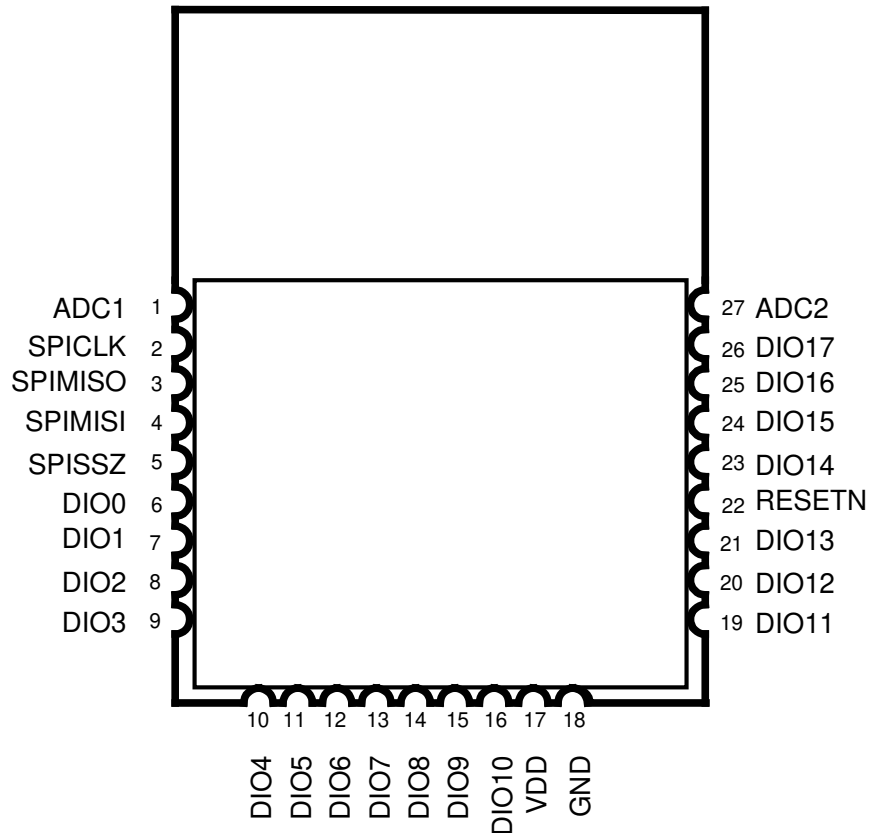
## 2.1. JN5168 Single Chip Wireless Microcontroller

The JN5168-001-My series is constructed around the JN5168-001 single chip wireless microcontroller, which includes the radio system, a 32-bit RISC CPU, Flash, RAM & EEPROM memory and a range of analogue and digital peripherals.

The chip is described fully in JN-DS-JN5168 Wireless Microcontroller Datasheet [2].

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### 3. Pin Configurations



**Figure 1: Pin Configuration (top view)**

Note that the same basic pin configuration applies for all module designs. However, DIO3 (pin 9) and DIO2 (pin 8) are not available on the JN5168-001-M05 and JN5168-001-M06.

## 3.1. Pin Assignment

| Pin No | Pin Functions |                     |            |           |                | Signal Type | Description  |
|--------|---------------|---------------------|------------|-----------|----------------|-------------|--|
|        | Primary       | Alternate Functions |            |           |                |             |  |
| 1      | ADC1          |                     |            |           |                | 3.3V        | Analogue to Digital Input  |
| 2      | SPICLK        |                     |            |           | PWM2           | CMOS        | SPI Master Clock Output or PWM2 Output   |
| 3      | SPIMISO       |                     |            |           |                | CMOS        | SPI Master In Slave Out Input  |
| 4      | SPIMOSI       |                     |            |           | PWM3           | CMOS        | SPI Master In Slave Out Input or PWM3 Output   |
| 5      | SPISEL0       |                     |            |           |                | CMSO        | SPI Select From Module – SS0 Output  |
| 6      | DIO0          | SPISEL1             | ADC3       |           |                | CMOS        | DIO0, SPI Master Select Output 1 or ADC input 3  |
| 7      | DIO1          | SPISEL2             | ADC4       | PC0       |                | CMOS        | DIO1, SPI Master Select Output 2, ADC input 4 or Pulse Counter 0 Input   |
| 8      | DIO2*         |                     | RFRX       | TIM0CK_GT |                | CMOS        | DIO2, Radio Receive Control Output or Timer0 Clock/Gate Input  |
| 9      | DIO3*         |                     | RFTX       | TIM0CAP   |                | CMOS        | DIO3, Radio Transmit Control Output or Timer0 Capture Input  |
| 10     | DIO4          | CTS0                | JTAG_TCK   | TIM0OUT   | PC0            | CMOS        | DIO4, UART 0 Clear To Send Input, JTAG CLK Input, Timer0 PWM Output, or Pulse Counter 0 input  |
| 11     | DIO5          | RTS0                | JTAG_TMS   | PWM1      | PC1            | CMOS        | DIO5, UART 0 Request To Send Output, JTAG Mode Select Input, PWM1 Output or Pulse Counter 1 Input  |
| 12     | DIO6          | TXD0                | JTAG_TDO   | PWM2      |                | CMOS        | DIO6, UART 0 Transmit Data Output, JTAG Data Output or PWM2 Output   |
| 13     | DIO7          | RXD0                | JTAG_TDI   | PWM3      |                | CMOS        | DIO7, UART 0 Receive Data Input, JTAG Data Input or PWM 3 Output   |
| 14     | DIO8          | TIM0CK_GT           | PC1        | PWM4      |                | CMOS        | DIO8, Timer0 Clock/Gate Input, Pulse Counter1 Input or PWM 4 Output  |
| 15     | DIO9          | TIM0CAP             | 32KXTALIN  | RXD1      | 32KIN          | CMOS        | DIO9, Timer0 Capture Input, 32K External Crystal Input, UART 1 Receive Data Input or 32K external clock Input                                    |
| 16     | DIO10         | TIM0OUT             | 32KXTALOUT |           |                | CMOS        | DIO10, Timer0 PWM Output or 32K External Crystal Output  |
| 17     | VDD           |                     |            |           |                | 3.3V        | Supply Voltage   |
| 18     | GND           |                     |            |           |                | 0V          | Digital Ground   |
| 19     | DIO11         | PWM1                |            | TXD1      |                | CMOS        | DIO11, PWM1 Output or UART 1 Transmit Data Output  |
| 20     | DIO12         | PWM2                | CTS0       | JTAG_TCK  | ADO or SPIMOSI | CMOS        | DIO12, PWM2 Output, UART 0 Clear To Send Input, JTAG CLK Input, Antenna Diversity Odd Output or SPI Slave Master Out Slave In Input              |
| 21     | DIO13         | PWM3                | RTS0       | JTAG_TMS  | ADE or SPIMISO | CMOS        | DIO13, PWM3 Output, UART 0 Request To Send Output, JTAG Mode Select Input, Antenna Diversity Even output or SPI Slave Master In Slave Out Output |
| 22     | RESETN        |                     |            |           |                | CMOS        | Reset input  |
| 23     | DIO14         | SIF_CLK             | TXD0 TXD1  | JTAG_TDO  | SPISEL1 or     | CMOS        | DIO14, Serial Interface Clock,   |

|    |       |        |           |          |         |      |  |
|----|-------|--------|-----------|----------|---------|------|--|
|    |       |        |           |          | SPISEL  |      | UART 0 Transmit Data Output, UART 1 Transmit Data Output, JTAG Data Output, SPI Master Select Output 1 or SPI Slave Select Input |
| 24 | DIO15 | SIF_D  | RXD0 RXD1 | JTAG_TDI | SPISEL2 | CMOS | DIO15, Serial Interface Data or Intelligent Peripheral Data Out  |
| 25 | DIO16 | COMP1P | SIF_CLK   | SPISMOSI |         | CMOS | DIO16, Comparator Positive Input, Serial Interface clock or SPI Slave Master Out Slave In Input                                  |
| 26 | DIO17 | COMP1M | PWM4      | I2C DATA | SPISIMO | CMOS | DIO17, Comparator Negative Input, Serial Interface Data or SPI Slave Master In Slave Out Output                                  |
| 27 | ADC2  |        |           |          |         | 3.3V | Analogue to Digital Input  |

\* These two pins are not connected for JN5168-001-M05 & JN5168-001-M06 modules.

## 3.2. Pin Descriptions

All pins behave as described in the JN-DS-JN5168 Wireless Microcontroller Datasheet [2], with the exception of the following:

### 3.2.1 Power Supplies

A single power supply pin, VDD is provided.



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## 4. Electrical Characteristics

In most cases, the Electrical Characteristics are the same for both module and chip. They are described in detail in the chip datasheet. Where there are differences, they are detailed below.

### 4.1. Maximum Ratings

Exceeding these conditions will result in damage to the device.

| Parameter                 | Min   | Max        |
|---------------------------|-------|------------|
| Device supply voltage VDD | -0.3V | 3.6V       |
| All Pins                  | -0.3V | VDD + 0.3V |
| Storage temperature       | -40°C | 150°C      |

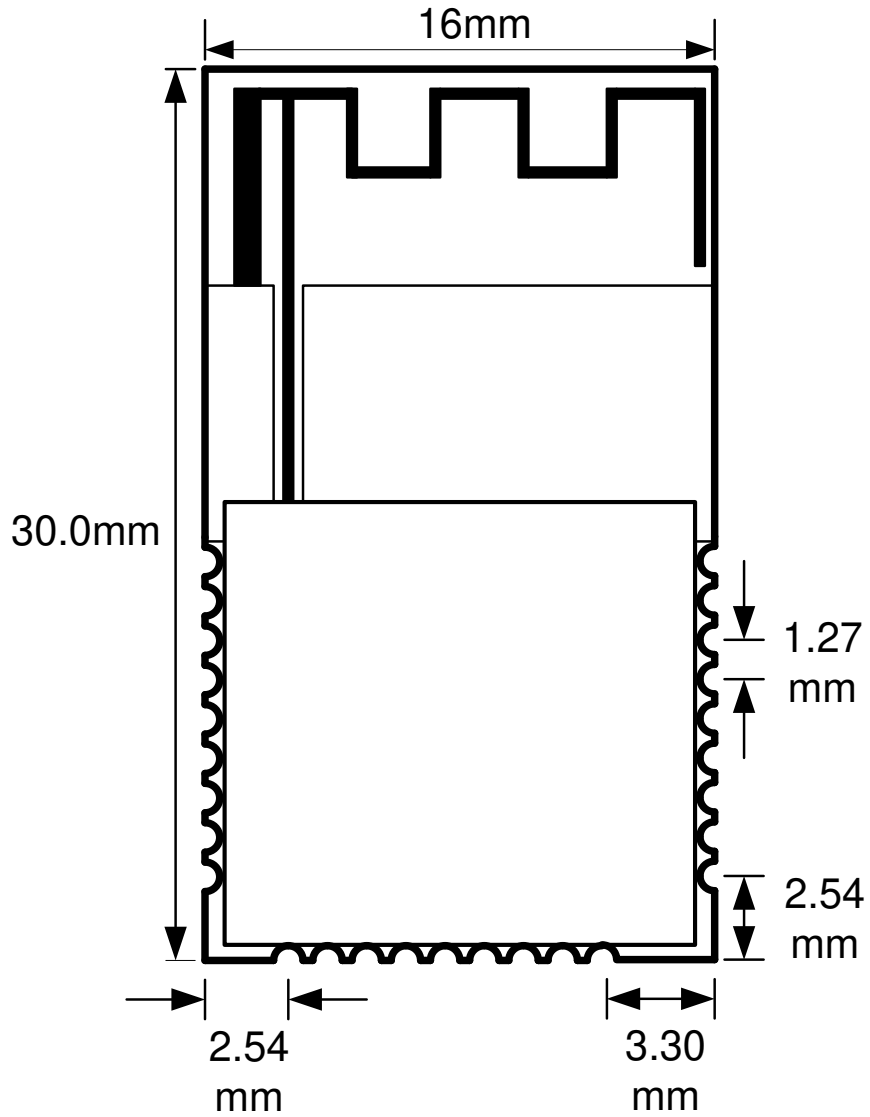
### 4.2. Operating Conditions

| Supply                    | Min   | Max  |
|---------------------------|-------|------|
| VDD                       | 2.0V  | 3.6V |
| Ambient temperature range | -40°C | 85°C |

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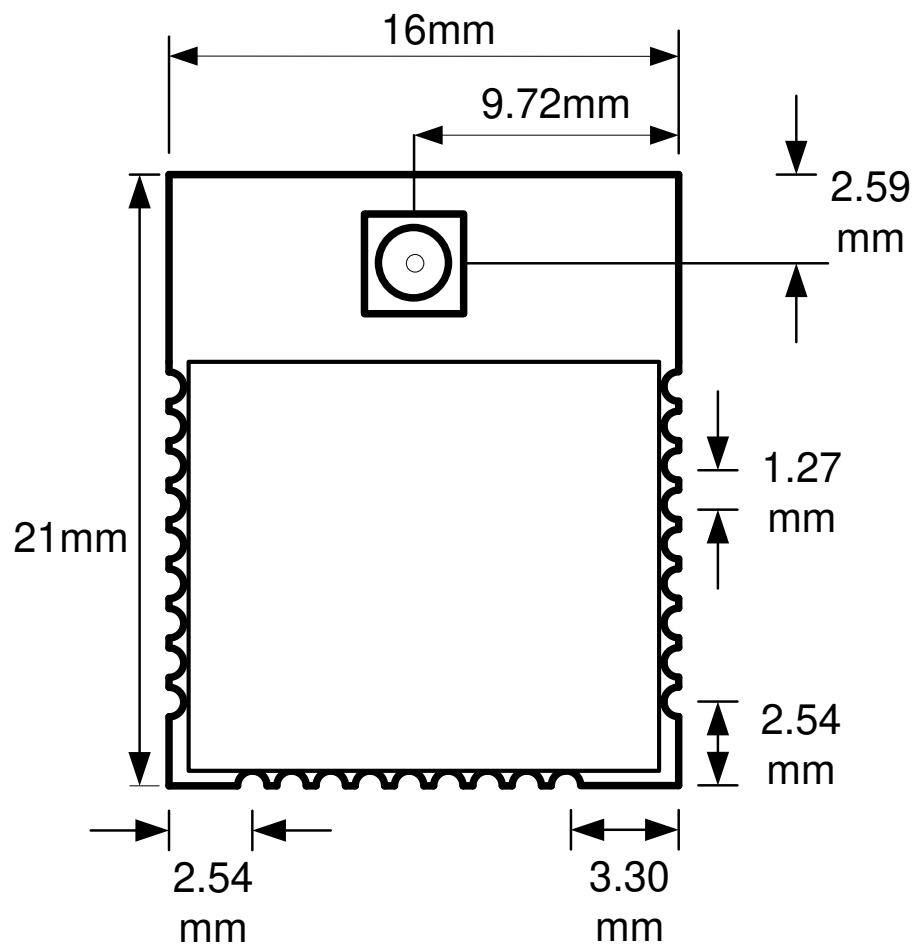
## Appendix A Additional Information

### A.1 Outline Drawing



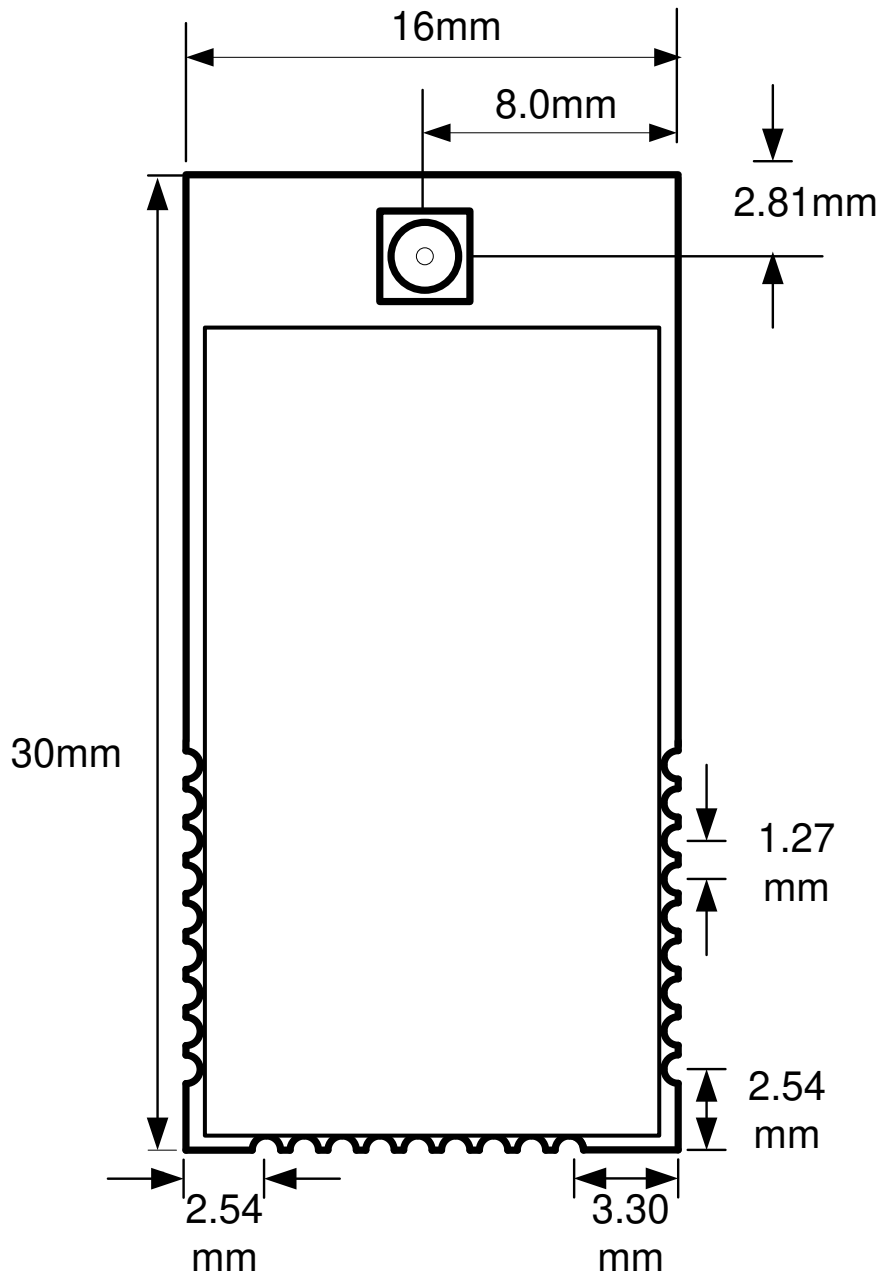
Thickness: 3.5mm

**Figure 2** JN5168-001-M00 Outline Drawing



Thickness: 3.5mm

**Figure 3** JN5168-001-M03 Outline Drawing

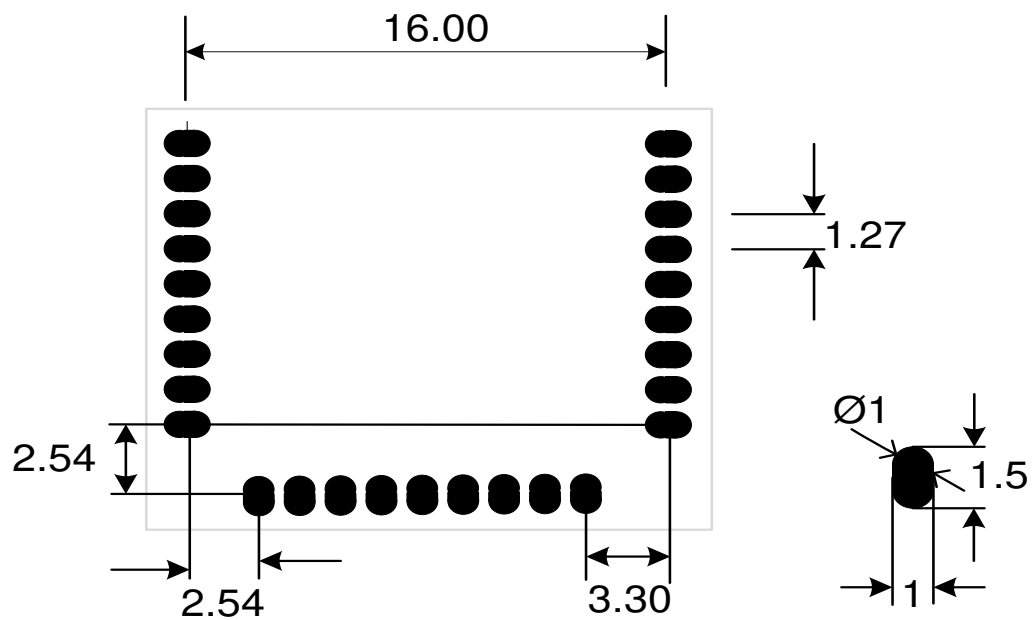


Thickness: 3.5mm

Figure 4 JN5168-001-M05 and JN5168-001-M06 Outline Drawing

## A.2 Module PCB Footprint

All dimensions are in mm.



Note: All modules have the same footprint

Figure 5 Module PCB footprint

### A.3 Optimal PCB placement of the JN5168-001-M00 Module

The JN5168-001-M00 module features an optimised, low cost, integrated, inverted F, printed PCB antenna. The antenna has a vertically polarised near omnidirectional radiation pattern and up to 1.6 dBi of peak gain. The PCB design has been elongated in order to increase the ground plane area which increases the antenna efficiency. This allows stand alone operation without any additional ground plane however care must be taken when mounting this module onto another PCB. The area around the antenna must be kept clear of conductors or other metal objects for an absolute minimum of 20 mm. This is true for all layers of the PCB and not just the top layer. Any conductive objects close to the antenna could severely disrupt the antenna pattern resulting in deep nulls and high directivity in some directions.

The diagrams below show various possible scenarios. The top 3 scenarios are correct; groundplane may be placed beneath JN5168-001-M00 module as long as it does not protrude beyond the edge of the top layer ground plane on the module PCB.

The bottom 3 scenarios are incorrect; the left hand side example because there is groundplane underneath the antenna, the middle example because there is insufficient clearance around the antenna (it is best to have no conductors anywhere near the antenna), finally the right hand example has a battery's metal casing in the recommended keep out area.

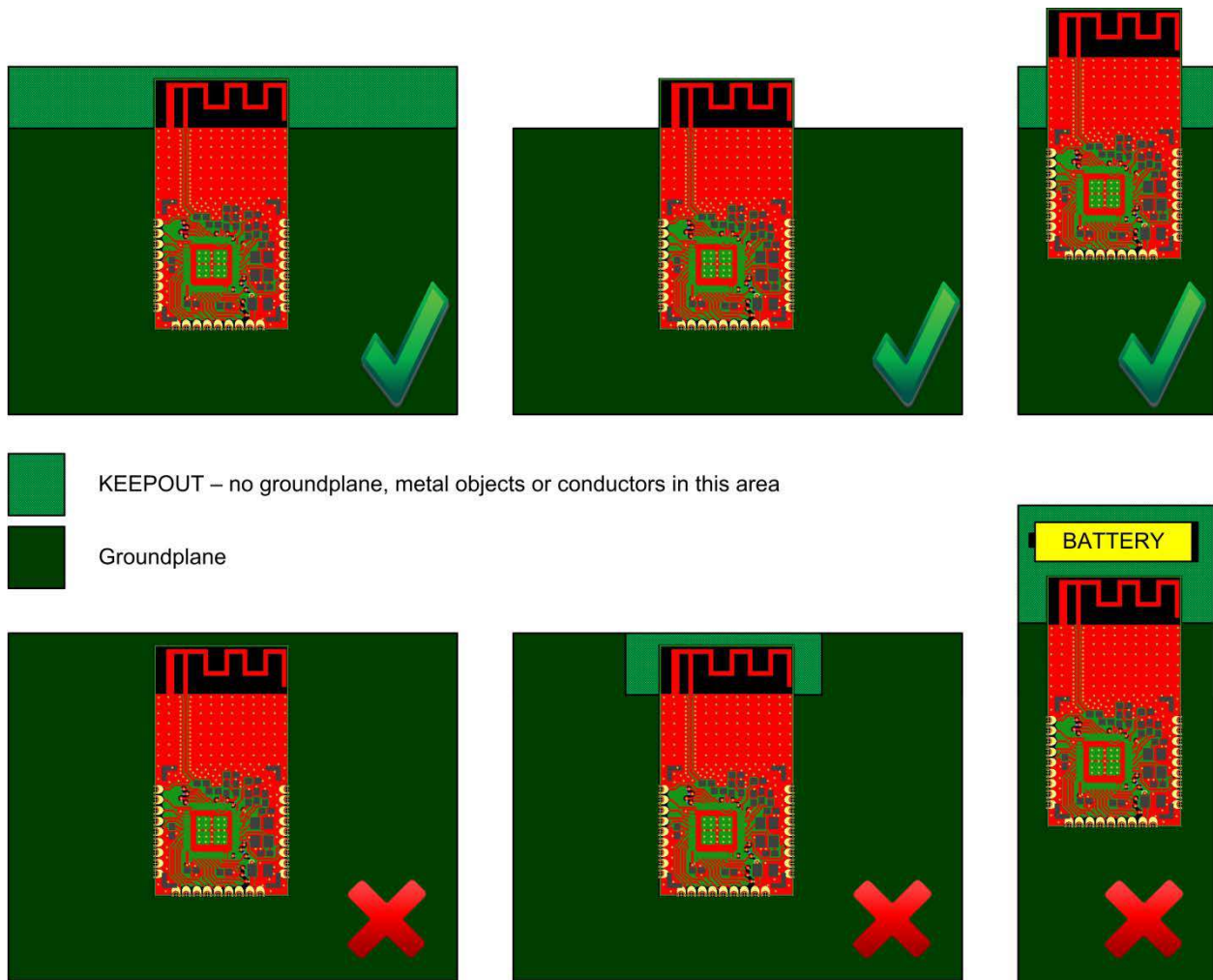
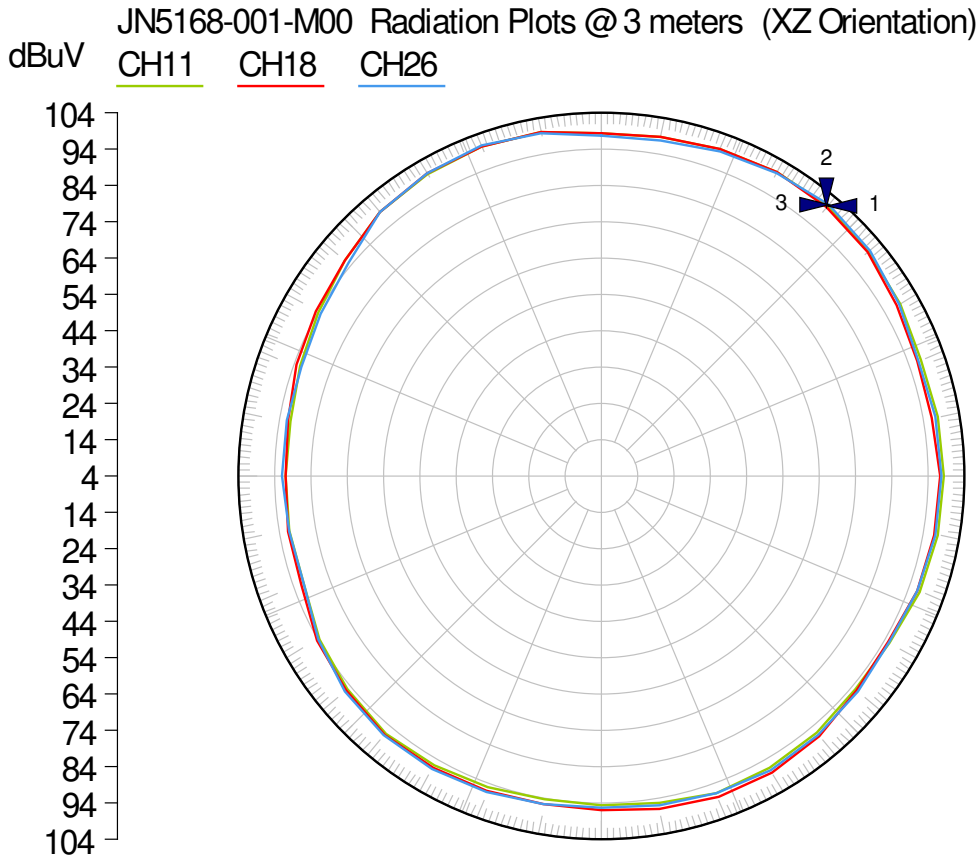


Figure 6 PCB placement of the JN5168-001-M00 Module

## A.4 JN5168-001-M00 Antenna Radiation Pattern

Figure 7, Figure 8 & Figure 9 are simulated 3D radiation plots of the JN5168-001-M00. They are provided here to help the user orientate the module in end equipment in an optimal way. These visualisations are an accurate representation of the antenna radiation pattern in the 3D space.

The 2D XZ plots for each channel are shown in



| Mkr | Trace | X-Axis   | Value       |
|-----|-------|----------|-------------|
| 1 ▼ | CH11  | 40.0 deg | 101.04 dBuV |
| 2 ▼ | CH18  | 40.0 deg | 100.67 dBuV |
| 3 ▼ | CH26  | 40.0 deg | 101.26 dBuV |

Figure 10. These are actual measurements in an anechoic chamber with the JN5168-001-M00 mounted on a DR1174 carrier board from the JN516x-EK001 Evaluation kit. The device under test and the antenna height was 1m and the values are in dBuV/m at a distance of 3m.

Figure 11 is a plot of the peak field strengths for a JN5168-001-M00, JN5148-001-M00 and JN5168-001-M03. The M03 is used with a  $\lambda/2$  vertical antenna. Figure 11 shows that the new integrated antenna is 1.5-3dB better than the JN5148-001-M00 and is within 1.5 dB of a JN5168-001-M03  $\lambda/2$  vertical.

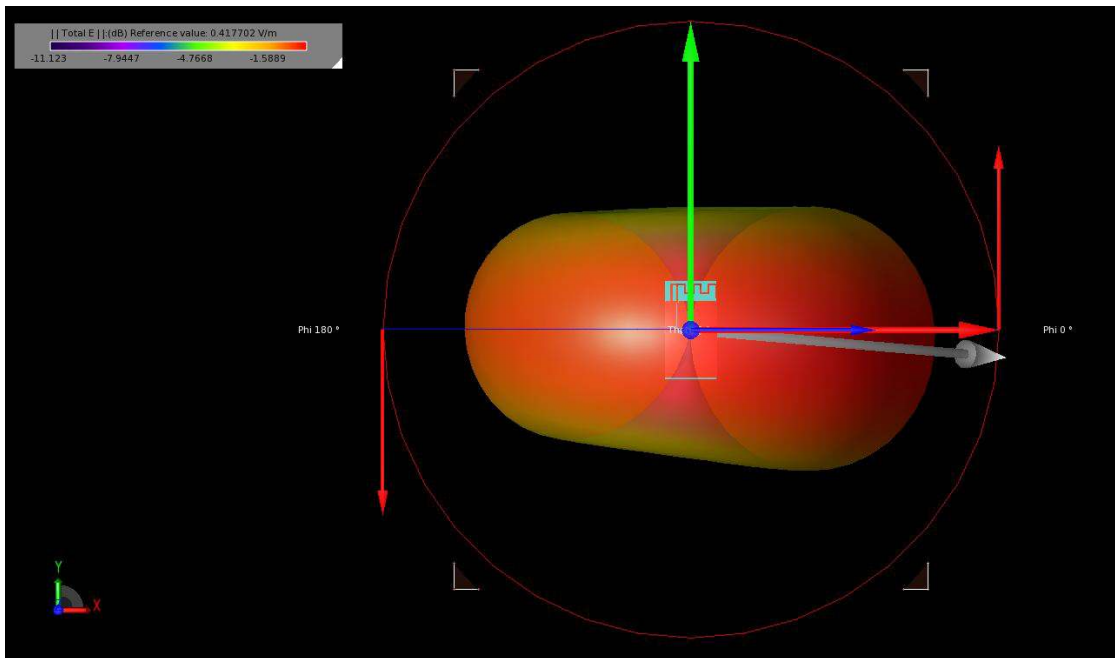


Figure 7: 3D radiation plot JN5168-001-M00 XY Orientation (simulation)

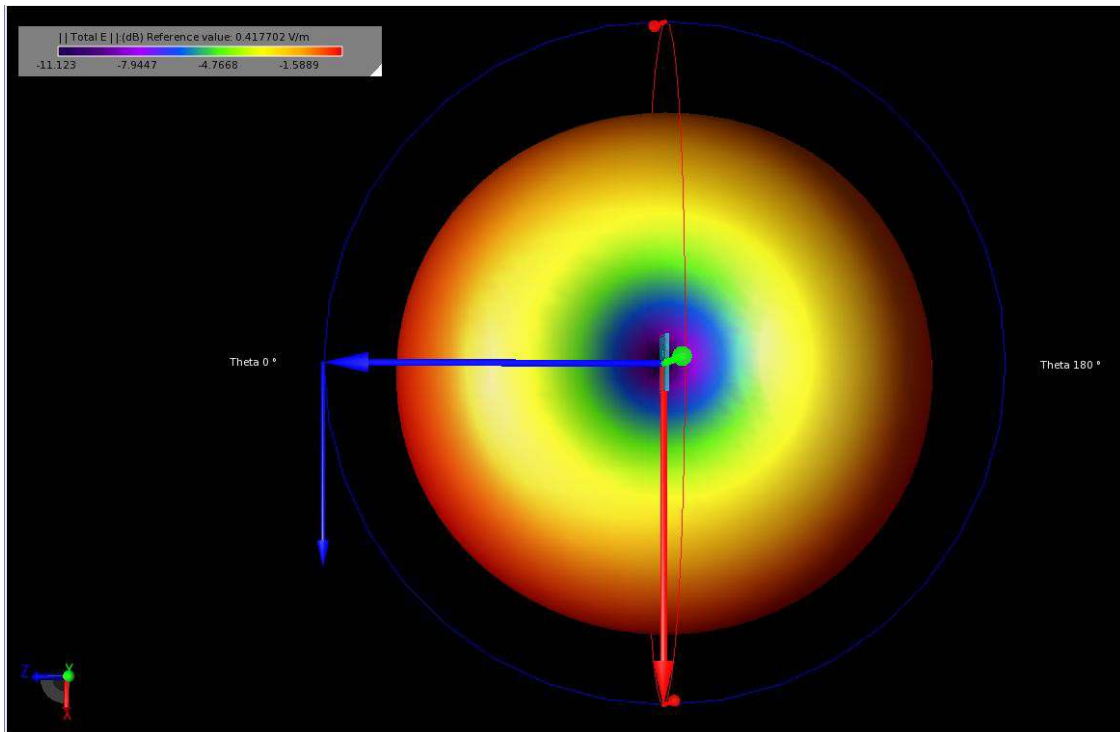


Figure 8: 3D radiation plot JN5168-001-M00 XZ Orientation (simulation)



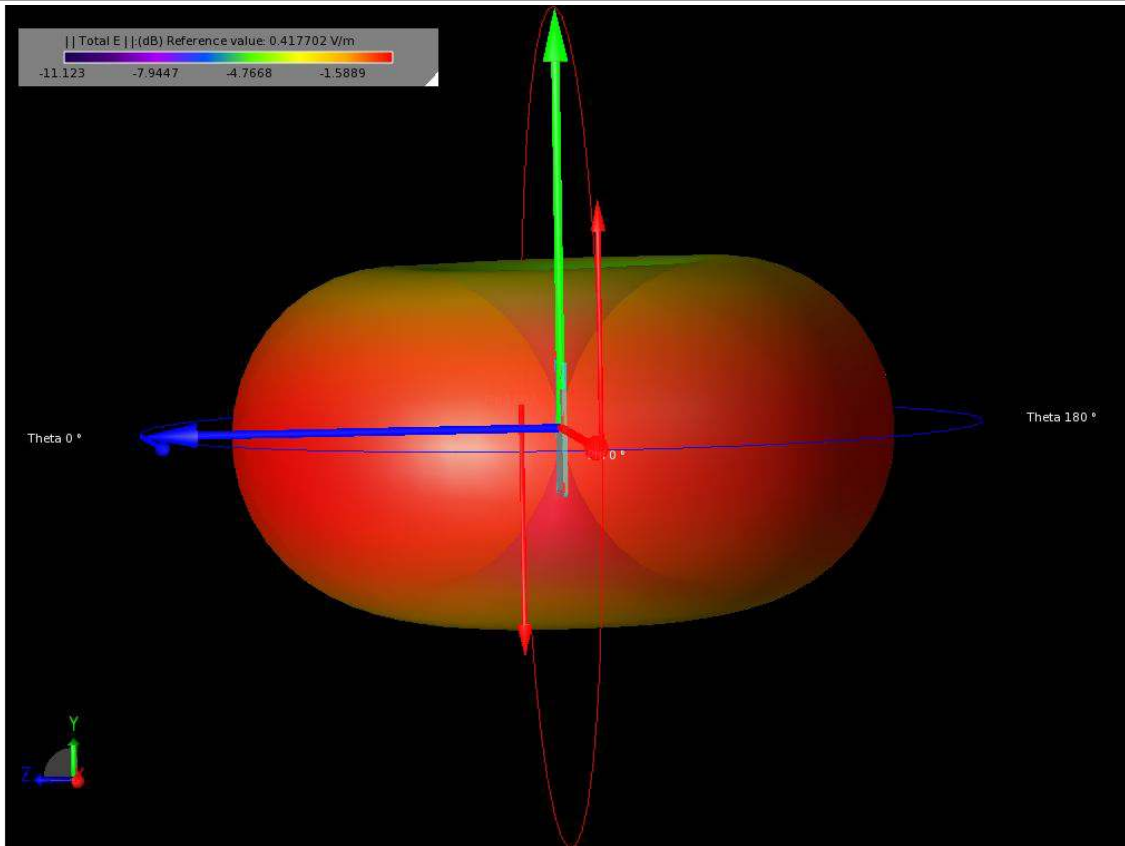
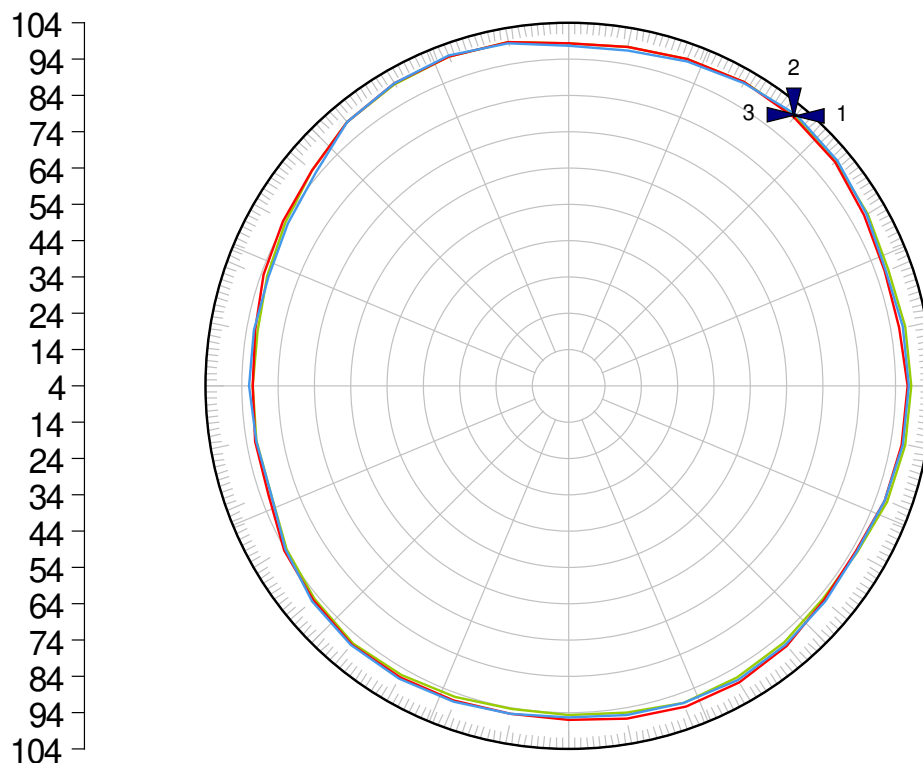


Figure 9: 3D radiation plot JN5168-001-M00 YZ Orientation (simulation)

JN5168-001-M00 Radiation Plots @ 3 meters (XZ Orientation)

dBuV CH11 CH18 CH26



| Mkr | Trace | X-Axis   | Value       |
|-----|-------|----------|-------------|
| 1 ▼ | CH11  | 40.0 deg | 101.04 dBuV |
| 2 ▼ | CH18  | 40.0 deg | 100.67 dBuV |
| 3 ▼ | CH26  | 40.0 deg | 101.26 dBuV |

Figure 10: Actual radiation plot of JN5168-001-M00 Mounted on a carrier PCB – XZ orientation

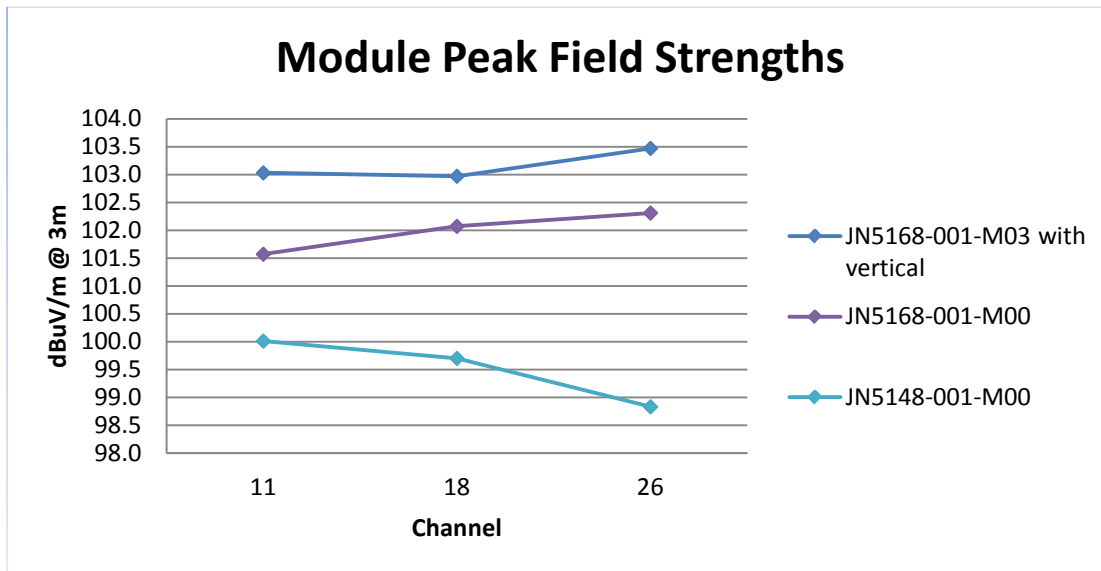
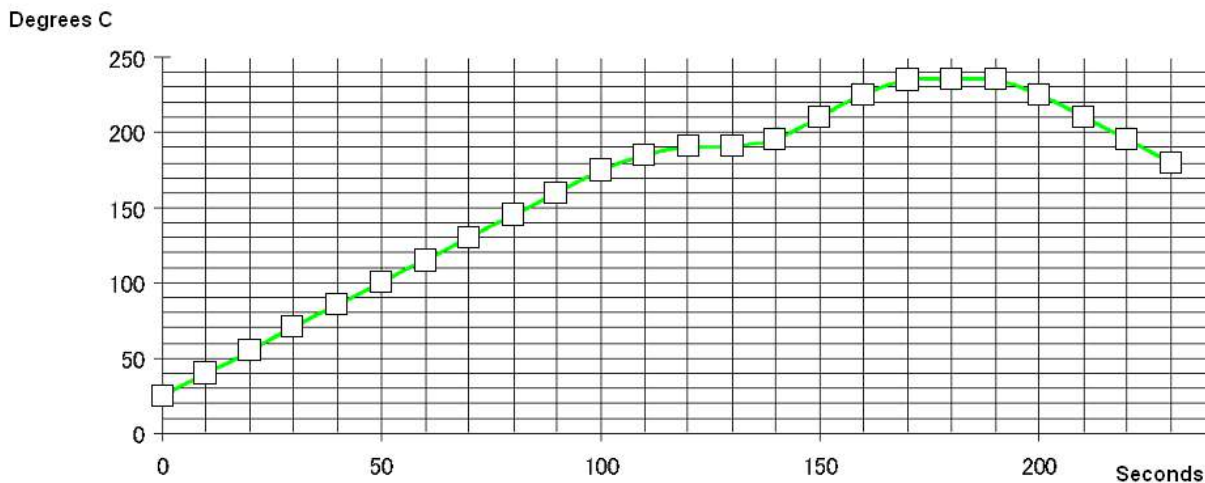


Figure 11: Peak Field Strengths for various modules optimised for height and azimuth

## A.5 Manufacturing

### A.5.1 Reflow Profile

For reflow soldering, it is recommended to follow the reflow profile in figure 6 as a guide, as well as the paste manufacturer's guidelines on peak flow temperature, soak times, time above liquid and ramp rates.



| Temperature     | 25~160 °C | 160~190 °C | > 220° C | 230~Pk. | Pk. Temp (235°C) |
|-----------------|-----------|------------|----------|---------|------------------|
| Target Time (s) | 90~130    | 30~60      | 20~50    | 10~15   | 150~270          |

Figure 12: Recommended solder reflow profile

## A.5.2 Soldering Paste and Cleaning

NXP does not recommend use of a solder paste that requires the module and PCB assembly to be cleaned (rinsed in water) for the following reasons:

Solder flux residues and water can be trapped by the PCB, can or components and result in short circuits.

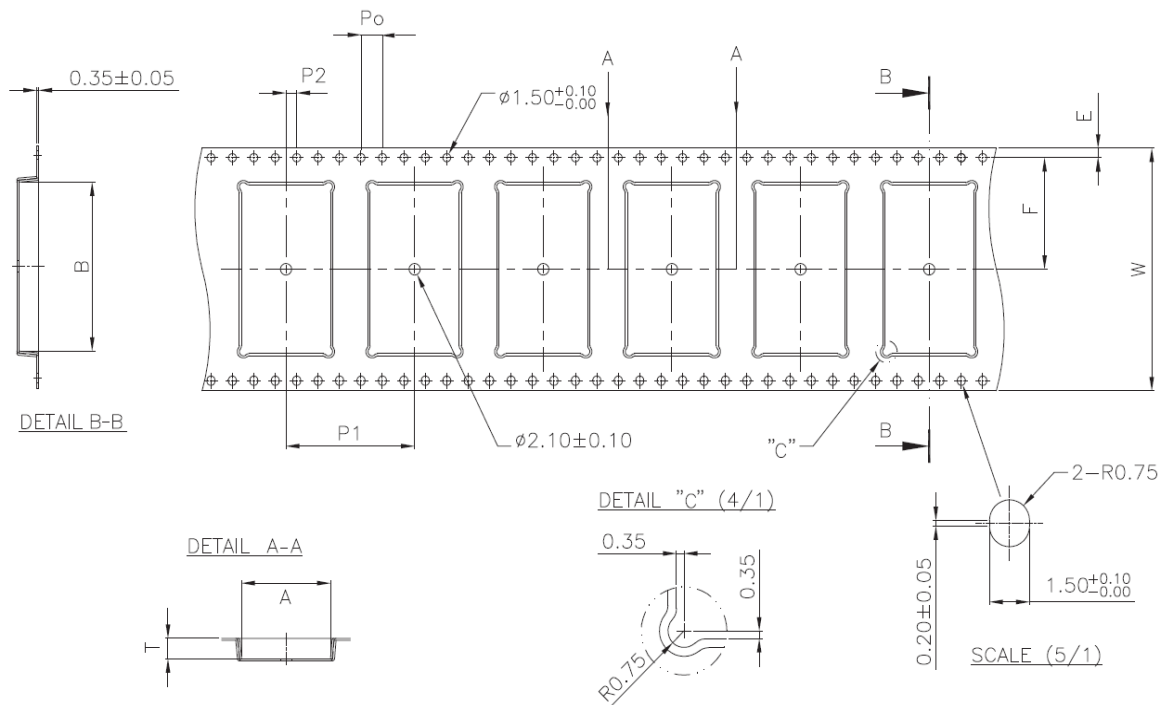
The module label could be damaged or removed.

NXP recommends use of a 'no clean' solder paste for all its module products.

## A.6 Tape and Reel Information:

### A.6.1 Tape Orientation and dimensions

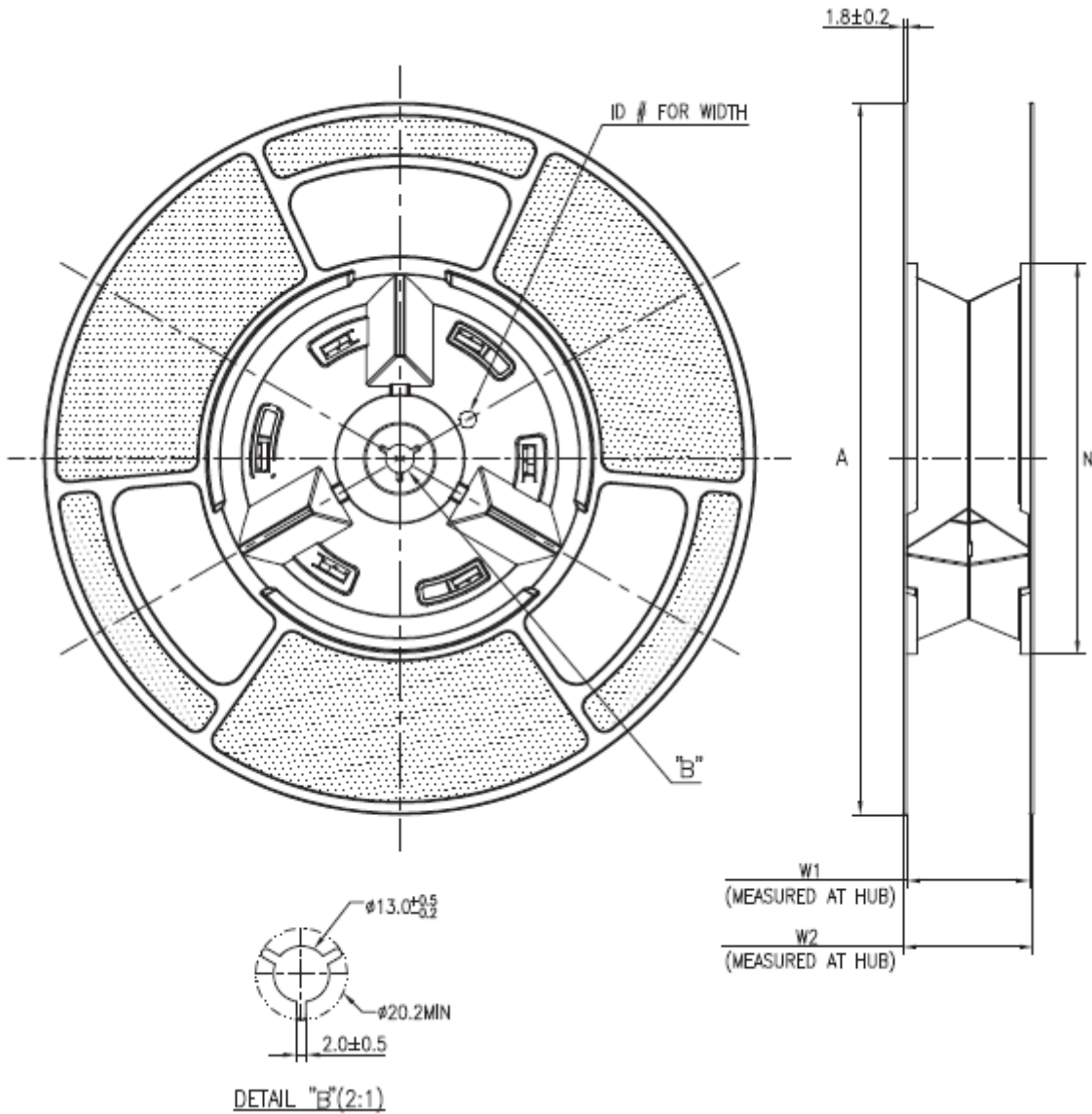
All dimensions are in mm



| Module type:   | A    | B    | W    | F     | E    | P0   | P1   | P2    | T    | Cover Tape width (W) |
|----------------|------|------|------|-------|------|------|------|-------|------|----------------------|
| JN5168-001-M00 | 16.6 | 30.6 | 44   | 20.2  | 1.75 | 4.0  | 24.0 | 2.0   | 3.7  | 44.0                 |
| JN5168-001-M03 | 16.6 | 21.6 | 32   | 14.2  | 1.75 | 4.0  | 24.0 | 2.0   | 3.7  | 32.0                 |
| JN5168-001-M05 | 16.6 | 30.6 | 44   | 20.2  | 1.75 | 4.0  | 24.0 | 2.0   | 3.7  | 44.0                 |
| JN5168-001-M06 | 16.6 | 30.6 | 44   | 20.2  | 1.75 | 4.0  | 24.0 | 2.0   | 3.7  | 44.0                 |
| Tolerance      | ±0.1 | ±0.1 | ±0.3 | ±0.15 | +0.1 | ±0.1 | ±0.1 | ±0.15 | ±0.1 | ±0.3                 |

## A.6.2 Reel Dimensions:

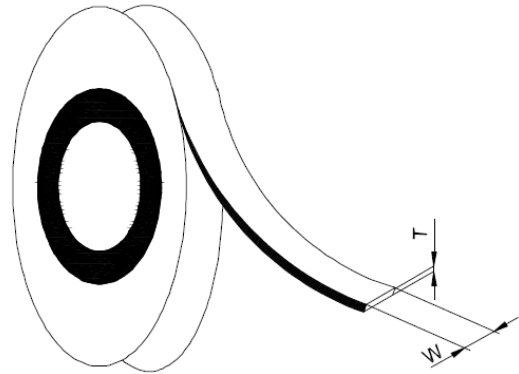
All dimensions are in mm.



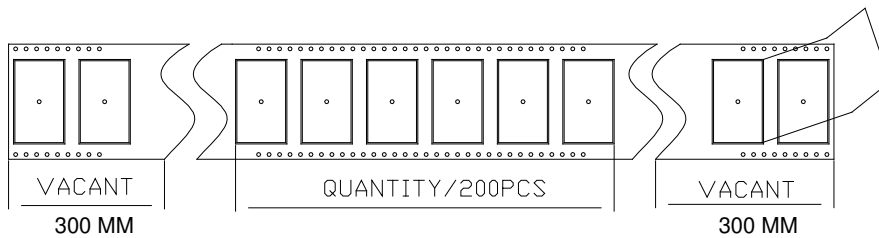
| Module type:     | A             | B             | N               | W1               | W2 (Max) |
|------------------|---------------|---------------|-----------------|------------------|----------|
| JN5168-M03       | $330 \pm 2.0$ | $2.0 \pm 0.5$ | $181.3 \pm 0.2$ | $33.0 +1.4/-0.6$ | 38.4     |
| JN5168-M00/05/06 | $330 \pm 2.0$ | $2.0 \pm 0.5$ | $181.3 \pm 0.2$ | $45.0 +1.4/-0.6$ | 50.4     |

### A.6.3 Cover tape details

|                                      |   |
|--------------------------------------|---|
| Thickness (T) – JN5168 M03           | 0.048 ± 0.005mm                             |
| Thickness (T) – JN5168 M00/M05/M06   | 0.048 ± 0.005mm                             |
| Width (W) – JN5168 M03               | 26.0 ± 0.1mm                                |
| Width (W) – JN5168 M00/M05/M06       | 37.5 ± 0.1mm                                |
| Surface resistivity (component side) | 10 <sup>5</sup> to 10 <sup>11</sup> Ohms/sq |
| Surface resistivity (component side) | Non-conductive                              |
| Backing type:                        | Polyester                                   |
| Adhesive type:                       | PSA   |
| Sealing:                             | Room ambient                                |



### A.6.4 Leader and Trailer



### A.7 Related Documents

- [1] IEEE Std 802.15.4-2003 IEEE Standard for Information Technology – Part 15.4 Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (LR-WPANs)
- [2] JN-DS-JN5168 Wireless Microcontroller Datasheet

## A.8 Ordering Information

### Ordering Code Format:

JN5168 - 001 – MYY

#### Module Type (YY)

|    |                                  |
|----|----------------------------------|
| 00 | Standard Power, Integral antenna |
| 03 | Standard Power, uFl connector    |
| 05 | Medium Power, uFL connector      |
| 06 | High Power, uFl connector        |

Where this Data Sheet is denoted as “Advanced” or “Preliminary”, devices will be either Engineering Samples or Prototypes.

| Part Number    | Description                            |
|----------------|--|
| JN5168-001-M00 | Shipped in tape mounted 400 piece reel |
| JN5168-001-M03 |  |
| JN5168-001-M05 |  |
| JN5168-001-M06 |  |



| Line | Content    | Format             | Options   | Sample   |
|------|------------|--------------------|---|--|
| 1    | NXP Logo   | B&W outline logo   |  | <br><b>JN5168-001-M00</b><br>ZSDYWW NNNNN<br><br>FCC ID:TYOJN5168M0<br>IC:7438A-CYO5168M0 |
| 2    | Part ID    | JN5168-001-M0x     | x is module type, 0, 3, 5 or 6  |  |
| 3    |            |                    | Z SSMC  |  |
|      |            |                    | S APK   |  |
|      |            |                    | D RoHs Compliant  |  |
|      |            |                    | Y Year  |  |
|      |            |                    | WW Week   |  |
| 3    | Serial No. | NNNNN              | Serial number from test   |  |
| 5    | FCC ID     | FCCID:TYOJN5168Mx  | x is module type 0,3,5 or 6   |  |
| 6    | IC ID      | IC:7438A-CYO5168Mx | x is module type 0,3,5 or 6   |  |

Figure 13: Example module labelling

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## A.9 Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one 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.

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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

### **WARNING!**

#### **FCC Radiation Exposure Statement:**

This portable equipment with its antenna complies with FCC's RF radiation exposure limits set forth for an uncontrolled environment. To maintain compliance follow the instructions below;

1. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
2. Avoid direct contact to the antenna, or keep it to a minimum while using this equipment.

**This transmitter module is authorized to be used in other devices only by OEM integrators under the following condition:**

The transmitter module must not be co-located with any other antenna or transmitter.

As long as the above condition is met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

This applies to the JN5168-001-M00, JN5168-001-M03 and JN5168-001-M05 devices, the JN5168-001-M06 is a mobile device (see section A.9.2)



## A.9.1 Antennas approved by FCC for use with JN5168 modules

|    | Brand                    | Model Number      | Description                      | Gain (dBi) | Connector type |
|----|--------------------------|-------------------|----------------------------------|------------|----------------|
| 1  | Antenna Factor           | ANT-2.4-CW-RCT-RP | Vertical - knuckle antenna       | 2.2        | RP-SMA         |
| 2  | Antennova                | 2010B6090-01      | Vertical - knuckle antenna       | 2.2        | RP-SMA         |
| 3  | Hyperlink Technology     | HG2402RD-RSF      | Vertical - knuckle antenna       | 2.2        | RP-SMA         |
| 4  | Aveslink Technology, Inc | E-0005-AC         | Vertical- flying lead            | 2          | RP-SMA         |
| 5  | Aveslink Technology, Inc | E-2411-GC         | Vertical - swivel                | 2          | RP-SMA         |
| 6  | Aveslink Technology, Inc | E-2410-CA         | Vertical - bulkhead- flying lead | 2          | uFL            |
| 7  | Aveslink Technology, Inc | E-2410-GC         | Vertical - swivel                | 2          | RP-SMA         |
| 8  | Aveslink Technology, Inc | E-2820-CA         | Vertical - bulkhead- flying lead | 2          | uFL            |
| 9  | Aveslink Technology, Inc | E-2820-GC         | Vertical - swivel                | 2          | RP-SMA         |
| 10 | Embedded Antenna Design  | FBKR35068-RS-KR   | Vertical - knuckle antenna       | 2          | RP-SMA         |
| 11 | Nearson                  | S131CL-L-PX-2450S | Vertical - knuckle-flying lead   | 2          | uFL            |
| 12 | Laird Technologies       | WRR2400-IP04      | Vertical - knuckle-flying lead   | 1.5        | uFL            |
| 13 | Laird Technologies       | WRR2400-RPSMA     | Vertical - knuckle-flying lead   | 1.3        | RP-SMA         |
| 14 | Aveslink Technology, Inc | E-6170-DA         | Vertical - right angle           | 1          | uFL            |
| 15 | Laird Technologies       | WCR2400-SMRP      | Vertical - knuckle antenna       | 1          | RP-SMA         |

This device has been designed to operate with the antennas listed above, and having a maximum gain of 2.2 dBi. Alternative vertical antennas may be used provided that the gain does not exceed 2.2 dBi. Antennas having a gain greater than 2.2 dBi are strictly prohibited for use with this device.

The required antenna impedance is 50 ohms.

## A.9.2 High Power Module usage limitation

The high power module variants are classified as 'mobile' device pursuant with FCC § 2.1091 and **must not** be used at a distance of < 20 cm (8") from any people. This applies to the JN5168-001-M06 module type (TYOJN5168M6).

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

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user manual of the end product.

The user manual for the end product must include the following information in a prominent location;

"To comply with FCC's RF radiation exposure requirements, the antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter."

## A.9.3 FCC End Product Labelling

The final 'end product' should be labelled in a visible area with the following:

"Contains TX FCC ID: TYOJN5168M0, TYOJN5168M3, TYOJN5168M5 or TYOJN5168M6" to reflect the version of the module being used inside the product.

## A.10 Industry Canada Statement

|  |   |
|--|---|
| <p><i>This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.</i></p> | <p><i>Le présent appareil est conforme aux CNR 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.</i></p> |
|--|---|

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropic radiated power (e.i.r.p.) is not more than that permitted for successful communication.

These modules have been designed to operate with antennas having a maximum gain of 2.2 dBi. Antennas having a gain greater than 2.2 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

As long as the above condition is met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc).

### A.10.1 Industry Canada End Product Labelling

For Industry Canada purposes the following should be used.

"Contains Industry Canada ID IC: 7438A-CYO5168M0, IC: 7438A-CYO5168M3, IC: 7438A-CYO5168M5 or IC: 7438A-CYO5168M6" to reflect the version of the module being used inside the product.

## A.11 European R & TTE Directive 1999/5/EC Statement

All modules listed in this datasheet with the exception of the JN5168-001-M06 are compliant with ETSI EN 300 328 V1.7.1 (2006-10), EMC, EN 301 489-17 v2.1.1 (2009-02) and the Basic Safety Assessment (BSA) EN 60950-1:2006 (2006-06) and are subject to a Notified Body Opinion.

The modules are approved for use with the antennas listed in the following table. The JN5168-001-M06 module is not approved for use in Europe, instead use the JN5168-001-M05 which produces the maximum permitted power.

Alternative vertical antennas may be used provided that the gain does not exceed 2.2 dBi.

|    | Brand                    | Model Number       | Description                      | Gain (dBi) | Connector type |
|----|--------------------------|--------------------|----------------------------------|------------|----------------|
| 1  | Antenna Factor           | ANT-2.4-CW-RCT-SMA | Vertical - knuckle antenna       | 2.2        | SMA            |
| 2  | Antennova                | B6090              | Vertical - knuckle antenna       | 2.2        | RP-SMA         |
| 3  | Hyperlink Technology     | HG2402RD-RSF       | Vertical - knuckle antenna       | 2.2        | RP-SMA         |
| 4  | Aveslink Technology, Inc | E-0005-AC          | Vertical- flying lead            | 2          | RP-SMA         |
| 5  | Aveslink Technology, Inc | E-2411-GC          | Vertical - swivel                | 2          | RP-SMA         |
| 6  | Aveslink Technology, Inc | E-2410-CA          | Vertical - bulkhead- flying lead | 2          | uFL            |
| 7  | Aveslink Technology, Inc | E-2410-GC          | Vertical - swivel                | 2          | RP-SMA         |
| 8  | Aveslink Technology, Inc | E-2820-CA          | Vertical - bulkhead- flying lead | 2          | uFL            |
| 9  | Aveslink Technology, Inc | E-2820-GC          | Vertical - swivel                | 2          | RP-SMA         |
| 10 | Embedded Antenna Design  | FBKR35068-RS-KR    | Vertical - knuckle antenna       | 2          | RP-SMA         |
| 11 | Nearson                  | S131CL-L-PX-2450S  | Vertical - knuckle-flying lead   | 2          | uFL            |
| 12 | Laird Technologies       | WRR2400-IP04       | Vertical - knuckle-flying lead   | 1.5        | uFL            |
| 13 | Laird Technologies       | WRR2400-RPSMA      | Vertical - knuckle-flying lead   | 1.3        | RP-SMA         |
| 14 | Aveslink Technology, Inc | E-6170-DA          | Vertical - right angle           | 1          | uFL            |
| 15 | Laird Technologies       | WCR2400-SMRP       | Vertical - knuckle antenna       | 1          | RP-SMA         |

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## A.12 RoHS Compliance

JN5168-001-My modules meet the requirements of Directive 2002/95/EC of the European Parliament and of the Council on the Restriction of Hazardous Substance (RoHS) and of the Chinese RoHS requirements SJ/T11363-2006 which came into force on 1<sup>st</sup> March 2007.

## A.13 Status Information

The status of this Data Sheet is **Preliminary**.  
NXP products progress according to the following format:

### Advanced

The Data Sheet shows the specification of a product in planning or in development.  
The functionality and electrical performance specifications are target values and may be used as a guide to the final specification.  
NXP reserves the right to make changes to the product specification at anytime without notice.

### Preliminary

The Data Sheet shows the specification of a product that is commercially available, but is not yet fully qualified.  
The functionality of the product is final. The electrical performance specifications are target values and may be used as a guide to the final specification. NXP reserves the right to make changes to the product specification at anytime without notice.

### Production

This is the production Data Sheet for the product.  
All functional and electrical performance specifications, where included, including min and max values are derived from detailed product characterization.  
This Data Sheet supersedes all previous document versions.  
NXP reserves the right to make changes to the product specification at anytime.

## A.14 Disclaimers

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## Version Control

| Version | Notes   |
|---------|---|
| 1.0     | Initial release   |
| 1.1     | Additional clarification of RF exposure conditions added to FCC Section A8 and minor corrections made |
| 1.2     | Revision of key parameters. Module footprint dimension updated  |
| 1.3     | Tape and reel information added   |

**NXP Laboratories UK Ltd**

Furnival Street  
Sheffield  
S1 4QT  
United Kingdom

Tel: +44 (0)114 281 2655  
Fax: +44 (0) 114 281 2951

For the contact details of your local NXP office or distributor, refer to the NXP web site:

[www.nxp.com](http://www.nxp.com)