Features

- IEEE 802.11b/g/n Compliant Transceiver
- 2.4 GHz IEEE 802.11n Single Stream 1x1
- UART Interface to Host Controller (4-wire including RTS/CTS)
- Integrates Easily into Final Product - Minimizes Product Development, Provides Quicker Time to Market
- Configured using Simple ASCII Commands
- Fully Integrated Wireless Module with Voltage Regulation, Crystal, RF Matching Circuitry, Power Amplifier (PA), Low Noise Amplifier (LNA), and PCB Trace Antenna
- Ultra-Small W.FL Connector for External Antennas (RN1810E)
- Compact Surface Mount Module: 0.700” x 1.050” x 0.085” (17.8 mm x 26.7 mm x 2.2 mm)
- Castellated Surface Mount Pads for easy and reliable PCB mounting
- Environmentally Friendly, RoHS Compliant

Operational

- Single Operating Voltage: 3.15V to 3.45V (3.3V typical)
- Temperature Range: -40°C to +85°C Industrial
- Low-Current Consumption:
  - RX mode: 64 mA (typical)
  - TX mode: 246 mA at 18 dBm (typical)
- Power Saving Mode:
  - Sleep: 12 µA (typical)

RF/Analog

- Frequency: 2.412 to 2.472 GHz
- Channels: 1-13
- Modulation: DSSS, CCK, BPSK, QPSK, 16QAM, and 64QAM
- Sensitivity: -94 dBm

Antenna

- Integral PCB Trace Antenna (RN1810)
- External Antenna (RN1810E)

Compliance

- Modular Certified for the United States (FCC) and Canada (IC)
- European R&TTE Directive Assessed Radio Module

Applications

- Utility and Smart Energy
- Consumer Electronics
- Industrial Controls
- Remote Device Management
- Retail
- Medical, Fitness, and Health Care

Networking

- Supports Infrastructure and SoftAp Networking Modes
- Built-In Networking Applications: IPv4/IPv6, TCP, UDP, DHCP, DNS, ICMP, ARP, HTTP, FTP, SNTP, and SSL/TLS
- Complete On-Board TCP/IP Networking
- Upgrade Firmware Over the Air using TFTP
- Supports Wi-Fi® Protected Setup (WPS)
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• Your local Microchip sales office (see last page)

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1.0 DEVICE OVERVIEW

The RN1810 and RN1810E are low-power, 2.4 GHz, IEEE 802.11n compliant, surface mount modules containing all associated RF components: crystal oscillator, bypass and bias passives with integrated MAC, baseband, RF and power amplifier, and built-in hardware support for encryption. Refer to Figure 1-1.

The integrated module design frees the designer from RF and antenna design tasks and regulatory compliance testing, ultimately providing faster time to market.

The RN1810 incorporates an on-board TCP/IP networking stack, cryptographic accelerator, power management subsystem, real-time clock, 2.4 GHz transceiver, and RF power amplifier. With the module, designers can embed Wi-Fi and networking functionality rapidly into virtually any device.

The RN1810 provides cost and time-to-market savings as a self-contained Internet-enabling solution. The module has been designed to provide designers with a simple Wi-Fi solution that features:

- Ease of integration and programming
- Vastly reduced development time
- Minimum system cost
- Long battery life
- Maximum value in a range of applications

The RN1810 is configured with a simple ASCII command language.

In the simplest configuration, the module requires only power, ground and UART TX and RX connections. The RN1810 module can interface to low-cost microcontrollers using only two wires, UART TX and RX.

The RN1810 can independently maintain a low-power wireless network connection. Ultra-low power usage and flexible power management maximize the module's lifetime in battery-operated devices. A wide operating temperature range allows use in indoor and outdoor environments (industrial temperature range).

When operating in Sleep mode, the module minimizes battery usage while still being able to respond to certain events, including internal timers and WAKEUP signal. Applications that make efficient use of the Sleep state can extend battery life to multiple years.

The RN1810 module is approved for use with the integrated PCB trace antenna. The RN1810E module is approved for use with specific external antenna types that are certified with the module. An ultra-small coaxial connector (W.FL) is provided on the module for connection to the external antenna. Refer to Section 3.3, "External Antenna Types" for a listing of approved antenna types.

The RN1810/RN1810E modules received the regulatory approvals for modular devices in the United States (FCC) and Canada (IC). Modular approval removes the need for expensive RF and antenna design, and enables the end user to place the RN1810/ RN1810E modules inside a finished product without requiring a regulatory testing for an intentional radiator (RF transmitter).

The RN1810/RN1810E module is an R&TTE Directive assessed radio module for operation in Europe. The module tests can be applied toward final product certification and Declaration of Conformity (DoC).

Table 1-1 lists the RN1810 module's family types.

<table>
<thead>
<tr>
<th>Device</th>
<th>Antenna</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN1810</td>
<td>Integral</td>
</tr>
<tr>
<td>RN1810E</td>
<td>External</td>
</tr>
</tbody>
</table>
FIGURE 1-1: RN1810/RN1810E BLOCK DIAGRAM

RN1810/RN1810E 2.4 GHz IEEE 802.11 b/g/n Module

- PCB Trace Antenna (RN1810)
- External Antenna Connector (RN1810E)
- Matching Circuitry
- Wi-Fi SoC
- Flash
- Sleep/Wake up/Reset/Control
- Event/Status
- UART
- Power/Ground

RN1810/RN1810E 2.4 GHz IEEE 802.11 b/g/n Module
1.1 Interface Description

Figure 1-2 shows the RN1810/RN1810E pin diagram. Table 1-2 describes the RN1810/RN1810E pins.

FIGURE 1-2: RN1810/RN1810E PIN DIAGRAM
TABLE 1-2: PIN DESCRIPTIONS

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Power</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>TEST</td>
<td>Test</td>
<td>Do not connect</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Power</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>VDD</td>
<td>Power</td>
<td>—</td>
</tr>
<tr>
<td>5</td>
<td>CMD_STATUS</td>
<td>DO</td>
<td>This is an optional IO that signals operational status.</td>
</tr>
<tr>
<td>6</td>
<td>STATUS_RDY</td>
<td>DO</td>
<td>This is an optional IO that signals WiFly is ready to accept commands.</td>
</tr>
<tr>
<td>7</td>
<td>UART0_TX</td>
<td>DO</td>
<td>Host interface UART0 TX</td>
</tr>
<tr>
<td>8</td>
<td>IP_STATUS</td>
<td>DO</td>
<td>This is an optional IO that signals WiFly has connected to an AP and received an IP address.</td>
</tr>
<tr>
<td>9</td>
<td>UART0_CTS</td>
<td>DI</td>
<td>UART0 CTS</td>
</tr>
<tr>
<td>10</td>
<td>UART0_RTS</td>
<td>DO</td>
<td>UART0 RTS</td>
</tr>
<tr>
<td>11</td>
<td>NC</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>12</td>
<td>TCP_STATUS</td>
<td>DO</td>
<td>This is an optional IO that signals a successful TCP connection or FTP transfer.</td>
</tr>
<tr>
<td>13</td>
<td>SLEEP</td>
<td>DI</td>
<td>This is an optional IO that puts the RN1810 into Sleep state.</td>
</tr>
<tr>
<td>14</td>
<td>FUNC_CONFIG</td>
<td>DI</td>
<td>This is an optional IO that starts various applications and resets configurations to factory defaults.</td>
</tr>
<tr>
<td>15</td>
<td>VDD</td>
<td>Power</td>
<td>—</td>
</tr>
<tr>
<td>16</td>
<td>GND</td>
<td>Power</td>
<td>—</td>
</tr>
<tr>
<td>17</td>
<td>TEST</td>
<td>Test</td>
<td>Do not connect</td>
</tr>
<tr>
<td>18</td>
<td>TEST</td>
<td>Test</td>
<td>Do not connect</td>
</tr>
<tr>
<td>19</td>
<td>RESET</td>
<td>DI</td>
<td>Resets RN1810</td>
</tr>
<tr>
<td>20</td>
<td>CMD_CTRL</td>
<td>DI</td>
<td>This is an optional IO that switches RN1810 modes.</td>
</tr>
<tr>
<td>21</td>
<td>UART0_RX/ MODE0</td>
<td>DI</td>
<td>Host interface UART0 RX/Mode0; connect to VDD via 100 kΩ pull-up resistor(2)</td>
</tr>
<tr>
<td>22</td>
<td>TCP_CTRL</td>
<td>DI</td>
<td>This is an optional IO that opens or closes a TCP connection, or handshakes FTP transfers.</td>
</tr>
<tr>
<td>23</td>
<td>MODE1</td>
<td>DI</td>
<td>Mode select 1; connect to GND(2)</td>
</tr>
<tr>
<td>24</td>
<td>GND</td>
<td>Power</td>
<td>—</td>
</tr>
<tr>
<td>25</td>
<td>WAKEUP</td>
<td>DI</td>
<td>This is an optional IO that awakens the RN1810 from Sleep mode.</td>
</tr>
<tr>
<td>26</td>
<td>MISC_STATUS</td>
<td>DO</td>
<td>This is an optional IO that signals miscellaneous application status.</td>
</tr>
<tr>
<td>27</td>
<td>GND</td>
<td>Power</td>
<td>—</td>
</tr>
<tr>
<td>28</td>
<td>NC</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>29</td>
<td>NC</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>30</td>
<td>NC</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>31</td>
<td>NC</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>32</td>
<td>NC</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>33</td>
<td>NC</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>34</td>
<td>GND</td>
<td>Power</td>
<td>—</td>
</tr>
<tr>
<td>35</td>
<td>VDD</td>
<td>Power</td>
<td>—</td>
</tr>
<tr>
<td>36</td>
<td>GND</td>
<td>Power</td>
<td>—</td>
</tr>
<tr>
<td>37</td>
<td>GND</td>
<td>Power</td>
<td>—</td>
</tr>
</tbody>
</table>

Legend:  A = Analog, D = Digital, I = Input, O = Output

Note 1: For NC = No Connect pins, do not make any connection. The module is configured with internal pull-up and pull-down resistors.

2: Refer to Section 2.2, "MODE0 and MODE1 Pins".
1.2 Mounting Details

Figure 1-3, Figure 1-4 and Figure 1-5 show the physical dimensions and the mounting details of the module. Figure 1-6 and Figure 1-7 show the recommended host PCB footprint and layout.

FIGURE 1-3: RN1810/RN1810E MODULE PHYSICAL DIMENSIONS (TOP AND SIDE VIEW)

Dimensions are in inches
Tolerances:

PCB outline: +/- 0.010"
PCB thickness: +/- 0.005"
FIGURE 1-4: RN1810/RN1810E MODULE PHYSICAL DIMENSIONS (BOTTOM VIEW)

Dimensions are in inches
FIGURE 1-5: RN1810/RN1810E MODULE MOUNTING DETAILS

Keep area around antenna (approximately 1.25 inches) clear of metallic structures for best performance.

Dimensions are in inches
FIGURE 1-6: RN1810/RN1810E RECOMMENDED HOST PCB FOOTPRINT

Dimensions are in inches

- Keep out area
- 0.050
- 0.040
- 0.035
- Shield Pads X4
  - 0.050 diameter
  - Do not locate Host PCB top layer copper under Shield Pads
- Host PCB
- Ground Plane Edge
- 1.050
- 0.795
- 0.775
- 0.725
- 0.675
- 0.625
- 0.575
- 0.525
- 0.475
- 0.425
- 0.375
- 0.325
- 0.275
- 0.225
- 0.175
- 0.125
- 0.000
- 0.000
- 0.065
- 0.165
- 0.265
- 0.365
- 0.465
- 0.565
- 0.665
- 0.765
- 0.770
1.3 Soldering Recommendations

The RN1810/RN1810E wireless module is assembled using the IPC/JEDEC J-STD-020 Standard lead-free reflow profile. The RN1810/RN1810E module can be soldered to the host PCB using standard leaded and lead-free solder reflow profiles.

To avoid damaging the module, adhere to the following recommendations:

- Solder reflow recommendations are provided in the Microchip Application Note, AN233 “Solder Reflow Recommendation” (DS00233)
- Do not exceed a peak temperature (TP) of 250°C
- Refer to the solder paste data sheet for specific reflow profile recommendations from the vendor
- Use no-clean flux solder paste
- Do not wash as moisture can be trapped under the shield
- Use only one flow. If the PCB requires multiple flows, apply the module on the final flow.
2.0 CIRCUIT DESCRIPTION

2.1 UART Interface

The UART interface supports 2-wire (RX, TX) and 4-wire configurations with hardware flow control (RX, TX, CTS, and RTS) as illustrated in Figure 2-1. The logic levels are CMOS voltage levels (not RS-232 voltage levels). The UART interface supports baud rates of 9,600, 19,200, 38,400, 57,600 and 115,200 bits per second.

**FIGURE 2-1:** HOST MCU TO RN1810/RN1810E BLOCK DIAGRAM

**FIGURE 2-2:** MCU TO RN1810 INTERFACE

*Note 1:* Hardware flow control is recommended for all baud rates, especially for 57,600 or greater.
2.2 MODE0 and MODE1 Pins

The MODE pins must be tied to the voltage levels for normal operation of the module. Refer to Table 2-1.

TABLE 2-1: MODE PIN OPERATION

<table>
<thead>
<tr>
<th>Pin</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODE1</td>
<td>Connect to GND</td>
</tr>
<tr>
<td>UART0_RX/MODE0</td>
<td>Connect to VDD via 100 kΩ pull-up resistor</td>
</tr>
</tbody>
</table>

The MODE pins are sampled at power on and wake-up. Refer to Section 2.4, "Sleep and Wakeup". In the case of UART0_RX/MODE0 pin, a 100 kΩ pull-up resistor is required, and the host MCU allows an active-high signal during power on and wake-up to ensure that the module start-up in normal operation. Once the module is operational, the pin becomes the UART0_RX pin.

2.3 VDD and GND Pin

The RN1810/RN1810E wireless module contains an integrated power management unit that generates all necessary voltages required by the internal circuitry. The module is powered from a single voltage source. Table 2-2 lists the recommended bypass capacitors. The capacitors must be closely placed to the module.

TABLE 2-2: RECOMMENDED BYPASS CAPACITORS

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Bypass Capacitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>VDD</td>
<td>0.1 µF and 2.2 µF</td>
</tr>
<tr>
<td>15</td>
<td>VDD</td>
<td>0.1 µF and 2.2 µF</td>
</tr>
<tr>
<td>35</td>
<td>VDD</td>
<td>0.1 µF and 2.2 µF</td>
</tr>
</tbody>
</table>

2.4 Sleep and Wakeup

The module enters the lowest power mode when the SLEEP pin is asserted high. WLAN and network connection information is preserved.

The module can wake-up when WAKEUP pin is asserted low. The module restores the saved information after wakeup.

2.5 Module Reset

There are several ways to Reset the module:

- A Power-On Reset is automatically generated when power is applied. This Reset is intended to initialize the module when a new battery is connected.
- Perform an external Power-On Reset by asserting the RESET pin low.
- Perform a soft Power-On Reset using software commands

The RESET pulse duration must be a minimum of 650 ns.

2.6 Factory Reset

The Factory Reset is intended to initialize provisioning information stored in flash memory by asserting FUNC_CONFIG Low to High five times with 300 ms between transitions.
3.0 APPLICATION INFORMATION

This section provides information on the Application Schematic, Integral PCB Trace Antenna, and Antenna Types.

3.1 Application Schematic

Figure 3-1 shows the schematic for the RN1810/RN1810E module.

FIGURE 3-1: APPLICATION SCHEMATIC

Note 1: Refer to Table 1-2: "PIN Descriptions".

2: Hardware flow control is recommended for all baud rates, especially for 57,600 or greater.

3: The default firmware bootup UART baud settings is 9,600 with hardware flow control disabled.
3.2 Integral PCB Trace Antenna

For the RN1810, the PCB antenna is fabricated on the top copper layer and covered in solder mask. The layers below the antenna do not have copper trace.

It is recommended that the module is mounted on the edge of the host PCB. It is permitted for PCB material to be below the antenna structure of the module as long as no copper traces or planes are on the host PCB in that area. For best performance, place the module on the host PCB according to the details shown in Figure 1-7.

The antenna patterns plotted in Figure 3-2 through Figure 3-5 are the simulated results of the PCB antenna.

Figure 3-2 illustrates the simulation drawing. The two-dimensional (2D) radiation pattern is illustrated in Figure 3-3, whereas Figure 3-4 and Figure 3-5 show the three-dimensional (3D) radiation patterns.

The calculated average of the radiated field is shown in Figure 3-3. The radiation pattern for the XZ plane is shown in red, whereas the YZ plane is shown in violet. The most powerful radiation occurs in the XZ plane as represented by the red pattern.

Figure 3-4 shows the relative position of the 3D radiation "donut" with reference to the module orientation. This is a very useful guide for placement of the module to obtain the maximum range.

Figure 3-5 shows the 3D radiation pattern with the colored distribution of the radiation magnitude. The values range from -9 dB to +0.3 dB. This is very useful in interpreting the 2D radiation pattern.
FIGURE 3-3: SIMULATED TWO-DIMENSIONAL RADIATION PATTERN

Two-dimensional (2D) pattern, including the average on main radiation planes (Phi = 0 and 90 degrees).
FIGURE 3-4: SIMULATED THREE-DIMENSIONAL RADIATION PATTERN

Radiation pattern against the module dimensions
FIGURE 3-5: SIMULATED THREE-DIMENSIONAL RADIATION PATTERN

Three-dimensional (3D) pattern and magnitude distribution
3.3 External Antenna Types

The RN1810E module has an ultra-small coaxial connector (W.FL) for connection to the external antenna.

The choice of antenna is limited to the antenna types in which the module is tested and approved. For a list of tested and approved antenna types that may be used with the module, refer to the respective country in Section 4.0, "Regulatory Approval".

Table 3-1 lists the approved antennas types.

<table>
<thead>
<tr>
<th>Type</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB Trace</td>
<td>1 dBi</td>
</tr>
<tr>
<td>Dipole</td>
<td>2 dBi</td>
</tr>
<tr>
<td>PIFA</td>
<td>-3 dBi</td>
</tr>
</tbody>
</table>
4.0 REGULATORY APPROVAL

This section outlines the regulatory information for the RN1810/RN1810E module for the following countries:

• United States
• Canada
• Europe
• Other Regulatory Jurisdictions

4.1 United States

The RN1810/RN1810E module has received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C “Intentional Radiators” single-modular approval in accordance with Part 15.212 Modular Transmitter approval. Single-modular transmitter approval is defined as a complete RF transmission sub-assembly, designed to be incorporated into another device, that must demonstrate compliance with FCC rules and policies independent of any host. A transmitter with a modular grant can be installed in different end-use products (referred to as a host, host product, or host device) by the grantee or other equipment manufacturer, then the host product may not require additional testing or equipment authorization for the transmitter function provided by that specific module or limited module device.

A host product itself is required to comply with all other applicable FCC equipment authorization regulations, requirements, and equipment functions that are not associated with the transmitter module portion. For example, compliance must be demonstrated: to regulations for other transmitter components within a host product; to requirements for unintentional radiators (Part 15 Subpart B), such as digital devices, computer peripherals, radio receivers, etc.; and to additional authorization requirements for the non-transmitter functions on the transmitter module (i.e., Verification or Declaration of Conformity) as appropriate (e.g., Bluetooth and Wi-Fi transmitter modules may also contain digital logic functions).

4.1.1 LABELING AND USER INFORMATION REQUIREMENTS

The RN1810/RN1810E module has been labeled with its own FCC ID number, and if the FCC ID is not visible when the module is installed inside another device, then the outside of the finished product into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording as follows:

Contains Transmitter Module FCC ID: W7O24WN0
or
Contains FCC ID: W7O24WN0

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.

A user’s manual for the product should include the following 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 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.

Additional information on labeling and user information requirements for Part 15 devices can be found in KDB Publication 784748 available at the FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB)
4.1.2 RF EXPOSURE

All transmitters regulated by FCC must comply with RF exposure requirements. KDB Publication 447498 General RF Exposure Guidance provides guidance in determining whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to Radio Frequency (RF) fields adopted by the Federal Communications Commission (FCC).

This module is approved for installation into mobile and/or portable host platforms and must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multitransmitter guidelines. End users must be provided with transmitter operating conditions for satisfying RF Exposure compliance.

4.1.3 APPROVED EXTERNAL ANTENNA TYPES

To maintain modular approval in the United States, only the antenna types that have been tested shall be used. It is permissible to use different antenna manufacturer provided the same antenna type and antenna gain (equal to or less than) is used. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.

Testing of the RN1810/RN1810E module was performed with the antenna types listed in Table 3-1.

4.1.4 HELPFUL WEB SITES

Federal Communications Commission (FCC):
http://www.fcc.gov

FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB):
http://apps.fcc.gov/oetcf/kdb/index.cfm

4.2 Canada

The RN1810/RN1810E module has been certified for use in Canada under Industry Canada (IC) Radio Standards Procedure (RSP) RSP-100, Radio Standards Specification (RSS) RSS-Gen, RSS-210, and RSS-247. Modular approval permits the installation of a module in a host device without the need to recertify the device.

4.2.1 LABELING AND USER INFORMATION REQUIREMENTS

Labeling Requirements (from RSP-100 - Issue 10, Section 3): The host device shall be properly labeled to identify the module within the host device.

Modular Devices (from RSP-100 - Issue 10, Section 7): The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labeled to display the Industry Canada certification number of the module, preceded by the words “Contains transmitter module”, or the word “Contains”, or similar wording expressing the same meaning, as follows:

Contains transmitter module IC: 7693A-24WN0

User Manual Notice for License-Exempt Radio Apparatus (from Section 8.4, RSS-Gen, Issue 4, November 2014): User manuals for license-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both:

This device complies with Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions:
(1) This device may not cause interference; and
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

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

4.2.2 RF EXPOSURE

All transmitters regulated by IC must comply with RF exposure requirements listed in RSS-102 - Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands).

This module is approved for installation into mobile and/or portable host platforms and must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with Industry Canada's multi-transmitter guidelines. End users must be provided with transmitter operating conditions for satisfying RF Exposure compliance.

4.2.3 APPROVED EXTERNAL ANTENNA TYPES

Transmitter Antenna for License-Exempt Radio Apparatus (from Section 8.3 RSS-Gen, Issue 4, November 2014):

The RN1810/RN1810E module can only be sold or operated with the antenna types with which it was approved. It is permissible to use different antenna manufacturer provided the same antenna type and antenna gain (equal to or less than) is used. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.

Approved external antenna types for the RN1810/RN1810E module are listed in Table 3-1.
User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (identifier le dispositif par son numéro de certification) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

4.2.4 HELPFUL WEB SITES

Industry Canada: http://www.ic.gc.ca/

4.3 Europe

The RN1810/RN1810E module is an R&TTE Directive assessed radio module that is CE marked and has been manufactured and tested with the intention of being integrated into a final product.

The RN1810/RN1810E module has been tested to R&TTE Directive 1999/5/EC Essential Requirements for Health and Safety (Article (3.1(a)), Electromagnetic Compatibility (EMC) (Article 3.1(b)), and Radio (Article 3.2) and are summarized in Table 4-1 European Compliance Testing. European Compliance Testing. A Notified Body Opinion has also been issued. All test reports are available on the RN1810/RN1810E product web page at http://www.microchip.com.


Note: To maintain conformance to the testing listed in Table 4-1 European Compliance Testing, the module shall be installed in accordance with the installation instructions in this data sheet and shall not be modified.

When integrating a radio module into a completed product the integrator becomes the manufacturer of the final product and is therefore responsible for demonstrating compliance of the final product with the essential requirements of the R&TTE Directive.

4.3.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the RN1810/RN1810E module must follow CE marking requirements. The R&TTE Compliance Association Technical Guidance Note 01 provides guidance on final product CE marking.

4.3.2 EXTERNAL ANTENNA REQUIREMENTS

From R&TTE Compliance Association document Technical Guidance Note 01:

Provided the integrator installing an assessed radio module with an integral or specific antenna and installed in conformance with the radio module manufacturer’s installation instructions requires no further evaluation under Article 3.2 of the R&TTE Directive and does not require further involvement of an R&TTE Directive Notified Body for the final product. [Section 2.2.4]

The European Compliance Testing listed in Table 4-1 was performed using the antenna types listed in Table 3-1.

4.3.3 HELPFUL WEB SITES

A document that can be used as a starting point in understanding the use of Short Range Devices (SRD) in Europe is the European Radio Communications Committee (ERC) Recommendation 70-03 E, which can be downloaded from the European Radio Communications Office (ERO) at: http://www.ero.dk/.
Additional helpful web sites are:

- Radio and Telecommunications Terminal Equipment (R&TTE):
  http://ec.europa.eu/enterprise/rtte/index_en.htm
- European Conference of Postal and Telecommunications Administrations (CEPT):
  http://www.cept.org/
- European Telecommunications Standards Institute (ETSI):
  http://www.etsi.org
- European Radio Communications Office (ERO):
  http://www.ero.dk/
- The Radio and Telecommunications Terminal Equipment Compliance Association (R&TTE CA):
  http://www.rrteca.com/

**TABLE 4-1: EUROPEAN COMPLIANCE TESTING**

<table>
<thead>
<tr>
<th>Certification</th>
<th>Standards</th>
<th>Article</th>
<th>Laboratory</th>
<th>Report Number</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>EN 62479:2010</td>
<td></td>
<td></td>
<td>Pending</td>
<td></td>
</tr>
<tr>
<td>EMC</td>
<td>EN 301 489-1 V1.9.2 (2011-09)</td>
<td>(3.1(b))</td>
<td></td>
<td>Pending</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EN 301 489-17 V2.2.1 (2012-09)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radio</td>
<td>EN 300 328 V1.8.1 (2006-06)</td>
<td>(3.2)</td>
<td></td>
<td>Pending</td>
<td></td>
</tr>
<tr>
<td>Notified Body</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opinion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**4.4 Other Regulatory Jurisdictions**

Should other regulatory jurisdiction certification be required by the customer, or the customer need to recertify the module for other reasons, a certification utility is available. For further regulatory Certification Utility and documentation, contact your local Microchip Technology sales office.
5.0 **ELECTRICAL CHARACTERISTICS**

Table 5-1, Table 5-2, Table 5-3 and Table 5-4 provide the absolute maximum ratings, recommended operating conditions, current consumption and the DC characteristics for digital IO pins of the module.

### TABLE 5-1: ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Max Rating</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDD</td>
<td>Voltage on VDD with respect to GND</td>
<td>-0.3 to 4.0</td>
<td>V</td>
</tr>
<tr>
<td>VDI</td>
<td>Minimum digital input voltage</td>
<td>-0.3</td>
<td>V</td>
</tr>
<tr>
<td>VDO</td>
<td>Maximum digital input voltage</td>
<td>VDD+0.3</td>
<td>V</td>
</tr>
<tr>
<td>RF&lt;sub&gt;in&lt;/sub&gt;</td>
<td>Maximum RF input (referenced to 50 ohms)</td>
<td>+10</td>
<td>dBm</td>
</tr>
</tbody>
</table>

**Note 1:** Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure above maximum rating conditions for extended periods may affect device reliability.

### TABLE 5-2: RECOMMENDED OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDD</td>
<td>Supply voltage</td>
<td>3.15</td>
<td>3.3</td>
<td>3.45</td>
<td>V</td>
</tr>
<tr>
<td>TAMB</td>
<td>Ambient temperature under bias</td>
<td>-40</td>
<td>—</td>
<td>85</td>
<td>°C</td>
</tr>
</tbody>
</table>

### TABLE 5-3: CURRENT CONSUMPTION

(1) **(NOMINAL CONDITIONS: 25°C, VDD = 3.3V)**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Units</th>
<th>Conditions (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDD, Sleep</td>
<td>—</td>
<td>12</td>
<td>—</td>
<td>µA</td>
<td>—</td>
</tr>
<tr>
<td>IDD, Receive</td>
<td>—</td>
<td>61</td>
<td>—</td>
<td>mA</td>
<td>11 Mbps</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>64</td>
<td>—</td>
<td></td>
<td>54 Mbps</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>62</td>
<td>—</td>
<td></td>
<td>HT20 MCS0</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>64</td>
<td>—</td>
<td></td>
<td>HT20 MCS7</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>72</td>
<td>—</td>
<td></td>
<td>HT40 MCS0</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>73</td>
<td>—</td>
<td></td>
<td>HT40 MCS7</td>
</tr>
<tr>
<td>IDD, Transmit</td>
<td>—</td>
<td>248</td>
<td>—</td>
<td>mA</td>
<td>1 Mbps</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>246</td>
<td>—</td>
<td></td>
<td>6 Mbps</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>242</td>
<td>—</td>
<td></td>
<td>11 Mbps</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>211</td>
<td>—</td>
<td></td>
<td>54 Mbps</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>263</td>
<td>—</td>
<td></td>
<td>HT20 MCS0</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>217</td>
<td>—</td>
<td></td>
<td>HT20 MCS7</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>222</td>
<td>—</td>
<td></td>
<td>HT40 MCS0</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>196</td>
<td>—</td>
<td></td>
<td>HT40 MCS7</td>
</tr>
</tbody>
</table>

**Note 1:** Current Consumption values represent Typical Peak currents. Wi-Fi applications typically operate at less than 85% TX duty cycle. TX current is dependent on such criteria as transmit power setting, transmit data rate, and bandwidth used. RX current is affected by connection distance.

2: Transmit current consumption at power output levels is listed in Table 5-6.

### TABLE 5-4: DC CHARACTERISTICS FOR DIGITAL IO PINS

<table>
<thead>
<tr>
<th>DC CHARACTERISTICS</th>
<th>Operating Conditions (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>Parameter</td>
</tr>
<tr>
<td>V&lt;sub&gt;IH&lt;/sub&gt;</td>
<td>High-Level Input Voltage</td>
</tr>
<tr>
<td>V&lt;sub&gt;IL&lt;/sub&gt;</td>
<td>Low-Level Input Voltage</td>
</tr>
</tbody>
</table>
Table 5-5, Table 5-6 and Table 5-7 show the frequency characteristics of the module.

### TABLE 5-5: RADIO RECEIVE CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ (1)</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>f_{RX}</td>
<td>RX input frequency range</td>
<td>—</td>
<td>2.412</td>
<td>—</td>
<td>2.472</td>
<td>GHz</td>
</tr>
<tr>
<td>s_{RF}</td>
<td>Sensitivity</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCK</td>
<td>1 Mbps</td>
<td>—</td>
<td>-95.7</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>CCK</td>
<td>11 Mbps</td>
<td>—</td>
<td>-87.7</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>OFDM</td>
<td>6 Mbps</td>
<td>—</td>
<td>-92.7</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>OFDM</td>
<td>54 Mbps</td>
<td>—</td>
<td>-75.7</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>HT20</td>
<td>MCS0</td>
<td>—</td>
<td>-92.7</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>HT20</td>
<td>MCS7</td>
<td>—</td>
<td>-72.7</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>HT40</td>
<td>MCS0</td>
<td>—</td>
<td>-90.7</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>HT40</td>
<td>MCS7</td>
<td>—</td>
<td>-69.7</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
</tbody>
</table>

**Note 1:** Performance measured at J1.

### TABLE 5-6: RADIO TRANSMIT CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ (1)</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>f_{RX}</td>
<td>TX output frequency range</td>
<td>—</td>
<td>2.412</td>
<td>—</td>
<td>2.472</td>
<td>GHz</td>
</tr>
<tr>
<td>p_{OUT}</td>
<td>Output power (1)</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>802.11b mask compliant</td>
<td>1 Mbps</td>
<td>—</td>
<td>20.7</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>802.11g mask compliant</td>
<td>6 Mbps</td>
<td>—</td>
<td>20.7</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>802.11g EVM compliant</td>
<td>54 Mbps</td>
<td>—</td>
<td>18.8</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>802.11n HT20 mask compliant</td>
<td>MCS0</td>
<td>—</td>
<td>20.7</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>802.11n HT40 mask compliant</td>
<td>MCS0</td>
<td>—</td>
<td>18.5</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>802.11n HT20 EVM compliant</td>
<td>MCS7</td>
<td>—</td>
<td>18.0</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>802.11n HT40 EVM compliant</td>
<td>MCS7</td>
<td>—</td>
<td>18.4</td>
<td>—</td>
<td>—</td>
<td>dBm</td>
</tr>
<tr>
<td>a_{PC}</td>
<td>Accuracy of power control</td>
<td>—</td>
<td></td>
<td>+/-1.5</td>
<td>—</td>
<td>dB</td>
</tr>
</tbody>
</table>

**Note 1:** Performance measured at J1.

### TABLE 5-7: SYNTHESIZER CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>f_{C}</td>
<td>Center channel frequency</td>
<td>—</td>
<td>2.412</td>
<td>—</td>
<td>2.472</td>
<td>GHz</td>
</tr>
<tr>
<td>f_{REF}</td>
<td>Reference oscillator frequency</td>
<td>+/−20 ppm</td>
<td>—</td>
<td>40</td>
<td>—</td>
<td>MHz</td>
</tr>
<tr>
<td>f_{STEP}</td>
<td>Frequency step size (at RF)</td>
<td>—</td>
<td>—</td>
<td>5</td>
<td>—</td>
<td>MHz</td>
</tr>
</tbody>
</table>

**Note:** Operating temperature: 25°C; Operating voltage: VDD = 3.3V
APPENDIX A: REVISION HISTORY

Revision A (January 2016)
This is the initial released version of the document.

Revision A (June 2017)
Updated Section 4.0 “Regulatory Approval”.

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• Technical Support

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To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>Device</th>
<th>Temperature Range</th>
<th>RM Package</th>
<th>XXX Firmware Revision Number</th>
</tr>
</thead>
</table>

**Device:**
- RN1810: Integral Antenna
- RN1810E: External Antenna Connection

**Temperature Range:** I = -40°C to +85°C (Industrial)

**Package:** RM = Radio Module

**Examples:**
RN1810-I/RM100
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