RN1810/RN1810E

2.4 GHz IEEE 802.11b/g/n Wireless Module

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
- Australia, New Zealand, Korea, Taiwan and Japan

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)

NOTES:

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.

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 $\overline{\text{WAKEUP}}$ 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).

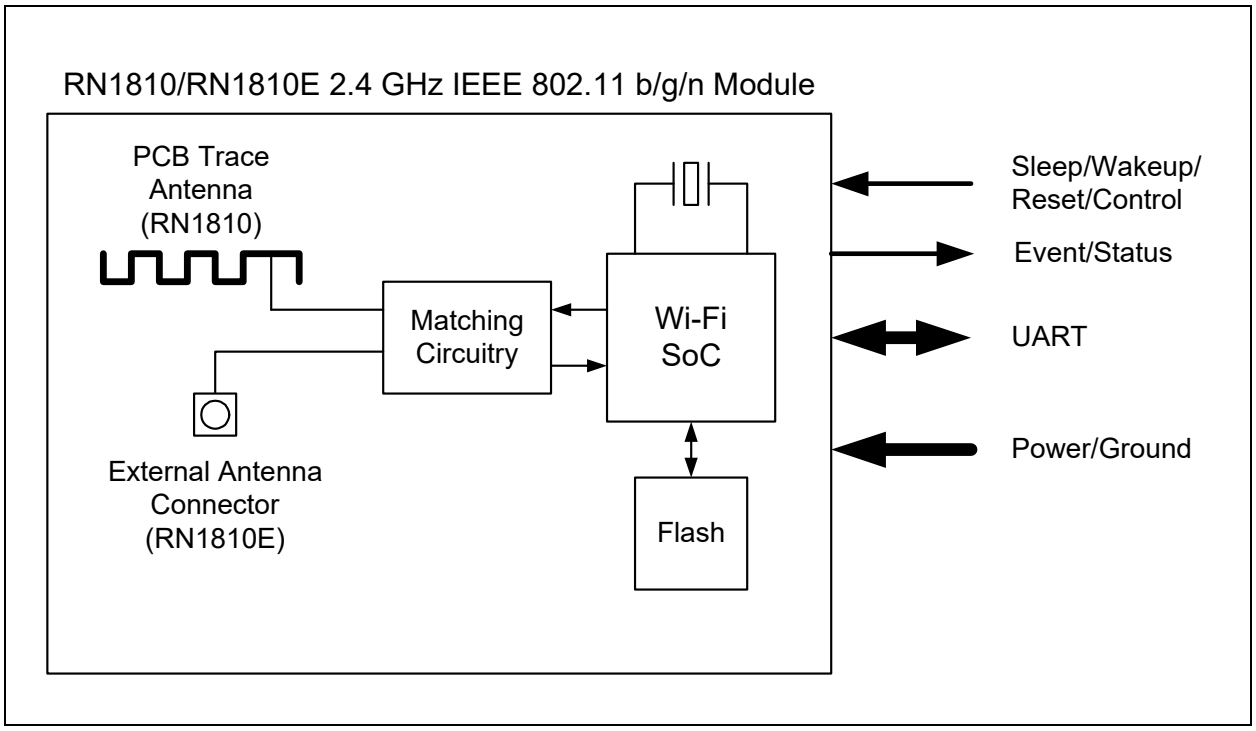
The RN1810/RN1810E module is an R&TTE Directive assessed radio module for operation in Europe. The module tests can be applied toward final product certification and Declaration of Conformity (DoC).

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

TABLE 1-1: RN1810 FAMILY TYPES

Device	Antenna
RN1810	Integral
RN1810E	External

FIGURE 1-1: RN1810/RN1810E BLOCK DIAGRAM



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

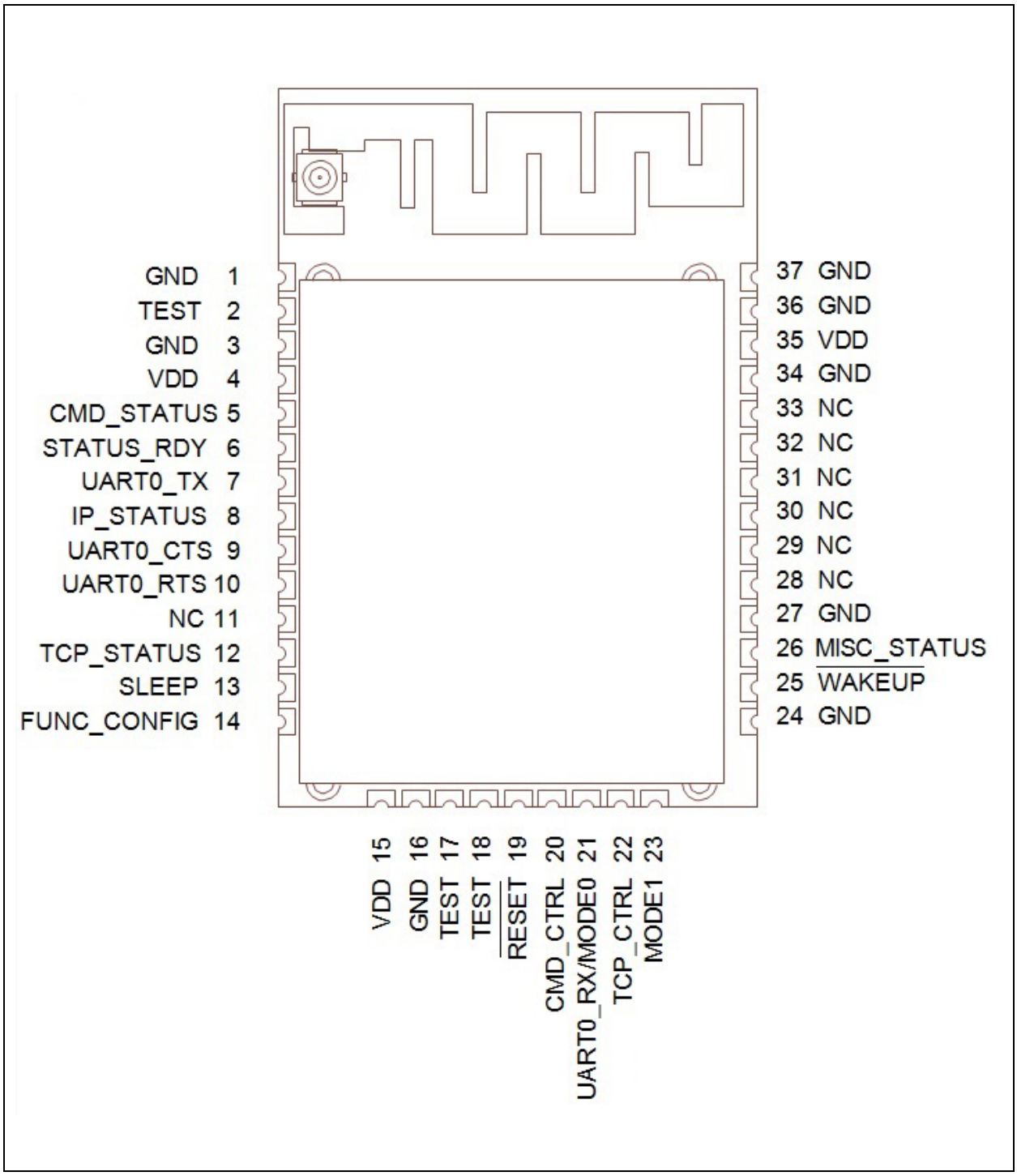


TABLE 1-2: PIN DESCRIPTIONS

Pin	Name	Type	Description[1]
1	GND	Power	—
2	TEST	Test	Do not connect
3	GND	Power	—
4	VDD	Power	—
5	CMD_STATUS	DO	This is an optional IO that signals operational status.
6	STATUS_RDY	DO	This is an optional IO that signals WiFly is ready to accept commands.
7	UART0_TX	DO	Host interface UART0 TX
8	IP_STATUS	DO	This is an optional IO that signals WiFly has connected to an AP and received an IP address.
9	UART0_CTS	DI	UART0 CTS
10	UART0_RTS	DO	UART0 RTS
11	NC	Reserved	Do not connect
12	TCP_STATUS	DO	This an optional IO that signals a successful TCP connection or FTP transfer.
13	SLEEP	DI	This is an optional IO that puts the RN1810 into Sleep state.
14	FUNC_CONFIG	DI	This is an optional IO that starts various applications and resets configurations to factory defaults.
15	VDD	Power	—
16	GND	Power	—
17	TEST	Test	Do not connect
18	TEST	Test	Do not connect
19	$\overline{\text{RESET}}$	DI	Resets RN1810
20	CMD_CTRL	DI	This is an optional IO that switches RN1810 modes.
21	UART0_RX/ MODE0	DI	Host interface UART0 RX/Mode select 0; connect to VDD via 100 kΩ pull-up resistor[2]
22	TCP_CTRL	DI	This is an optional IO that opens or closes a TCP connection or hand-shakes FTP transfers.
23	MODE1	DI	Mode select 1; connect to GND[2]
24	GND	Power	—
25	$\overline{\text{WAKEUP}}$	DI	This is an optional IO that awakens the RN1810 from Sleep mode.
26	MISC_STATUS	DO	This is an optional IO that signals miscellaneous application status.
27	GND	Power	—
28	NC	Reserved	Do not connect
29	NC	Reserved	Do not connect
30	NC	Reserved	Do not connect
31	NC	Reserved	Do not connect
32	NC	Reserved	Do not connect
33	NC	Reserved	Do not connect
34	GND	Power	—
35	VDD	Power	—
36	GND	Power	—
37	GND	Power	—

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

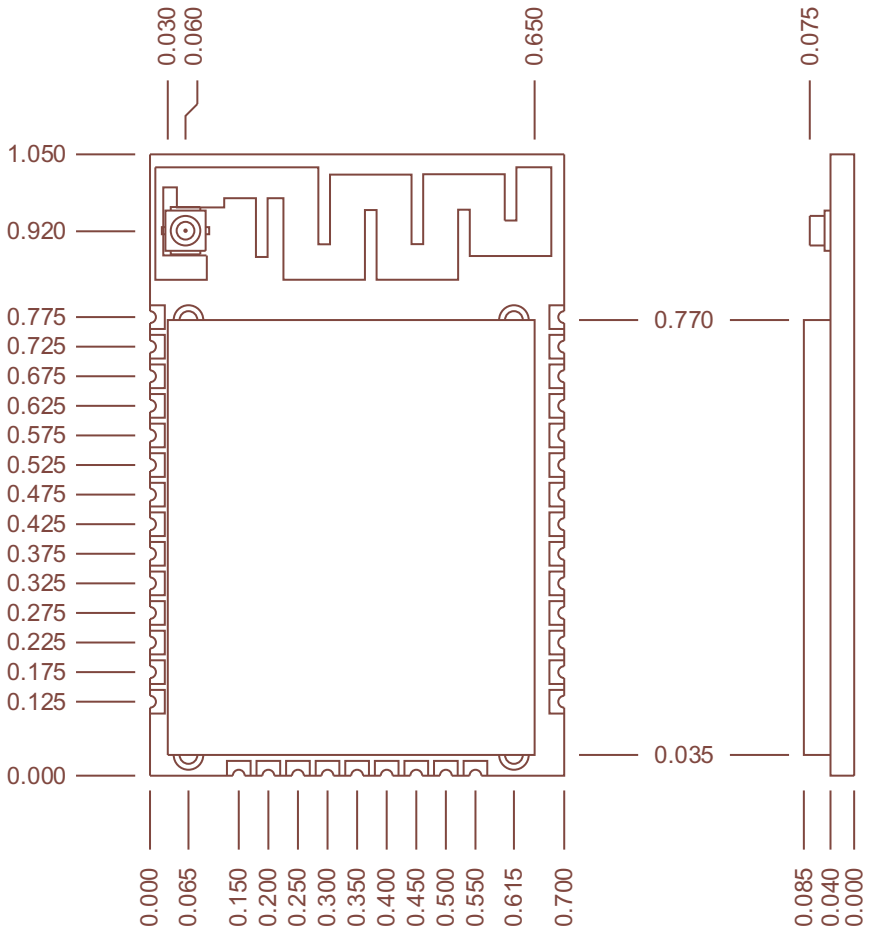
Note 1: For NC = No Connect pins, do not make any connection. The module is configured with internal pull-up and pull-down resistors.

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)

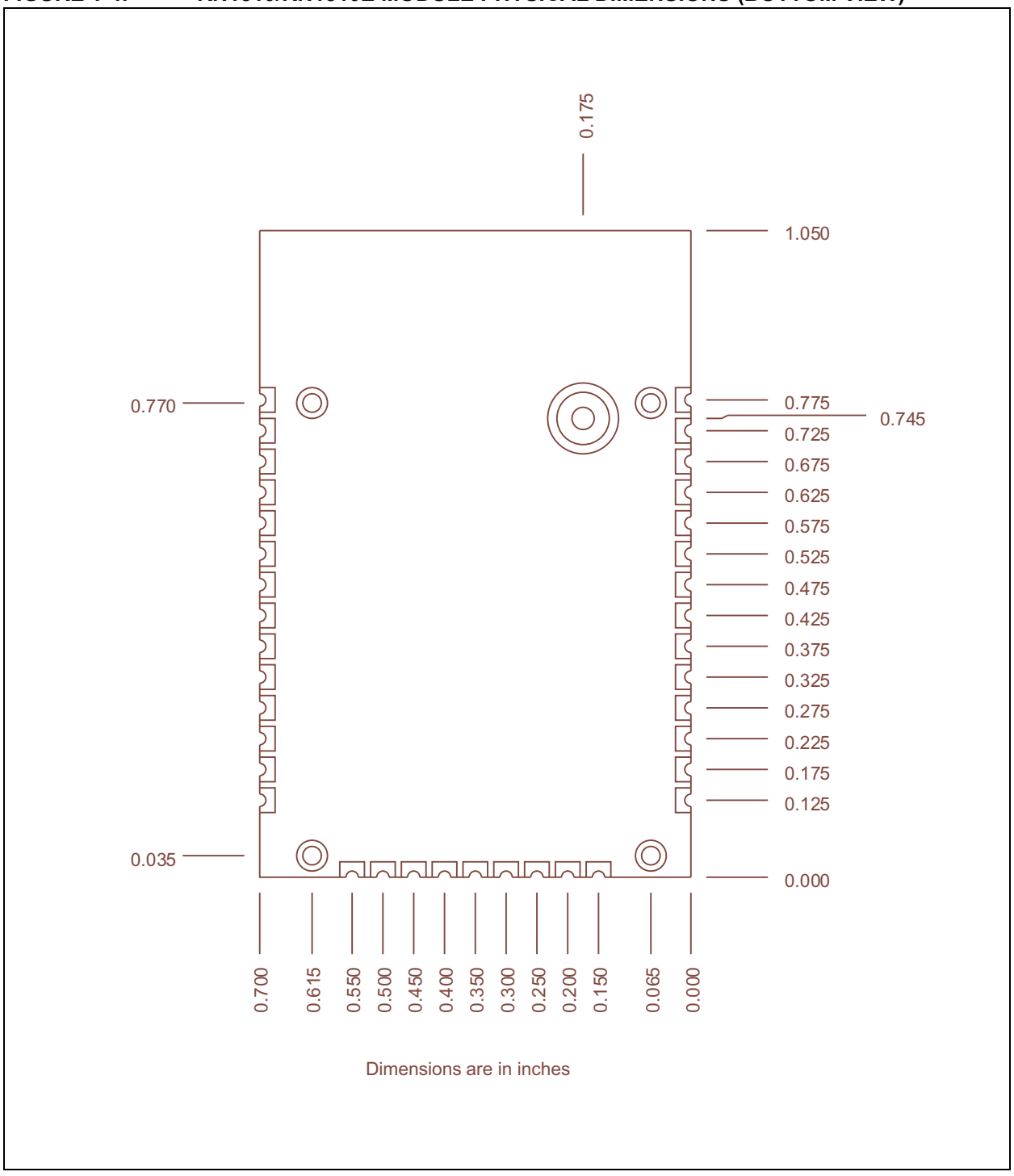


FIGURE 1-5: RN1810/RN1810E MODULE MOUNTING DETAILS

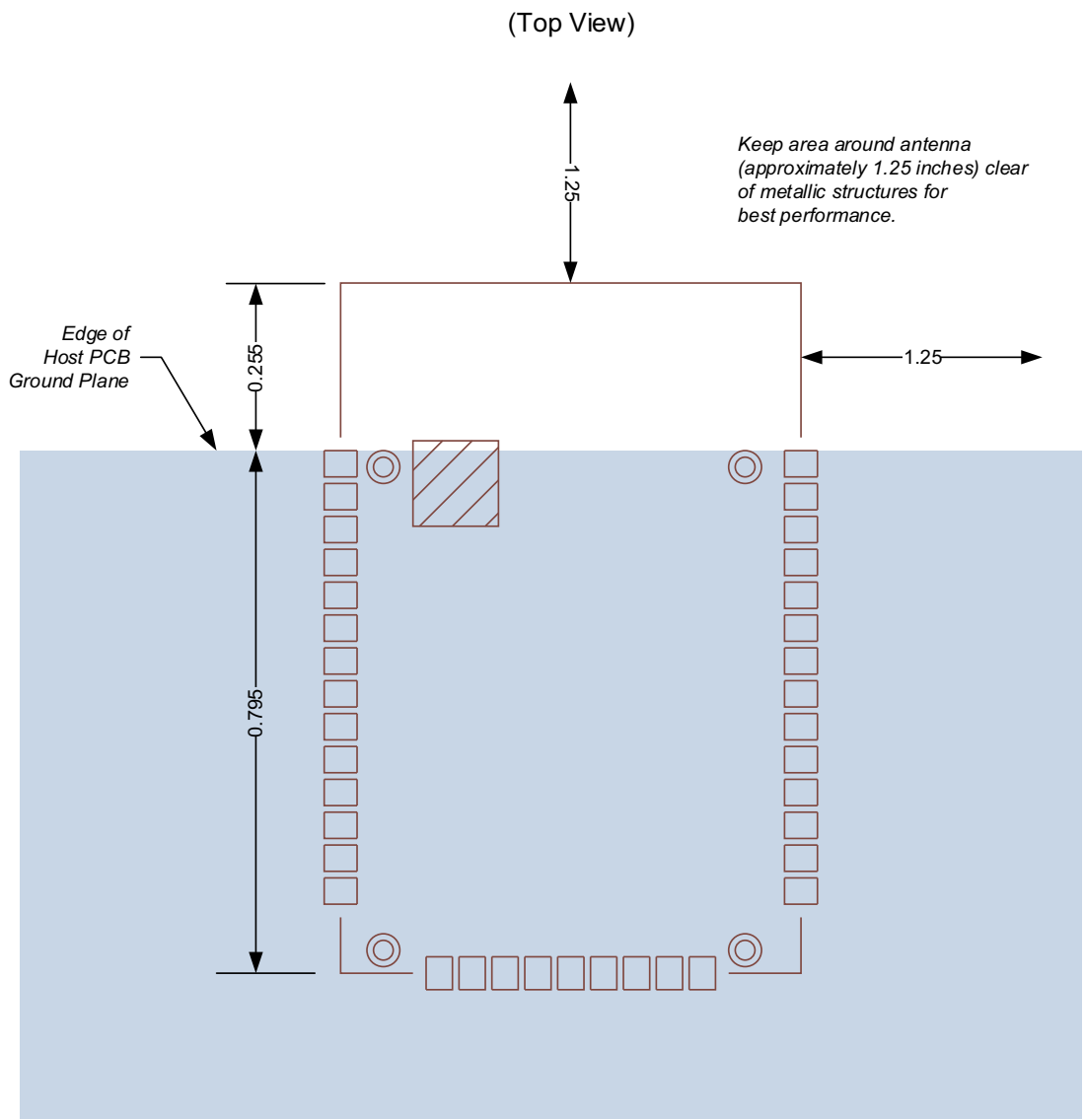


FIGURE 1-6: RN1810/RN1810E RECOMMENDED HOST PCB FOOTPRINT

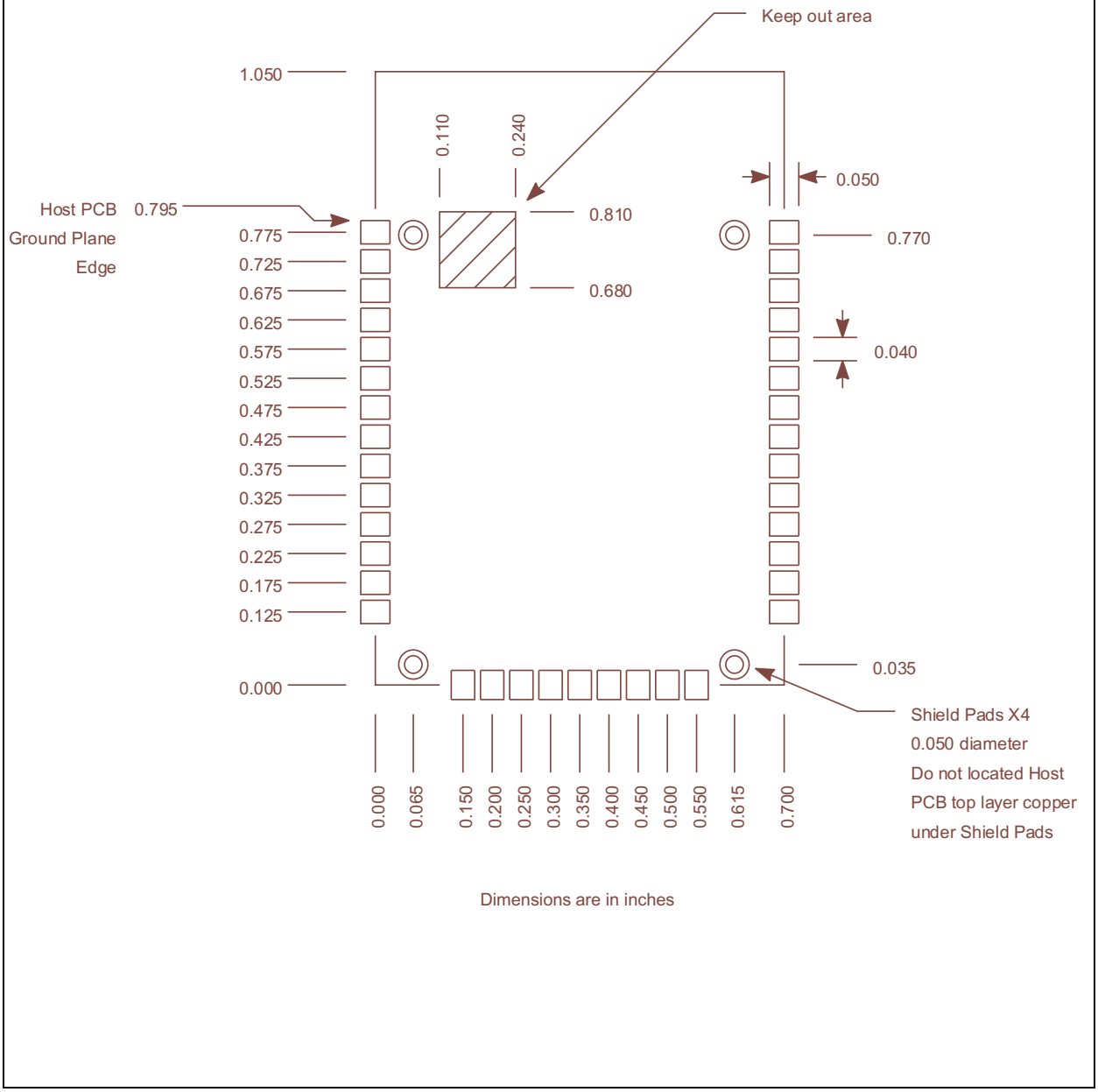
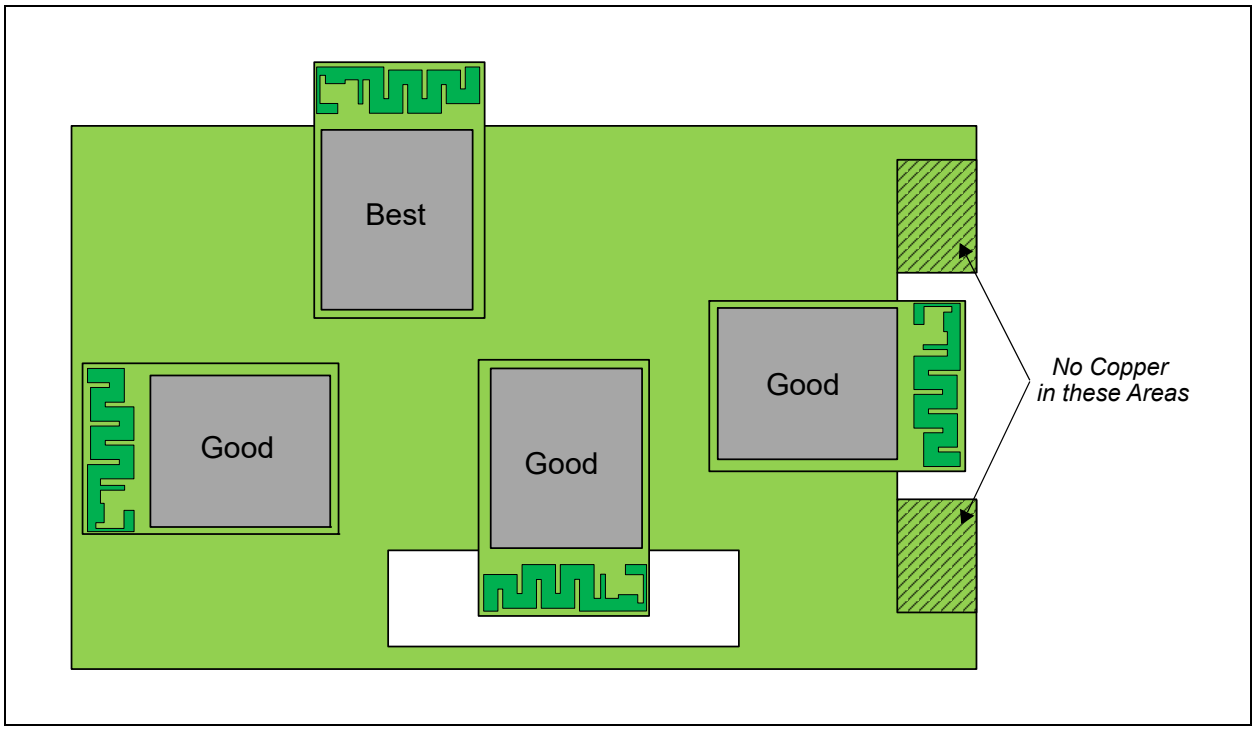


FIGURE 1-7: RN1810/RN1810E HOST PCB EXAMPLE LAYOUT



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.

NOTES:

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

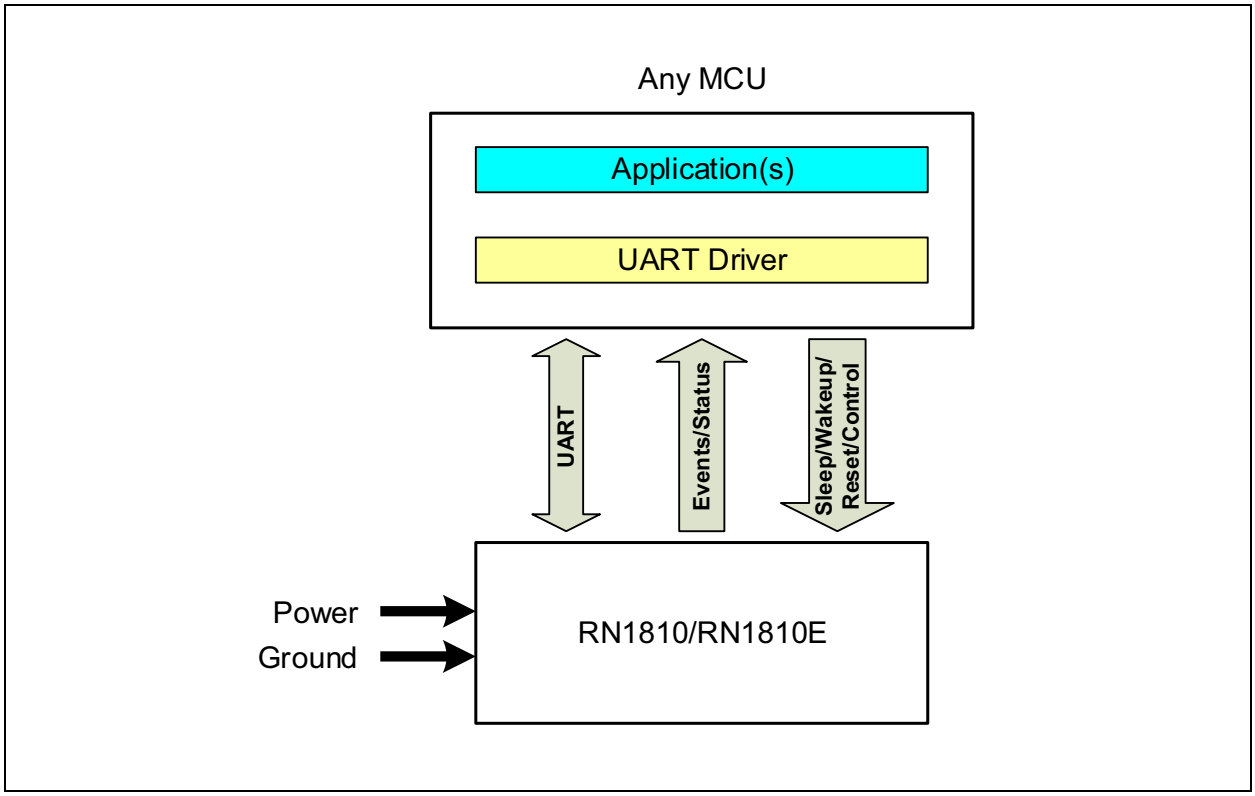
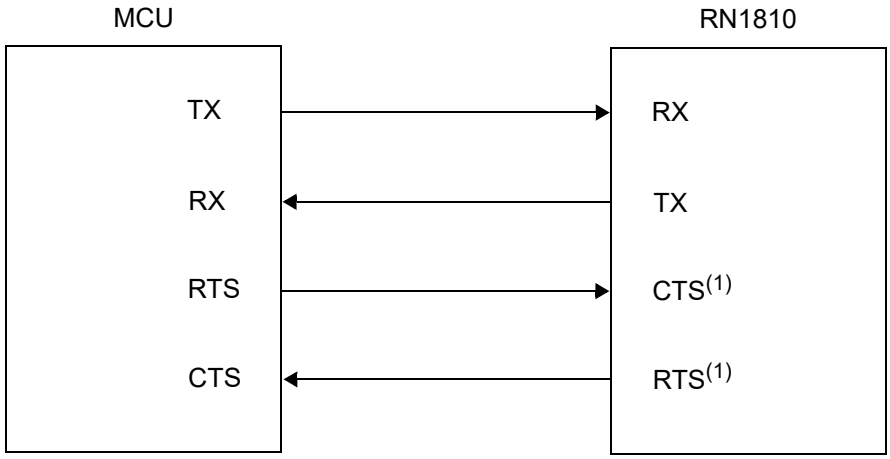


FIGURE 2-2: MCU TO RN1810 INTERFACE



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

Pin	Condition
MODE1	Connect to GND
UART0_RX/MODE0	Connect to VDD via 100 kΩ pull-up resistor

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

Pin	Symbol	Bypass Capacitors
4	VDD	0.1 µF and 2.2 µF
15	VDD	0.1 µF and 2.2 µF
35	VDD	0.1 µF and 2.2 µF

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 $\overline{\text{WAKEUP}}$ 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 $\overline{\text{RESET}}$ pin low.
- Perform a soft Power-On Reset using software commands

The $\overline{\text{RESET}}$ 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.

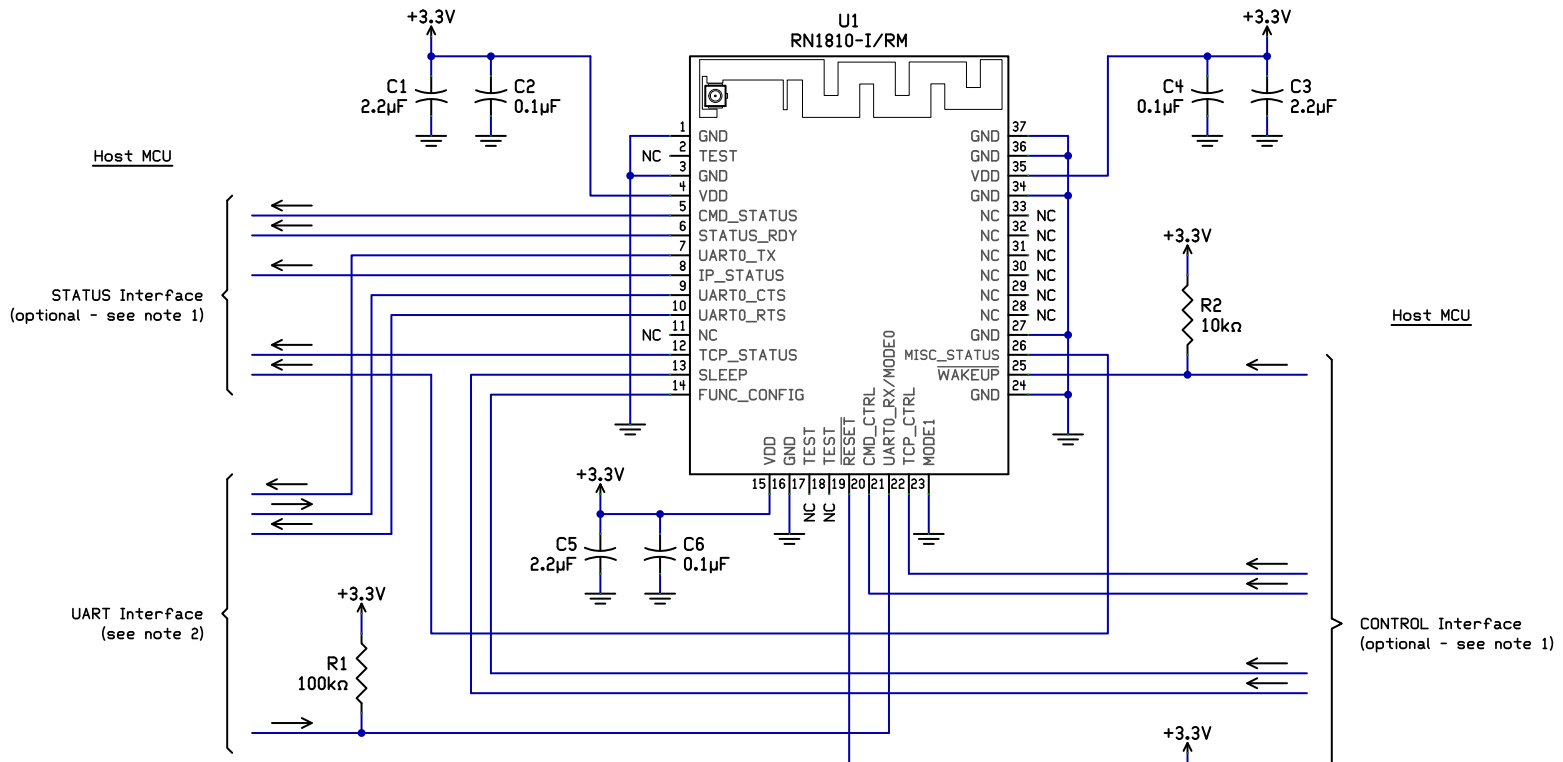
3.0 APPLICATION INFORMATION

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 3-2: PCB ANTENNA SIMULATION DRAWING

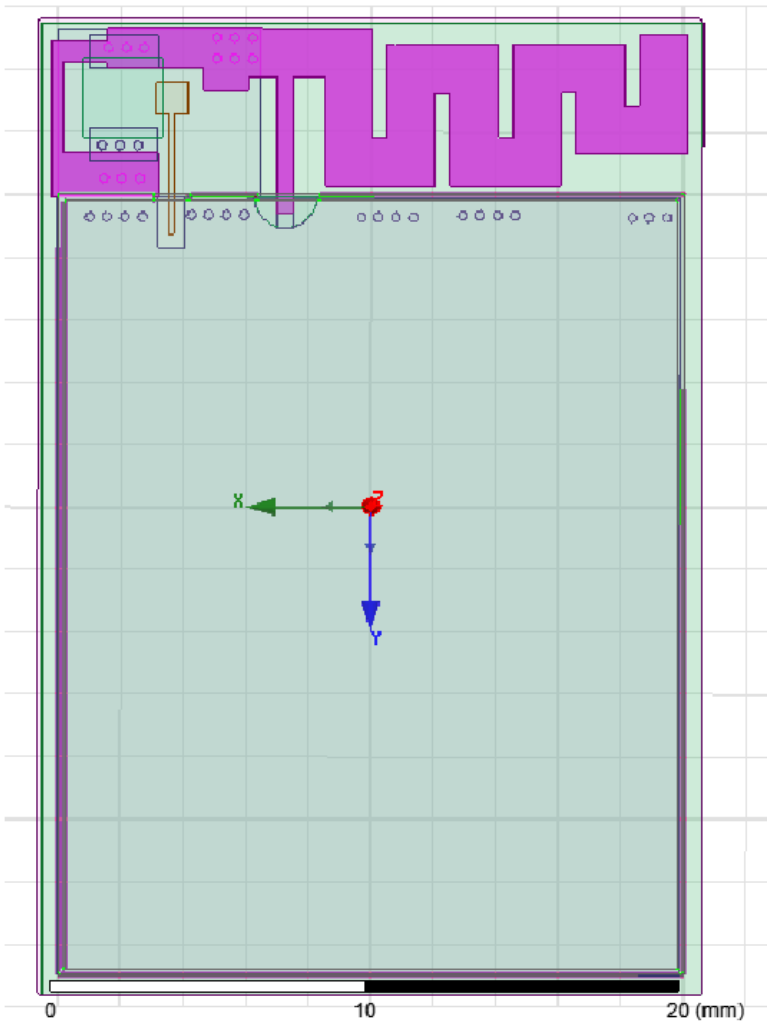
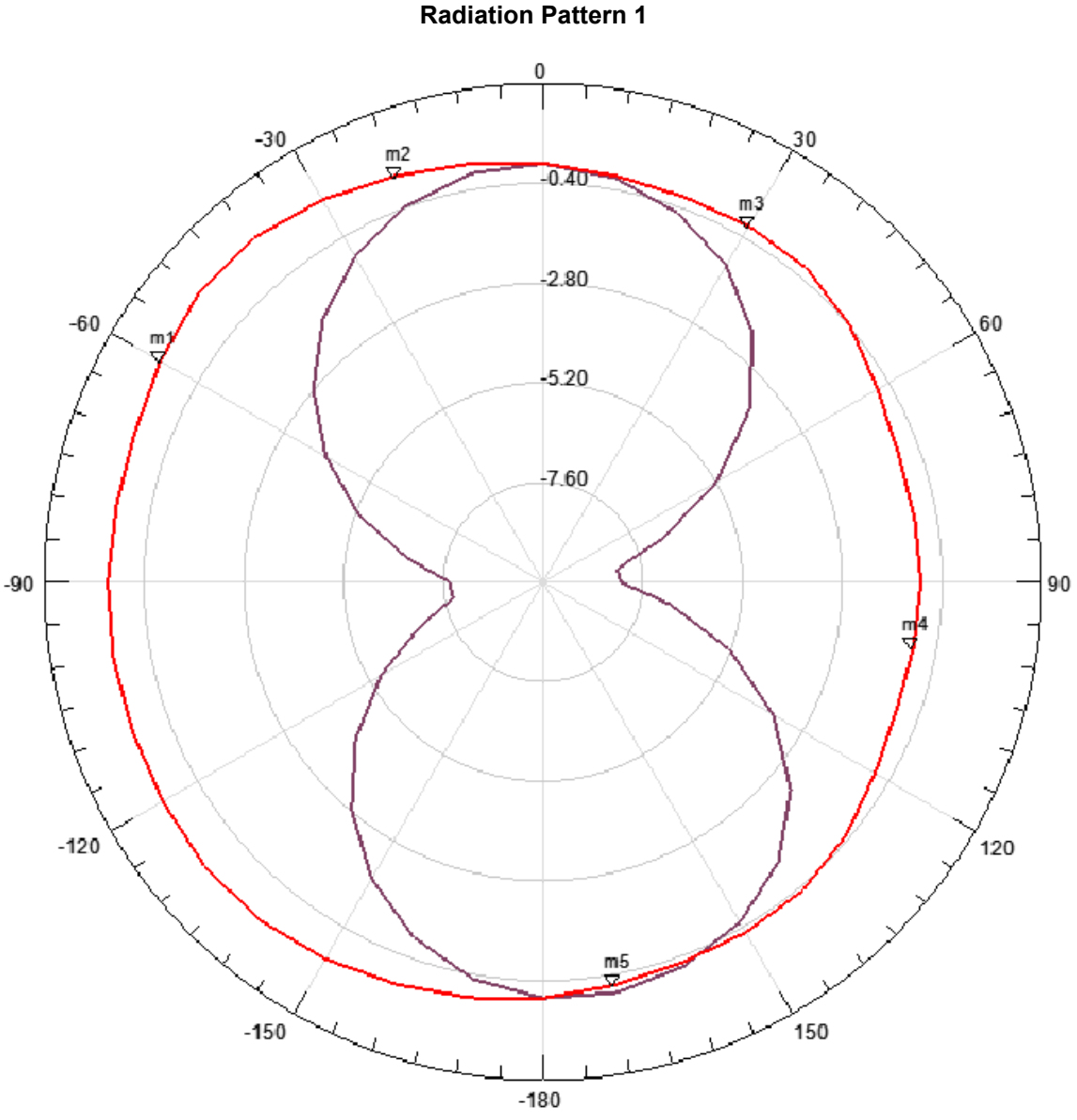


FIGURE 3-3: SIMULATED TWO-DIMENSIONAL RADIATION PATTERN

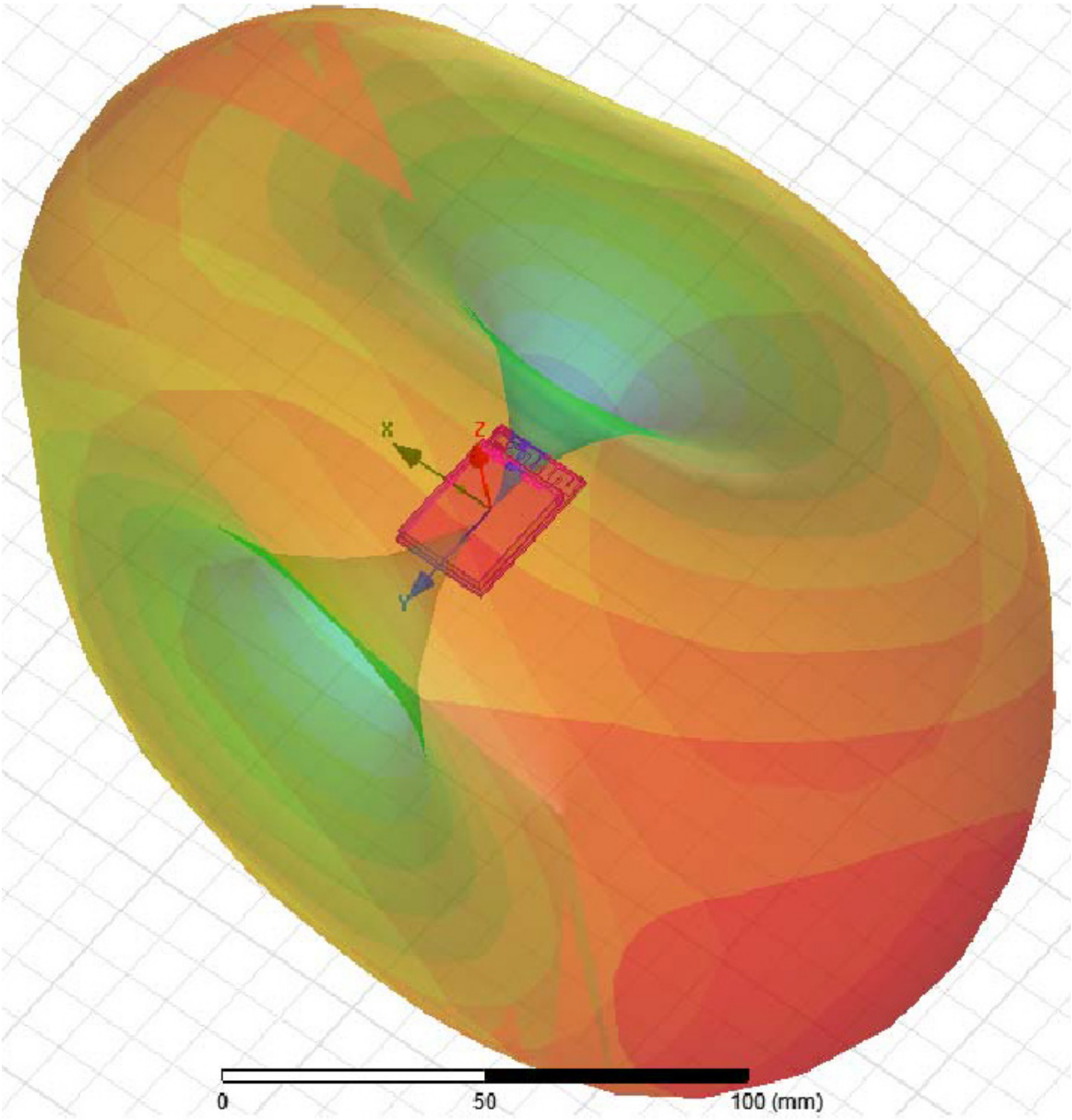
Name	Theta	Angle	Mag.
m1	-60.0000	-60.0000	0.6323
m2	-20.0000	-20.0000	0.3962
m3	30.0000	30.0000	-0.1038
m4	100.0000	100.0000	-0.9490
m5	170.0000	170.0000	-0.1414

Curve Information	Average
dB (Gain Total) Setup 1: Last Adaptive Freq. = “2.44 GHz” Phi = “0 deg”	0.0097
dB (Gain Total) Setup 2: Last Adaptive Freq. = “2.44 GHz” Phi = “0 deg”	-3.2020



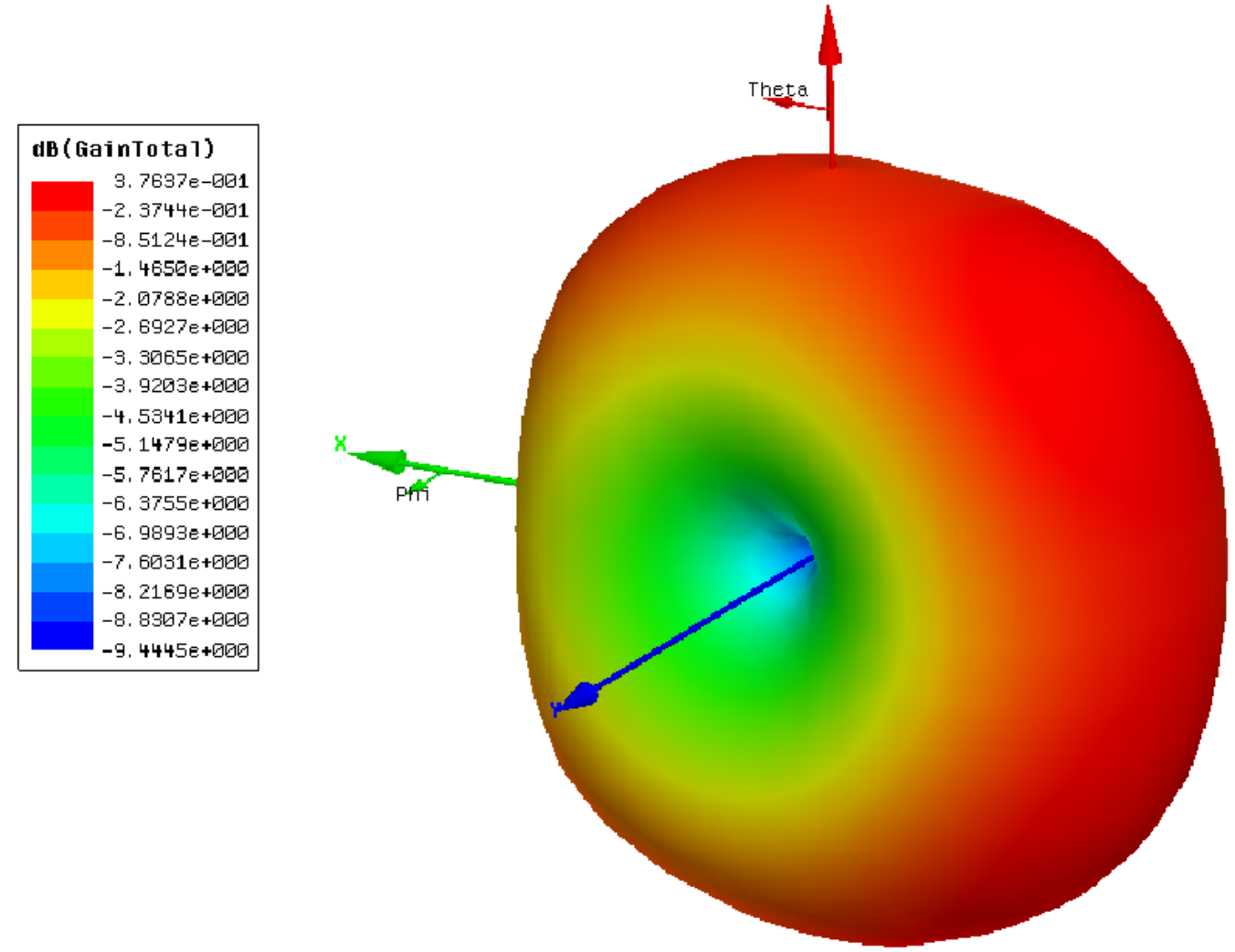
Two-dimensional (2D) pattern, including the average on main radiation planes (Phi = 0 and 90 degrees).

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 3-1: TESTED EXTERNAL ANTENNA TYPES

Type	Gain
PCB Trace	1 dBi
Dipole	2 dBi
PIFA	-3 dBi

4.0 REGULATORY APPROVAL

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

- United States
- Canada
- Europe
- Australia
- New Zealand
- Japan
- Korea
- Taiwan
- 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) http://apps.fcc.gov/oetcf/kdb/index.cfm.

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 Innovation, Science and Economic Development Canada (ISED, formerly Industry Canada) Radio Standards Specification (RSS) RSS-210 and RSSGen. 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 for the Host Device (from RSP-100, Issue 12, Section 5): The host device shall be properly labeled to identify the module within the host device.

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 5, March 2019): 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 contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada’s license-exempt RSS(s). Operation is subject to the following two conditions: 1. This device may not cause interference; 2. This device must accept any interference, including interference that may cause undesired operation of the device. L’émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d’Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes: 1. L’appareil ne doit pas produire de brouillage; 2. L’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

Transmitter Antenna (From Section 6.8 RSS-GEN, Issue 5, March 2019): User manuals, for transmitters shall display the following notice in a conspicuous location:

This radio transmitter [IC: 7693A-24WN0] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indi- cated. Antenna types not included in this list that have a gain greater than the maximum gain indi- cated for any type listed are strictly prohibited for use with this device. Le présent émetteur radio [IC: 7693A-24WN0] a été approuvé par Innovation, Sciences et Développement économique Canadapour fonctionner avec les types d'antenne énumérés cidessous 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 pour tout type figurant sur la liste, 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) and required impedance for each.

4.2.2 HELPFUL WEB SITES

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

4.3 Europe

The RN1810/RN1810E module is Radio Equipment Directive (RED) assessed, CE marked, and have been manufactured and tested with the intention of being integrated into a final product.

The RN1810/RN1810E module has been tested to RED 2014/53/EU Essential Requirements mentioned in the following European Compliance table.

TABLE 4-1: EUROPEAN COMPLIANCE

Certification	Standards	Article
Safety	EN 62368	3.1a
Health	EN 62311	
Electro Magnetic Compatibility (EMC)	EN 301 489-1	3.1b
	EN 301 489-17	
Radio	EN300 328	3.2

The ETSI provides guidance on modular devices in "*Guide to the application of harmonised standards covering Article 3.1b and Article 3.2 of the Directive 2014/53/EU RED to multi-radio and combined radio and non-radio equipment*" document available at http://www.etsi.org/deliver/etsi_eg/203300_203399/203367/01.01.01_60/eg_203367v010101p.pdf.

Note: To maintain conformance to the standards listed in the preceding European Compliance table, 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 against the RED.

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.

4.3.2 CONFORMITY ASSESSMENT

From ETSI Guidance Note EG 203367, section 6.1 Non-radio products are combined with a radio product:

If the manufacturer of the combined equipment installs the radio product in a host non-radio product in equivalent assessment conditions (i.e. host equivalent to the one used for the assessment of the radio product) and according to the installation instructions for the radio product, then no additional assessment of the combined equipment against article 3.2 of the RED is required.

4.3.2.1 SIMPLIFIED EU DECLARATION OF CONFORMITY

Hereby, Microchip Technology Inc. declares that the radio equipment type RN1810/RN1810E is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity for this product is available at

https://www.microchip.com/wwwproducts/en/RN1810

(available under *Documents* > *Certifications*).

4.3.3 APPROVED ANTENNAS

For RN1810/RN1810E, the approval is received using the external antenna types listed in Table 3-1.

4.3.4 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 Committee (ECC) at: http://www.ecodocdb.dk/.

Additional helpful web sites are:

- Radio Equipment Directive (2014/53/EU): https://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/red_en
- European Conference of Postal and Telecommunications Administrations (CEPT): http://www.cept.org
- European Telecommunications Standards Institute (ETSI): http://www.etsi.org
- The Radio Equipment Directive Compliance Association (REDCA): http://www.redca.eu/

4.4 Australia

The Australia radio regulations do not provide a modular approval policy similar to the United States (FCC) and Canada (IC). However, RN1810/RN1810E module RF transmitter test reports can be used in part to demonstrate compliance in accordance with ACMA Radio communications "Short Range Devices" Standard 2004 (The Short Range Devices standard calls up the AS/NZS 4268:2008 industry standard). The

RN1810/RN1810E module test reports can be used as part of the product certification and compliance folder. For more information on the RF transmitter test reports, contact Microchip Technology Australia sales office.

To meet overall Australian final product compliance, the developer must construct a compliance folder containing all relevant compliance test reports e.g. RF, EMC, electrical safety and DoC (Declaration of Conformity) etc. It is the responsibility of the integrator to know what is required in the compliance folder for ACMA compliance. All test reports are available on the RN1810/RN1810E product web page at http://www.microchip.com. For more information on Australia compliance, refer to the Australian Communications and Media Authority web site http://www.acma.gov.au/.

4.4.1 EXTERNAL ANTENNA REQUIREMENTS

The compliance testing listed in Table 4-1 was performed using the antenna types listed in Table 3-1.

4.4.2 HELPFUL WEB SITES

The Australian Communications and Media Authority: www.acma.gov.au/.

4.5 New Zealand

The New Zealand radio regulations do not provide a modular approval policy similar to the United States (FCC) and Canada (IC). However, RN1810/RN1810E module RF transmitter test reports can be used in part to demonstrate compliance against the New Zealand "General User Radio License for Short Range Devices". New Zealand Radio communications (Radio Standards) Notice 2010 calls up the AS / NZS 4268:2008 industry standard. The RN1810/RN1810E module test reports can be used as part of the product certification and compliance folder. All test reports are available on the RN1810/RN1810E product web page at http://www.microchip.com. For more information on the RF transmitter test reports, contact Microchip Technology sales office.

Information on the New Zealand short range devices license can be found in the following web links:

http://www.rsm.govt.nz/cms/licensees/types-oflicence/general-user-licences/short-range-devices

and

http://www.rsm.govt.nz/cms/policy-and-planning/spectrum-policy-overview/legislation/gazette-notices/product-compliance.

To meet overall New Zealand final product compliance, the developer must construct a compliance folder containing all relevant compliance test reports e.g. RF, EMC, electrical safety and DoC (Declaration of Conformity) etc. It is the responsibility of the developer to know what is required in the compliance folder for New Zealand Radio communications. For more information on New Zealand compliance, refer to the web site http://www.rsm.govt.nz/.

4.5.1 EXTERNAL ANTENNA REQUIREMENTS

The compliance testing listed in Table 4-1 was performed using the antenna types listed in Table 3-1.

4.5.2 HELPFUL WEB SITES

Radio Spectrum Ministry of Economic Development: http://www.rsm.govt.nz/.

4.6 Japan

The RN1810/RN1810E module has received type certification and is labeled with its own technical conformity mark and certification number as required to conform to the technical standards regulated by the Ministry of Internal Affairs and Communications (MIC) of Japan pursuant to the Radio Act of Japan.

Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed. Additional testing may be required:

- If the host product is subject to electrical appliance safety (for example, powered from an AC mains), the host product may require Product Safety Electrical Appliance and Material (PSE) testing. The integrator should contact their conformance laboratory to determine if this testing is required.
- There is a voluntary Electromagnetic Compatibility (EMC) test for the host product administered by VCCII: http://www.vcci.jp/vcci_e/index.html

4.6.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the RN1810/RN1810E module must follow Japan marking requirements. The integrator of the module should refer to the labeling requirements for Japan available at the Ministry of Internal Affairs and Communications (MIC) website.

The RN1810/RN1810E module is labeled with its own technical conformity mark and certification number. The final product in which this module is being used must have a label referring to the type certified module inside:

Contains transmitter module with certificate number:

PENDING

4.6.2 HELPFUL WEB SITES

Ministry of Internal Affairs and Communications (MIC): http://www.tele.soumu.go.jp/e/index.htm

Association of Radio Industries and Businesses (ARIB): http://www.arib.or.jp/english/

4.7 Korea

The RN1810/RN1810E module has received certification of conformity in accordance with the Radio Waves Act. Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed.

4.7.1 LABELING AND USER INFORMATION REQUIREMENTS

The label on the final product which contains the RN1810/RN1810E module must follow KC marking requirements. The integrator of the module should refer to the labeling requirements for Korea available on the Korea Communications Commission (KCC) website.

The RN1810/RN1810E module is labeled with its own KC mark. The final product requires the KC mark and certificate number of the module:

PENDING

4.7.2 EXTERNAL ANTENNA REQUIREMENTS

The Korea compliance testing was performed using the antenna types listed in Table 3-1.

4.7.3 HELPFUL WEB SITES

Korea Communications Commission (KCC): http://www.kcc.go.kr.

National Radio Research Agency (RRA): http://rra.go.kr.

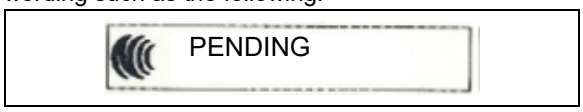
4.8 Taiwan

The RN1810/RN1810E module has received compliance approval in accordance with the Telecommunications Act. Customers seeking to use the compliance approval in their product should contact Microchip Technology sales or distribution partners to obtain a Letter of Authority.

Integration of this module into a final product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed.

4.8.1 LABELING AND USER INFORMATION REQUIREMENTS

The RN1810/RN1810E module is labeled with its own NCC ID number, and if the NCC ID is not visible when the module is installed inside another device, then the outside of the device must also display a label referring to the enclosed module. This exterior label can use wording such as the following:



The user's manual should contain below warning (for RF device) in traditional Chinese:

注意！
依據 低功率電波輻射性電機管理辦法
第十二條 經型式認證合格之低功率射頻電機，非經許可，
公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計
之特性及功能。
第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；
經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。
前項合法通信，指依電信規定作業之無線電信。
低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性
電機設備之干擾。

4.8.2 EXTERNAL ANTENNA REQUIREMENTS

The Taiwan compliance testing was performed using the antenna types listed in Table 3-1.

4.8.3 HELPFUL WEB SITES

National Communications Commission (NCC): http://www.ncc.gov.tw.

4.9 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(1)

Symbol	Description	Max Rating	Units
VDD	Voltage on VDD with respect to GND	-0.3 to 4.0	V
V_{DI} Min.	Minimum digital input voltage	-0.3	V
V_{DO} Max.	Maximum digital input voltage	VDD+0.3	V
RF_{IN}	Maximum RF input (referenced to 50 ohms)	+10	dBm

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

Symbol		Min.	Typ.	Max.	Units
VDD	Supply voltage	3.15	3.3	3.45	V
TAMB	Ambient temperature under bias	-40	—	85	°C

TABLE 5-3: CURRENT CONSUMPTION(1) (NOMINAL CONDITIONS: 25°C, VDD = 3.3V)

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

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

DC CHARACTERISTICS		Operating Conditions(1)			
Symbol	Parameter	Min.	Typ.	Max.	Units
VIH	High-Level Input Voltage	1.8	—	3.6	V
VIL	Low-Level Input Voltage	-0.3	—	0.3	V

TABLE 5-4: DC CHARACTERISTICS FOR DIGITAL IO PINS (CONTINUED)

DC CHARACTERISTICS		Operating Conditions[1]			
Symbol	**Parameter**	**Min.**	**Typ.**	**Max.**	**Units**
VOH	High-Level Output Voltage	2.2	—	3.3	V
VOL	Low-Level Output Voltage	0	—	0.4	V
IIH	High-Level Input Current	—	—	0.1	µA
IIL	Low -Level Input Current	—	—	0.1	µA
IOH	High-Level Output	—	—	20	mA
IOL	Low-Level Output Current	—	—	20	mA
CIN	Input Capacitance	—	3		pF

Note: Operating temperature: 25°C; Operating voltage: VDD = 3.3V

Table 5-5, Table 5-6 and Table 5-7 show the frequency characteristics of the module.

TABLE 5-5: RADIO RECEIVE CHARACTERISTICS

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
fRX	RX input frequency range	—	2.412	—	2.472	GHz
sRF	Sensitivity					
	CCK	1 Mbps	—	-95.7	—	dBm
		11 Mbps	—	-87.7	—	
	OFDM	6 Mbps	—	-92.7	—	
		54 Mbps	—	-75.7	—	
	HT20	MCS0	—	-92.7	—	
		MCS7	—	-72.7	—	
	HT40	MCS0	—	-90.7	—	
		MCS7	—	-69.7	—	

Note 1: Performance measured at J1.

TABLE 5-6: RADIO TRANSMIT CHARACTERISTICS

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
fRX	TX output frequency range	—	2.412	—	2.472	GHz
pOUT	Output power[1]					
	802.11b mask compliant	1 Mbps	—	20.7	—	dBm
	802.11g mask compliant	6 Mbps	—	20.7	—	
	802.11g EVM compliant	54 Mbps	—	18.8	—	
	802.11n HT20 mask compliant	MCS0	—	20.7	—	
	802.11n HT40 mask compliant	MCS0	—	18.5	—	
	802.11n HT20 EVM compliant	MCS7	—	18.0	—	
	802.11n HT40 EVM compliant	MCS7	—	18.4	—	
aPC	Accuracy of power control	—	—	+/-1.5	—	dB

Note 1: Performance measured at J1.

TABLE 5-7: SYNTHESIZER CHARACTERISTICS

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
fC	Center channel frequency	Center frequency at 5 MHz spacing	2.412	—	2.472	GHz
fREF	Reference oscillator frequency	+/-20 ppm	—	40	—	MHz
fSTEP	Frequency step size (at RF)	—	—	5	—	MHz

APPENDIX A: REVISION HISTORY

Revision A (January 2016)

This is the initial released version of the document.

Revision B (June 2017)

Updated **Section 4.0 "Regulatory Approval"**

Revision C (May 2021)

Updated **Section 4.2 "Canada"** and **Section 4.3 "Europe"**

NOTES:

PRODUCT IDENTIFICATION SYSTEM

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

PART NO.	I	RM	XXX
Device	Temperature Range	Package	Firmware Revision Number

Device:	RN1810: RN1810E:		Integral Antenna External Antenna Connection
Temperature Range:	I	=	-40°C to +85°C (Industrial)
Package:	RM	=	Radio Module

Examples:

RN1810-I/RM100

NOTES:

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods being used in attempts to breach the code protection features of the Microchip devices. We believe that these methods require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Attempts to breach these code protection features, most likely, cannot be accomplished without violating Microchip's intellectual property rights.
- Microchip is willing to work with any customer who is concerned about the integrity of its code.
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