OEM INTEGRATOR'S MANUAL

IEEE 802.15.4 radio module

Product Number: 2-14231

(Revision 1.3)
Prepared by Carmanah Signs Inc
August 2, 2016
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Document Revision

Version	Description	Author	Date
1.0	Initial Revision	Bryce Klippenstein	June 14, 2016
1.1	Added additional compliance information	Bryce Klippenstein	July 27, 2016
1.2	Clarified grantee and manufacturer details	Bryce Klippenstein	Aug. 2, 2016
1.3	Added RF exposure information	Bryce Klippenstein	Aug. 4, 2016

Contents

Compliance statements

Warnings

Carmanah Signs Inc. is the FCC license grantee and the Host Manufacturer.

Carmanah Signs Inc. shall provide guidance to the host manufacturer to ensure product compliance with FCC and IC requirements.

This wireless module shall not be made available for purchase except as part of a complete product.

This module is limited to OEM installation ONLY.

The OEM integrator is responsible for ensuring the end-user has no manual instruction to install or remove the module.

This module is limited to installation in mobile or fixed applications only.

Separate approval is required for all other operating configurations, including portable configurations with respect to Title 47 Part 2.1093 of the FCC rules and different antenna configurations.

FCC Part 15

15.19

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.

15.21

THE GRANTEE IS NOT RESPONSIBLE FOR ANY CHANGES OR MODIFICATIONS NOT
EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE. SUCH
MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

Industry Canada Notifications

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

Labeling

The OEM must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the final product enclosures that display the statement below:

Contains FCC ID: 2AIQM-214231
Contains IC ID: 21436-214231
This device complies with FCC Rules Part 15 operation is subject to the following two conditions:
1. This device may not cause harmful interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

RF Exposure Compliance

When kept at a distance of 20cm or greater the maximum RF exposure will be less than 843µW, which is below IC and FCC limits.
This module is not tested for RF exposure at ranges closer then 20cm, and shall not be used at ranges closer than 20cm.

Mechanical Drawings
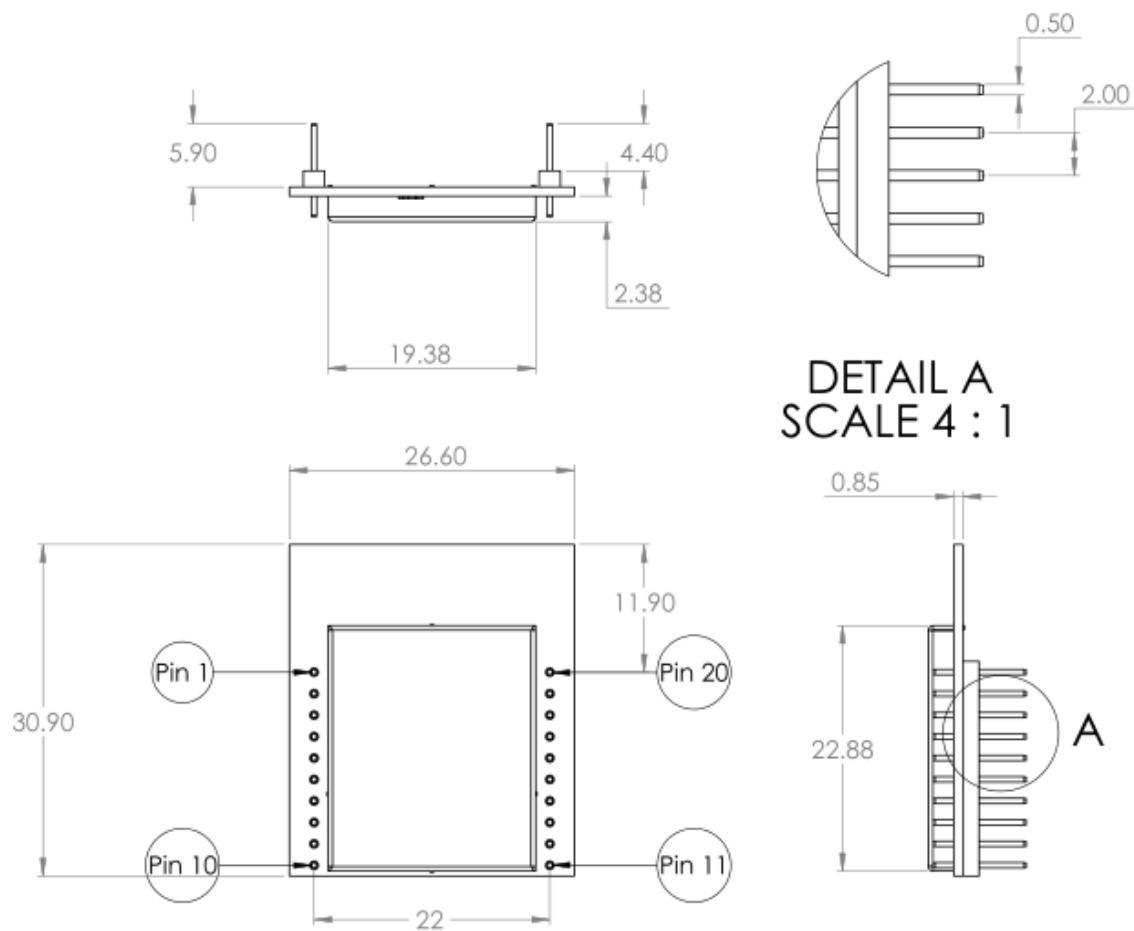
DETAIL A
SCALE 4 : 1

Label Detail

MODEL: 2-14231
FCC ID: 2AIQM-214231
IC ID: 21436-214231
FIRMWARE: AAAA
LOT: BCCDD
S/N: EEEEE

FC RoHS

AAAA: Firmware Version
B: Manufacturing Location
CC: Week Manufactured
DD: Year Manufactured
EEEEE: Serial Number

Specifications

Model Number	2-14231
Performance	
Indoor Range	Up to 30m
Outdoor Range	Up to 90m
Transmit Power	+5dBm
RF Data Rate	250 kbps
Serial Interface data rate	9600 bps
Receiver Sensitivity	-98dBm
Power Requirements	
Supply Voltage	2.8V - 3.6V
Transmit Current	41mA (@3.3V)
Idle / Receive Current	29mA (@3.3V)
General	
Operating Frequency	2394MHz - 2507MHz
Adjacent Channel Rejection	49dB
Dimensions	26.6mm x 30.9mm
Operating Temperature	-40°C to +85°C
Antenna Options	Printed Antenna
Networking Options	
Supported Networking Topologies	Point to Multi-point
Number of Channels	16 User Selectable Channels
Agency Approvals	
Canada	21436-214231
United States	2AIQM-214231

Pin Signals

Pin #	Name	Direction	Description
1	Vcc	Power	Power Supply Input
2	Dout	Output	UART Data Out
3	Din	Input	UART Data In
4	NC	-	No Connection
5	RESET	Input	Radio Reset
6	NC	-	No Connection
7	NC	-	No Connection
8	NC	-	No Connection
9	NC	-	No Connection
10	Gnd	Power	Power Supply Ground
11	NC	-	No Connection
12	NC	-	No Connection
13	NC	-	No Connection
14	Reserved	-	Reserved for Factory Use Only
15	NC	-	No Connection
16	NC	-	No Connection
17	NC	-	No Connection
18	Reserved	-	Reserved for Factory Use Only
19	Reserved	-	Reserved for Factory Use Only
20	Reserved	-	Reserved for Factory Use Only

Supported AT Commands

AP – API Enable

The AP command is used to enable the RF module to operate using a frame-based API instead of using the default Transparent (UART) mode.

AT Command: `ATAP`
Parameter Range: `0 – 2`

Parameter	Configuration
0	Disabled (Transparent Operation)
1	API Enabled
2	API Enabled (With escaped characters)
Default Value: 0	

Example usage: `ATAP 2<CR>`

CH – Channel Command

The CH command is used to set/read the operating channel on which RF connections are made between RF modules. The channel is one of three addressing options available to the module. The other options are the PAN ID (ID command) and destination addresses (DL & DH commands).

AT Command: `ATCH`
Parameter Range: `0x0B – 0x1A`
Default Value: `0x0C`

Example usage: `ATCH C<CR>`

CN – Exit Command Mode

The CN command is used to explicitly exit the RF module from AT Command Mode.

AT Command: `ATCN`
Parameters: `None`

Example usage: `ATCN<CR>`

ED – Energy Scan

The ED command is used to send an "Energy Detect Scan". This parameter determines the length of scan on each channel. The maximal energy on each channel is returned and each value is followed by a carriage return. An additional carriage return is sent at the end of the command. The values returned represent the detected energy level in units of -dBm. The actual scan time on each channel is measured as Time = [(2 ^ ED PARAM) * 15.36] ms.

AT Command: `ATED`
Parameter Range: `0 - 6`

Parameter	Scan Length
0	15.36ms
1	30.72ms
2	61.44ms
3	122.88ms
4	245.76ms
5	491.52ms
6	983.04ms

Example usage: `ATED 2<CR>`

ND – Node Discover

<Networking {Identification}> The ND command is used to discover and report all modules on its current operating channel (CH parameter) and PAN ID (ID parameter). ND also accepts an NI (Node Identifier) value as a parameter. In this case, only a module matching the supplied identifier will respond. ND uses a 64-bit long address when sending and responding to an ND request. The ND command causes a module to transmit a globally addressed ND command packet. The amount of time allowed for responses is determined by the NT (Node Discover Time) parameter. In AT Command mode, command completion is designated by a carriage return (0x0D). Since two carriage returns end a command response, the application will receive three carriage returns at the end of the command. If no responses are received, the application should only receive one carriage return. When in API mode, the application should receive a frame (with no data) and status (set to 'OK') at the end of the command. When the ND command packet is received, the remote sets up a random time delay (up to 2.2 sec) before replying as follows: Node Discover Response (AT command mode format - Transparent operation):
MY (Source Address) value<CR>
SH (Serial Number High) value<CR>
SL (Serial Number Low) value<CR>
DB (Received Signal Strength) value<CR>
NI (Node Identifier) value<CR>
<CR> (This is part of the response and not the end of command indicator.)

AT Command: `ATND`
Parameter Range: Optional 20 Character NI Value

Example usage: `ATND<CR>`

NT – Node Discover Time

The NT command is used to set the amount of time a base node will wait for responses from other nodes when using the ND (Node Discover) command. The NT value is transmitted with the ND command. Remote nodes will set up a random hold-off time based on this time. The remotes will adjust this time

down by 250 ms to give each node the ability to respond before the base ends the command. Once the ND command has ended, any response received on the base will be discarded.

AT Command: `ATNT`
Parameter Range: 0x01 – 0xFC [x 100 ms]
Default Value: 0x19 (2.5 decimal seconds)

Example usage: `ATNT AB<CR>`

RE – Restore Defaults

The RE command is used to restore all configurable parameters to their factory default settings. The RE command does not write restored values to non-volatile (persistent) memory. Issue the WR (Write) command subsequent to issuing the RE command to save restored parameter values to non-volatile memory.

AT Command: `ATRE`
Parameter Range: `None`

Example usage: `ATRE<CR>`

SC – Scan Channels

The SC command is used to set and read the list of channels to scan for all Active and Energy Scans as a bit field. This affects scans initiated in command mode [AS (Active Scan) and ED (Energy Scan) commands] and during End Device Association and Coordinator startup.

AT Command: `ATSC`
Parameter Range: 0x1 – 0xFFFF [Bitfield]
Default Value: 0x1FFE All XBee Pro channels.

bit 0 - 0x0B bit 4 - 0x0F bit 8 - 0x13 bit 12 - 0x17
bit 1 - 0x0C bit 5 - 0x10 bit 9 - 0x14 bit 13 - 0x18
bit 2 - 0x0D bit 6 - 0x11 bit 10 - 0x15 bit 14 - 0x19
bit 3 - 0x0E bit 7 - 0x12 bit 11 - 0x16 bit 15 - 0x1A

Example usage: ATSC FFFF<CR>

VR – Firmware Version

Shows the firmware version running on the radio.

AT Command: `ATVR`
Parameter Range: `None`

Example usage: `ATVR<CR>`

WR – Write non-volatile memory

The WR command is used to write configurable parameters to the RF module's non-volatile memory. Parameter values remain in the module's memory until overwritten by subsequent use of the WR Command. If changes are made without writing them to non-volatile memory, the module reverts back to previously saved parameters the next time the module is powered-on.

AT Command: ATWR
Parameter Range: None

Example usage: ATWR<CR>

Appendix A: Agency Certifications

Industry Canada

Insert IC Documents Here

FCC

Insert FCC Documents Here