



## **ROAMMOD0001 User's Manual**

[illegible]

## Background

The ROAMMOD0001 radio module is intended for installation in wireless streetlight controls applications. The module is supplied regulated 3.3Vdc by a ROAM/SSG custom host board with +/-1% regulated supply in all applications. The module contains filtering capacitors onboard to smooth variations in supply voltage.

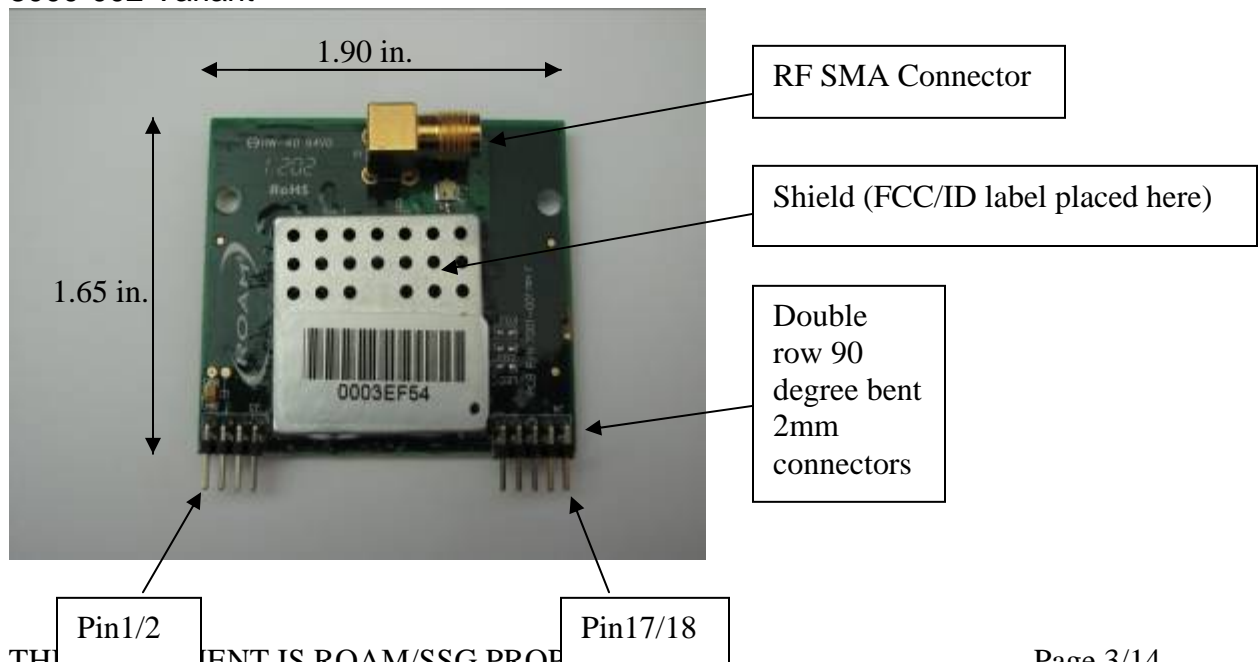
The module assembly is also known as ROAM part numbers; 8000-004 (mica permanently connected antenna) and 8000-003 (permanently connected 1/4 wave whip 2dBi antenna) and 8000-002 (SMA connected 5dBi whip antenna). Each variant is physically and electrically identical except for the antenna implementation.

Modem User's Manual (not accessible to end-users).

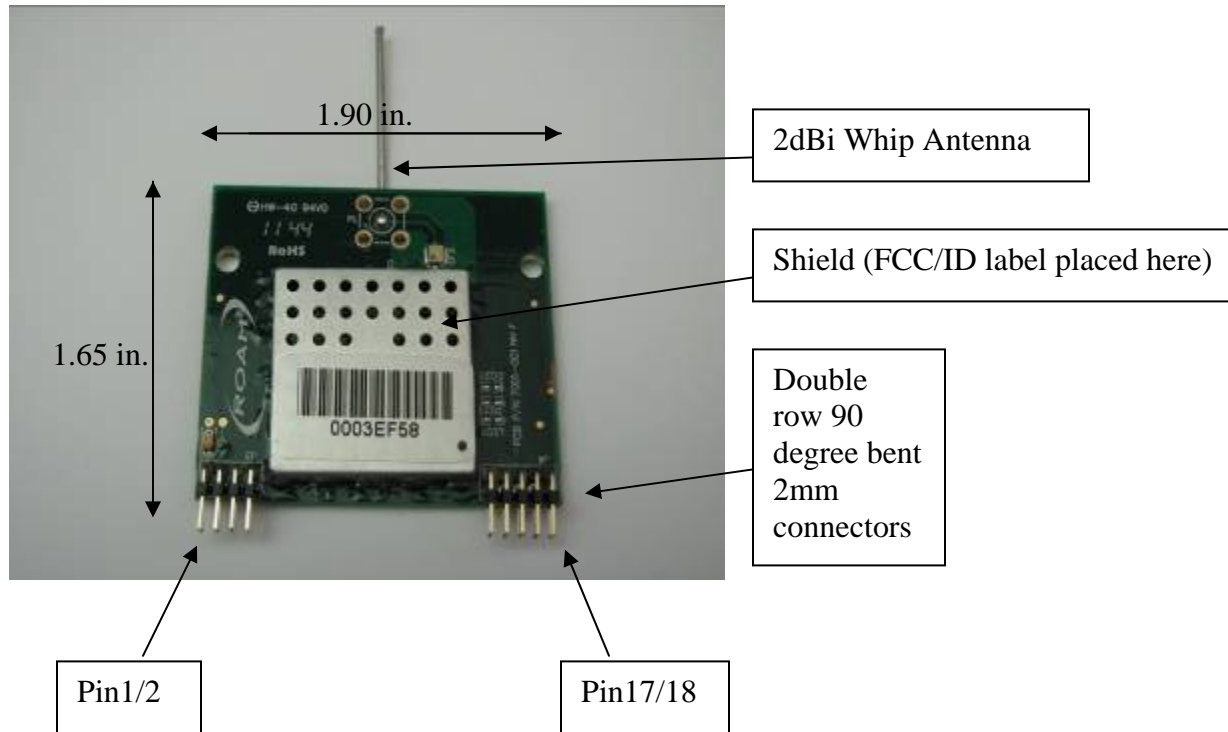
### 1. Overview of the Radio Modem Hardware

The ROAMMOD0001 modem is an 802.15.4 wireless module that allows wireless communication using a standard asynchronous serial data stream. The main features of the ROAMMOD0001 radio modem are presented in the figures below. FCC ID label will be applied to the shield at a later date.

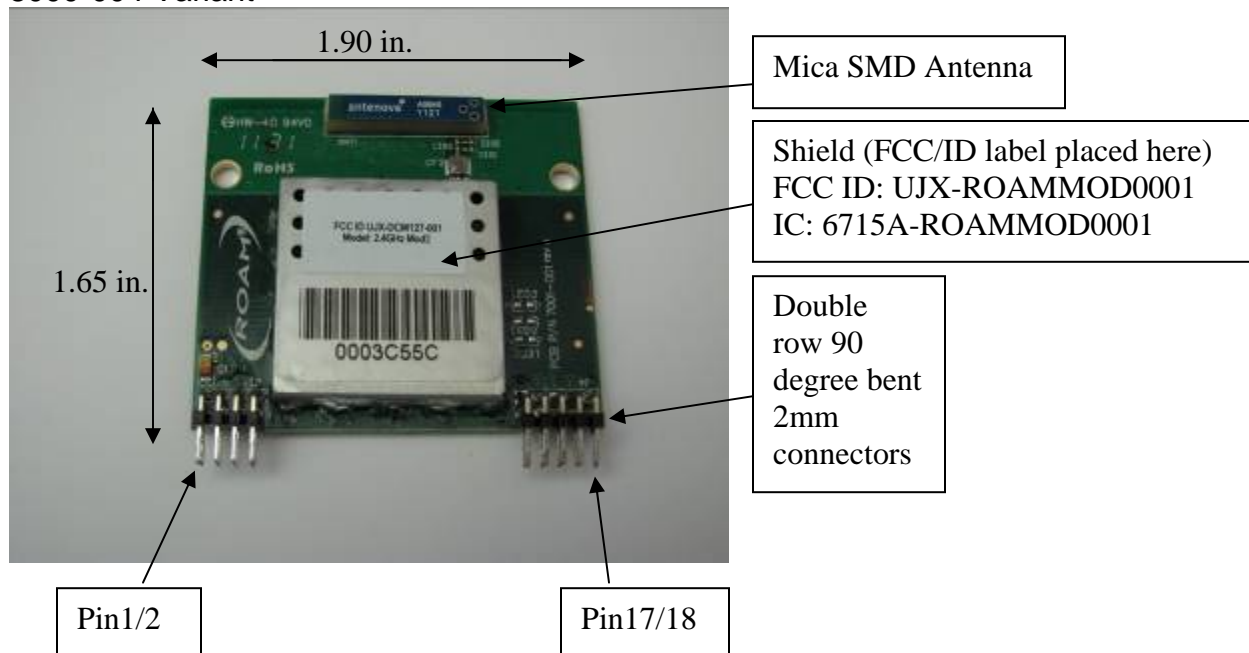
8000-002 Variant



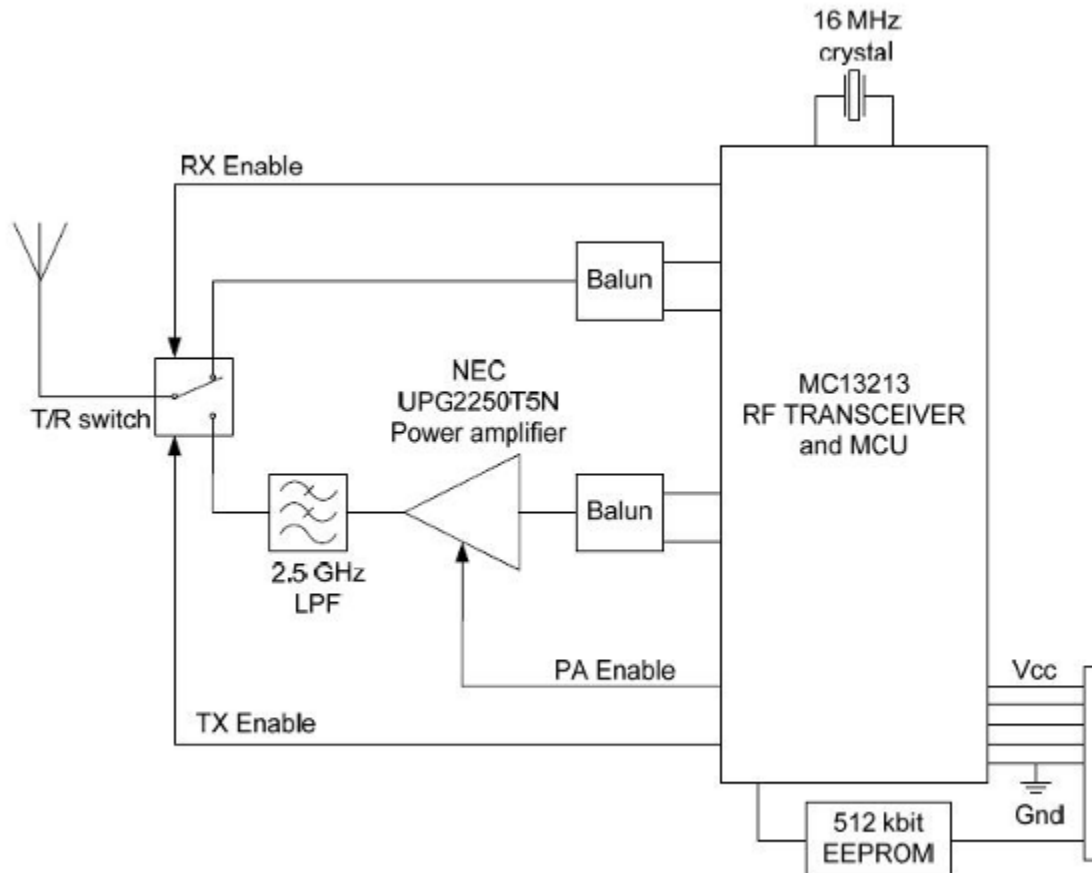
### 8000-003 Variant



### 8000-004 Variant



## Functional Block Diagram of the ROAMMOD0001 Module



The ROAMMOD0001 radio module consists of three functional entities:

1. Transceiver section – processor, RF transceiver
2. RF section – BALUNs, RF PA, RF filters, RF switch
3. Non-volatile storage – EEPROM

A table of the radio modem pins is provided below, describing the purpose and functionality of the pins and the max voltage range on the pins. The pin-out is identical for each of the above three module variants.



## Pin-Out Chart for the ROAMMOD0001 Module

Pin number	Pin name	Function of pin	Nominal voltage	Max voltage
1	VCC	Voltage supply	3.3 V	3.6 V
2	GND	Ground pin	0 V	0 V
3	RST	RESET, active low	3.3V	3.6V
4	BKGD	DEBUG line	3.3 V	3.6 V
5	KBD5	PTA5, GPIO1, Interrupt capable	3.3 V	3.6 V
6	VREFH	Voltage reference pin	2.5V	3.3 V
7	KBD7	PTA7, GPIO3, Interrupt capable	3.3 V	3.6 V
8	KBD6	PTA6, GPIO2, Interrupt capable	3.3 V	3.6 V
9	SCL	SCL line of I2C bus	3.3 V	3.6 V
10	SDA	SDA line of I2C bus	3.3 V	3.6 V
11	TXD2	TX line of UART 2	3.3 V	3.6 V
12	RXD2	RX line of UART 2	3.3 V	3.6 V
13	TXD1	TX line of UART 1	3.3 V	3.6 V
14	RXD1	RX line of UART 1	3.3 V	3.6 V
15	ADC2	PTB2, ADC input	3.3 V	3.6 V
16	ADC3	PTB3, ADC input	3.3 V	3.6 V
17	ADC1	PTB1, ADC input	3.3 V	3.6 V
18	ADC0	PTB0, ADC input	3.3 V	3.6 V

## 2. Operation of the ROAMMOD0001 Radio Modem

Communication with the ROAMMOD0001 radio modem happens through serial port 2. The baudrate is set to be 19200, 8N1.

### 2.1. Command Set

Open an instance of terminal software on a serial port with the above settings and connect to the RF modem. Any command is single line followed by enter command. Format of command is: command param1 param2 ... <enter> At startup pushing the enter key a few times is necessary until the reception of the prompt string.

PTS Commands description:

#### 1. Clear screen

- Description:** clear screen
- Command name:** "cls"
- Parameters:** None



d. **Ex:** cls<enter>

## **2. Help**

a. **Description:** display commands list and a short description of each command

b. **Command name:** "help"

c. **Parameters:** None

d. **Ex:** help<enter>

## **3. Read ADC (ATD) channels**

a. **Description:** read and display ADC channels values

b. **Command name:** "getadc"

c. **Parameters:** None

d. **Ex:** getadc<enter>

## **4. Get Modem SPI Register**

a. **Description:** get value for a modem register (from page0)

b. **Command name:** "getreg"

c. **Parameters:** 1

- register ID: hex format

d. **Ex:** getreg 00<enter>

## **5. Set Modem SPI Register**

a. **Description:** set value for a modem register (from page0)

b. **Command name:** "setreg"

c. **Parameters:** 2

- register ID: hex format

- register vlaue: hex format

d. **Ex:** setreg 20 80FF<enter>

## **6. Set Power Amplification value**

a. **Description:** set value for a modem PA power (not persistent value)

b. **Command name:** "setpa"

c. **Parameters:** 1

- PA value: hex format

d. **Ex:** setpa FC<enter>

## **7. Set Modem Channel**

a. **Description:** set value for a modem channel (not persistent value)

b. **Command name:** "setch"

c. **Parameters:** 1

- channel number: **decimal format**

d. **Ex:** setch 0<enter>

## **8. Set red LED value**

a. **Description:** set red LED on or off

b. **Command name:** "setredled"

c. **Parameters:** 1

- Red led: 0 or 1

d. **Ex:** setredled 0<enter>



**9. Set green LED value**

- a. **Description:** set green LED on or off
- b. **Command name:** "setgreenled"
- c. **Parameters: 1**
  - Green led: 0 or 1
- d. **Ex:** setgreenled 0<enter>

**10. Put modem in IDLE state**

- a. **Description:** put modem in IDLE state
- b. **Command name:** "idle"
- c. **Parameters: None**
- d. **Ex:** idle<enter>

**11. Put modem in PULSE state**

- a. **Description:** put modem in pulse PRBS9 state
- b. **Command name:** "pulse"
- c. **Parameters: None**
- d. **Ex:** pulse<enter>

**12. Put modem in RX state**

- a. **Description:** put modem in RX state
- b. **Command name:** "rx"
- c. **Parameters: None**
- d. **Ex:** rx<enter>

**13. Put modem in RX echo state**

- a. **Description:** put modem in RX echo state (used for message success rate)
- b. **Command name:** "rxecho"
- c. **Parameters: 1 (but can missing)**
  - Msg signature: hex format, default value 0xFF
- d. **Ex:** rxecho<enter>

**14. Calculate the TX message success rate**

- a. **Description:** Calculate message success rate
- b. **Command name:** "txmsg"
- c. **Parameters: 4 (but can missing)**
  - Packet no: **decimal format**, default 100
  - Delay (in ms): **decimal format**, default 100
  - Packet len: **decimal format**, default 125
  - Msg signature: hex format, default value 0xFF
- d. **Ex:** txmsg 10<enter>

**15. Put modem in TX not modulated state**

- a. **Description:** put modem in continuous TX not modulated state
- b. **Command name:** "txnomod"
- c. **Parameters: None**
- d. **Ex:** txnomod<enter>

**16. Put modem in TX modulated state**





a. **Description:** put modem in continuous TX modulated state

b. **Command name:** "txmod"

c. **Parameters:** None

d. **Ex:** txmod<enter>

#### **17. Read main info stored on EEPROM**

a. **Description:** displays SN, max PA power, and VRef stored on EEPROM

b. **Command name:** "iic\_read"

c. **Parameters:** None

d. **Ex:** iic\_read<enter>

#### **18. Clear EEPROM (except main info)**

a. **Description:** Clear EEPROM except main info

b. **Command name:** "iic\_erase"

c. **Parameters:** None

d. **Ex:** iic\_erase<enter>

#### **19. Write device SN on EEPROM**

a. **Description:** Set device SN on EEPROM and clear rest of EEPROM

b. **Command name:** "iic\_setsn"

c. **Parameters:** 1

- Device SN: hex format, up to 16 digits (8 bytes)

d. **Ex:** iic\_setsn 4FC0<enter>

#### **20. Write VRef on EEPROM**

a. **Description:** Set VRef on EEPROM

b. **Command name:** "iic\_setvref"

c. **Parameters:** 1

- Value VRef: **decimal format** (between 2450 and 2550)

d. **Ex:** iic\_sevref 2500<enter>

#### **21. Write max PA on EEPROM**

a. **Description:** Set max PA on EEPROM

b. **Command name:** "iic\_setpa"

c. **Parameters:** 1

- Max power hex format

d. **Ex:** iic\_setpa FF<enter>

#### **22. Set output pin in lo**

a. **Description:** Set a pin as output and in lo state

b. **Command name:** "outlo"

c. **Parameters:** 1

- Pin definition: string: port and bit

d. **Ex:** outlo A5<enter>

#### **23. Set output pin in hi**

a. **Description:** Set a pin as output and in hi state

b. **Command name:** "outhi"

c. **Parameters:** 1

- Pin definition: string: port and bit



d. **Ex:** outhi A5<enter>

## ROAMMOD0001 Frequency Selection

The ROAMMOD0001 module is not frequency agile during run-time, but it can select an unoccupied portion of the spectrum at startup. The series uses a set of 16 channels as defined by the IEEE 802.15.4 standards which span a range from 2405 to 2480 MHz with 5 MHz spacing between channels:

Center Frequency (MHz)	Channel Designator	Nominal Occupied BW
<b>2405</b>	11	2402.5-2407.5
2410	12	2407.5-2412.5
<b>2415</b>	13	2412.5-2417.5
2420	14	2417.5-2422.5
<b>2425</b>	15	2422.5-2427.5
2430	16	2427.5-2432.5
2435	17	2432.5-2437.5
2440	18	2437.5-2442.5
2445	19	2442.5-2447.5
<b>2450</b>	20	2447.5-2452.5
2455	21	2452.5-2457.5
2460	22	2457.5-2462.5
2465	23	2462.5-2467.5
2470	24	2467.5-2472.5
2475	25	2472.5-2477.5
<b>2480</b>	26	2477.5-2482.5

The channel mask is the name used to describe the list of frequency channels that a radio can use. The default channel mask for client radios allows them to operate on any frequency highlighted blue in the table above.

## 3. RF Exposure Limit Warning

To comply with FCC's RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

**The above statement must be placed in the end-user's operating manual of finished products.**

## 4. FCC Certification Requirements

This Device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:



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

**The above statement must be placed in the end-user's operating manual of finished products.**

## **5. Warning (Part 15.21)**

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**The above statement must be placed in the end-user's operating manual of finished products.**

## **6. Compliance Statement (Industry Canada)**

IC – Canada This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radio électrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

**The above statement must be placed in the end-user's operating manual of finished products.**

## **7. Example Applications**

### **Pictures of Typical Applications for the ROAMMOD0001 Module**

ROAM/SSG – A Division of Acuity Brands  
ROAMMOD0001 User's Manual



ROAM REG127 gateway contains ROAMMOD0001 radio module 8000-002 variant



ROAM DCM127 dimming module contains ROAMMOD0001 radio module 8000-004 variant (shown with plastic cover removed).



## 8. Installation

- **This module is limited to OEM installation only**
- **OEM Integrators may not provide instructions for end user to remove/install module.**
- **This module is to be installed only in mobile or fixed applications -- reference part 2.1091(b) for a definition of mobile and fixed devices.**
- **Separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.**

## 9. RF Exposure Limit Warning

To comply with FCC's RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter (must not transmit simultaneously with any other antenna or transmitter, except in accordance with FCC multi transmitter product procedures).

**The above statement must be placed in the end-user's operating manual of finished products.**

## 10. Host Manufacturer Statements

To ensure compliance with all non-transmitter functions the host manufacturer (ROAM/Acuity Brands Technical Services) is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, the grantee (the party responsible for the module grant) shall provide guidance to the host manufacturer for compliance with the Part 15B requirements.

## 11. Import Statement

The FCC regulates marketing, sale and importation of radio frequency devices. When importing a radio frequency (RF) device the importer or ultimate consignee, or their designated broker, may be required to declare that the radio frequency device meets the FCC importation conditions under Title 47 of the Code of Federal Regulation (CFR) Section 2.1204. ROAM/Acuity Brands



Technical Services marks the master carton of all devices containing ROAMMOD0001 radios with the FCC ID and IC ID.

## **12. Module Labeling**

A certified module has the option to use a permanently affixed label, or an electronic label (see 9. Electronic Labelling below). For a permanently affixed label, the module must be labelled with an FCC ID - Section 2.926. See section 1 above for figures instructing installation of permanently affixed label.

## **13. Host Device Labeling**

For a host using a certified module with a standard fixed label, if (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module FCC ID: XYZMODEL1" or "Contains FCC ID: XYZMODEL1" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID. See section 1 above for figures depicting the FCC ID and IC ID that must be affixed to the exterior of the host device into which the ROAMMOD0001 module will be installed.