

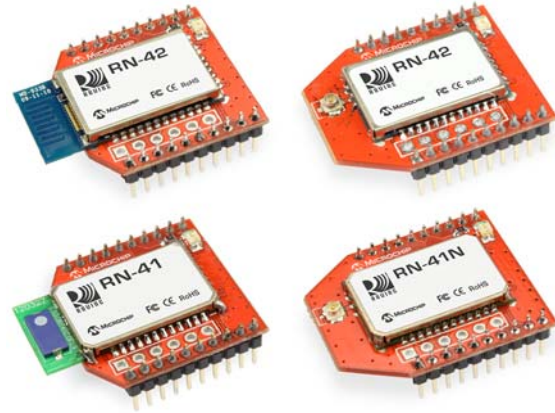
## RN41XV & RN42XV Bluetooth Module

### Features:

- Fully qualified Bluetooth® version 2.1 Class 1 (RN41XV) and Class 2 (RN42XV) data module, supports version 2.1 + Enhanced Data Rate (EDR)
- Backwards-compatible with Bluetooth version 2.0, 1.2, and 1.1
- Pin compatible with widely used 2 x 10 2-mm socket typically used by 802.15.4 applications
- RN42XV: 26 µA sleep, 3 mA connected, 30 mA transmit
- RN41XV: 30 mA connected, < 10 mA sniff mode
- UART data connection interface
- Supports secure simple pairing (SPP)
- Sustained data rates: 240 Kbps (slave), 300 Kbps (master)
- Embedded Bluetooth stack profiles: SPP and HID profile support as well as GAP, SDP, RFCOMM, and L2CAP protocols
- Bluetooth SIG certified
- Certifications: FCC, IC, CE
- Environmentally friendly, RoHS compliant

### Applications:

- Bluetooth replacement for 802.15.4 modules
- Cable replacement
- Barcode scanners/readers
- Measurement and monitoring systems
- Industrial sensors and controls
- Medical devices
- Computer accessories
- Asset tracking



## 1.0 DESCRIPTION

The RN41XV and RN42XV are small form factor, low-power Bluetooth radio modules offering plug-in compatibility for the widely used 2 x 10 (2-mm) socket typically used by 802.15.4 radio modules.

Based on the popular 2 x 10 (2-mm) socket footprint often found in embedded applications, the Roving Networks' RN41XV and RN42XV modules provide Bluetooth connectivity in legacy and existing designs that may have been based upon the 802.15.4 standard.

The RN41XV Class 1 Bluetooth module is based on the RN41, and the RN42XV Class 2 Bluetooth module is based on the RN42. These modules are simple to design in and are fully certified, making them a complete embedded Bluetooth solution. The RN42 is functionally compatible with the RN41.

The Class 1 RN41 module has a range up to 100 meters. The Class 2 RN42 module has a range up to 20 meters.

## 2.0 OVERVIEW

- Pin compatible with 2 x 10 (2-mm) socket
- Baud rate speeds: 1,200 bps up to 921 Kbps, non-standard baud rates can be programmed
- RN41XV: Class 1 radio, 330 feet (100 m) range, +16 dBm output transmitter, -80 dBm typical receive sensitivity
- RN42XV: Class 2 radio, 60 feet (20 m) distance, +4 dBm output transmitter, -80 dBm typical receive sensitivity
- Frequency 2,402 ~ 2,480 MHz
- FHSS/GFSK modulation, 79 channels at 1-MHz intervals
- Secure communications, 128-bit encryption
- Error correction for guaranteed packet delivery
- Configuration via the local UART and over-the-air RF
- Auto-connect master, I/O pin (DTR), and character-based trigger modes

The module's moisture sensitivity level (MSL) is 1. [Table 2-1](#) shows the module's size and weight.

**TABLE 2-1: MODULE SIZE & WEIGHT**

| Parameter | RN41XVC<br>RN42XVP | RN41XVU<br>RN42XVU | Units |
|-----------|--------------------|--------------------|-------|
| Size      | 24.4 x 29.9        | 24.4 x 29.0        | In.   |
| Weight    | 5.5                | 5.5                | g     |

[Table 2-2](#), [Table 2-3](#), [Table 2-4](#), [Table 2-5](#), [Table 2-6](#), and [Table 2-7](#) provide detailed specifications for the module.

**TABLE 2-2: ENVIRONMENTAL CONDITIONS**

| Parameter                     | Value          |
|-------------------------------|----------------|
| Temperature Range (Operating) | -40° C ~ 85° C |
| Temperature Range (Storage)   | -40° C ~ 85° C |
| Relative Humidity (Operating) | ≤ 90%          |
| Relative Humidity (Storage)   | ≤ 90%          |

**TABLE 2-3: RN41XV & RN42XV DIGITAL I/O CHARACTERISTICS**

| 3.0 V ≤ VDD ≤ 3.3 V                                   | Min.      | Typ. | Max.      | Units |
|---|-----------|------|-----------|-------|
| Input Logic Level Low                                 | -0.4      | -    | +0.8      | V     |
| Input Logic Level High                                | 0.7 VDD   | -    | VDD + 0.4 | V     |
| Output Logic Level Low                                | -         | -    | 0.2       | V     |
| Output Logic Level High                               | VDD - 0.2 | -    | -         | V     |
| All I/O pins (Except Reset) Default to Weak Pull Down | +0.2      | +1.0 | +5.0      | μA    |

**TABLE 2-4: RN41XV ELECTRICAL CHARACTERISTICS**

| Parameter                         | Min. | Typ. | Max. | Units |
|-----------------------------------|------|------|------|-------|
| Supply Voltage (DC)               | 3.0  | 3.3  | 3.6  | V     |
| RX Supply Current                 |      | 35   | 60   | mA    |
| TX Supply Current                 |      | 65   | 100  | mA    |
| <b>Average Power Consumption</b>  |      |      |      |       |
| Standby/Idle (Default Settings)   |      | 25   |      | mA    |
| Connected (Normal Mode)           |      | 30   |      | mA    |
| Connected (Low-Power Sniff)       |      | 8    |      | mA    |
| Standby/Idle (Deep Sleep Enabled) | 250  | 2.5  |      | mA    |

**TABLE 2-5: RN42XV ELECTRICAL CHARACTERISTICS**

| Parameter  | Min. | Typ. | Max. | Units   |
|--|------|------|------|---------|
| Supply Voltage (DC)  | 3.0  | 3.3  | 3.6  | V       |
| <b>Average Power Consumption</b>                           |      |      |      |         |
| Radio On (Discovery or Inquiry Window Time), <i>Note 1</i> |      | 40   |      | mA      |
| Connected Idle (No Sniff)                                  |      | 25   |      | mA      |
| Connected Idle (Sniff 100 ms)                              |      | 12   |      | mA      |
| Connected with Data Transfer                               | 40   | 45   | 50   | mA      |
| Deep Sleep Idle Mode                                       |      | 26   |      | $\mu$ A |

**Note 1:** In slave mode, there are bursts of radio on time that vary with the inquiry windows. The average current depends on how you set the inquiry window.

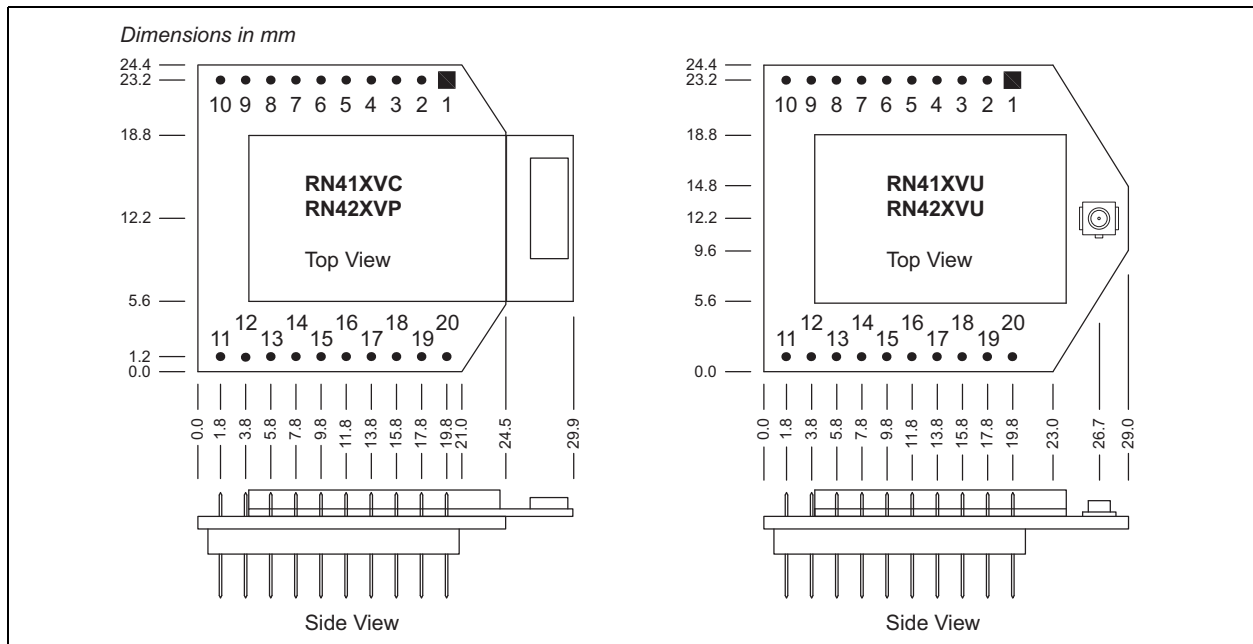
**TABLE 2-6: RN41XV RADIO CHARACTERISTICS**

| Parameter                               | Frequency (GHz) | Min. | Typ. | Max.  | Bluetooth Specification | Units |
|---|-----------------|------|------|-------|-------------------------|-------|
| Sensitivity at 0.1% BER                 | 2.402           | -    | -80  | -86   | $\leq -70$              | dBm   |
|   | 2.441           | -    | -80  | -86   |                         | dBm   |
|   | 2.480           | -    | -80  | -86   |                         | dBm   |
| RF Transmit Power                       | 2.402           | 15.0 | 16.0 |       | $\leq 20$               | dBm   |
|   | 2.441           | 15.0 | 16.0 |       |                         | dBm   |
|   | 2.480           | 15.0 | 16.0 |       |                         | dBm   |
| Initial Carrier Frequency Tolerance     | 2.402           | -    | 5    | 75    | 75                      | kHz   |
|   | 2.441           | -    | 5    | 75    |                         | kHz   |
|   | 2.480           | -    | 5    | 75    |                         | kHz   |
| 20 dB Bandwidth for Modulated Carrier   |                 | -    | 900  | 1,000 | $\leq 1,000$            | kHz   |
| Drift (Five Slots Packet)               |                 | -    | 15   | -     | 40                      | kHz   |
| Drift Rate                              |                 | -    | 13   | -     | 20                      | kHz   |
| $\Delta f_{1_{avg}}$ Maximum Modulation | 2.402           | 140  | 165  | 175   | $> 140$                 | kHz   |
|   | 2.441           | 140  | 165  | 175   |                         | kHz   |
|   | 2.480           | 140  | 165  | 175   |                         | kHz   |
| $\Delta f_{2_{avg}}$ Minimum Modulation | 2.402           | 140  | 190  | -     | 115                     | kHz   |
|   | 2.441           | 140  | 190  | -     |                         | kHz   |
|   | 2.480           | 140  | 190  | -     |                         | kHz   |

**TABLE 2-7: RN42XV RADIO CHARACTERISTICS**

| Parameter                                   | Frequency (GHz) | Min. | Typ. | Max.  | Bluetooth Specification | Units |
|---|-----------------|------|------|-------|-------------------------|-------|
| Sensitivity at 0.1% BER                     | 2.402           | -    | -80  | -86   | ≤ -70                   | dBm   |
|   | 2.441           | -    | -80  | -86   |                         | dBm   |
|   | 2.480           | -    | -80  | -86   |                         | dBm   |
| RF Transmit Power                           | 2.402           | 0    | 2    | 4     | ≤ 4                     | dBm   |
|   | 2.441           | 0    | 2    | 4     |                         | dBm   |
|   | 2.480           | 0    | 2    | 4     |                         | dBm   |
| Initial Carrier Frequency Tolerance         | 2.402           | -    | 5    | 75    | 75                      | kHz   |
|   | 2.441           | -    | 5    | 75    |                         | kHz   |
|   | 2.480           | -    | 5    | 75    |                         | kHz   |
| 20 dB Bandwidth for Modulated Carrier       |                 | -    | 900  | 1,000 | ≤ 1,000                 | kHz   |
| Drift (Five Slots Packet)                   |                 | -    | 15   | -     | 40                      | kHz   |
| Drift Rate                                  |                 | -    | 13   | -     | 20                      | kHz   |
| $\Delta f_{1\text{avg}}$ Maximum Modulation | 2.402           | 140  | 165  | 175   | > 140                   | kHz   |
|   | 2.441           | 140  | 165  | 175   |                         | kHz   |
|   | 2.480           | 140  | 165  | 175   |                         | kHz   |
| $\Delta f_{2\text{avg}}$ Minimum Modulation | 2.402           | 140  | 190  | -     | 115                     | kHz   |
|   | 2.441           | 140  | 190  | -     |                         | kHz   |
|   | 2.480           | 140  | 190  | -     |                         | kHz   |

Figure 2-1 shows the module's dimensions and Table 2-8 describes the pins.

**FIGURE 2-1: RN41XV & RN42XV DIMENSIONS**

**TABLE 2-8: PIN DESCRIPTION (PART 1 OF 2)**

| Pin Number | Signal Name | Description  | Optional Function | Direction   |
|------------|-------------|--|-------------------|-------------|
| 1          | VDD_3V3     | 3.3 V regulated power input to the module.   |                   | Power       |
| 2          | TXD         | UART TX, 8 mA drive, 3.3-V tolerant.   |                   | From module |
| 3          | RXD         | UART RX, 3.3 V tolerant.   |                   | To module   |
| 4          | GPIO7       | GPIO, 24 mA drive, 3.3 V tolerant/ADC input.   |                   | I/O         |
| 5          | RESET_N     | <i>Optional</i> module reset signal (active low), 100 k pull up, apply pulse of at least 160 $\mu$ s, 3.3 V tolerant.                              |                   | Input       |
| 6          | GPIO6       | GPIO, 24 mA drive, 3.3-V tolerant/ADC input.   | Data TX/RX        | From module |
| 7          | GPIO9       | GPIO, 24 mA drive, 3.3-V tolerant/ADC input.   |                   | I/O         |
| 8          | GPIO4       | GPIO, 24 mA drive, 3.3 V tolerant/ADC input.   |                   | I/O         |
| 9          | GPIO11      | GPIO, 8 mA drive, 3.3 V tolerant.  |                   | I/O         |
| 10         | GND         | Ground.  |                   | Ground      |
| 11         | GPIO8       | GPIO, 8 mA drive, 3.3-V tolerant. The RN41XV and RN42XV drive GPIO8 high on powerup, which overrides software configured powerup values, on GPIO8. |                   | I/O         |
| 12         | RTS         | UART RTS flow control, 8 mA drive, 3.3 V tolerant.   |                   | From module |
| 13         | GPIO2       | GPIO, 24 mA drive, 3.3 V tolerant/ADC input.   |                   | I/O         |
| 14         | Not Used    | No connect.  |                   | No Connect  |
| 15         | GPIO5       | GPIO, 24 mA drive, 3.3 V tolerant/ADC input.   |                   | I/O         |

TABLE 2-8: PIN DESCRIPTION (PART 2 OF 2)

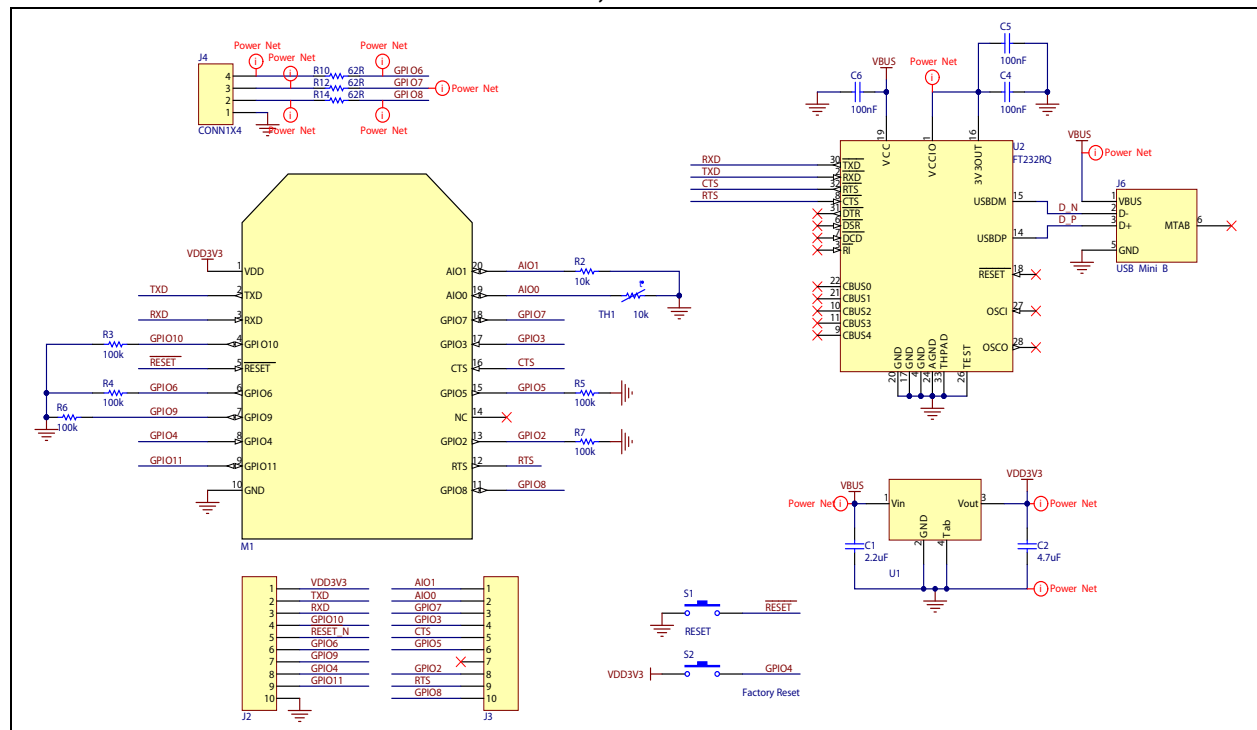
| Pin Number | Signal Name | Description                                  | Optional Function | Direction |
|------------|-------------|--|-------------------|-----------|
| 16         | CTS         | UART CTS flow control, 3.3 V tolerant.       |                   | To module |
| 17         | GPIO3       | GPIO, 24 mA drive, 3.3 V tolerant/ADC input. |                   | I/O       |
| 18         | GPIO7       | GPIO, 24 mA drive, 3.3 V tolerant/ADC input. |                   | I/O       |
| 19         | AIO0        |  |                   |           |
| 20         | AIO1        |  |                   |           |

### 3.0 TYPICAL APPLICATION SCHEMATIC

Figure 3-12 shows a typical application schematic. Because the RN41XV and RN42XV are functionally compatible, this diagram applies to both modules. The

RN-XV-EK evaluation kit is shown as a reference. The RN-XV-EK evaluation board provides a 2 x 10 (2-mm) socket for both the RN41XV and RN41XV modules. The design offers USB/serial connection to the on-board UART, a reset switch (pin 5), and switch to control GPIO4 (pin 8).

FIGURE 3-1: APPLICATION SCHEMATIC, Note 1



Note 1: The RN-XV-EK evaluation kit is shown as a reference.

## 4.0 DESIGN CONCERNS

The following sections provide information on designing with the RN41XV and RN42XV module, including radio interference, factory reset, connection status, etc.

### 4.1 Powering the Module

Apply ONLY 3.3 V  $\pm$ 10% regulated power to pin 1 (VDD) and pin 10 (ground). The module does not have an on-board voltage regulator and MUST be powered from a regulated 3.3 V power supply.

### 4.2 Reset Circuit

The RN41XV and RN42XV modules contain a 1k $\Omega$  pull-up to VCC, and the reset polarity is active low. The module's reset pin has an optional power-on-reset circuit with a delay, which should only be required if the input power supply has a very slow ramp or tends to bounce or have instability on power up. Often a micro-controller or embedded CPU I/O is available to gener-

ate the reset once power is stable. If not, designers can use one of the many low-cost power supervisor chips currently available, such as the MCP809, MCP102/121, and Torex XC61F.

### 4.3 Factory Reset Using GPIO4

Roving Networks recommends that designers connect GPIO4 (pin 8) to a switch, jumper, or resistor so it can be accessed. This pin can be used to reset the module to its factory default settings, which is critical in situations where the module has been misconfigured. To reset the module to the factory defaults, GPIO4 should be high on power-up and then toggle low, high, low, high with a 1 second wait between the transitions.

### 4.4 Connection Status

The RN41XV and RN42XV modules have an on-board green LED to indicate the connection status. The connection status LED is located in the lower right corner of the module.

**TABLE 4-1: CONNECTION STATUS LED**

| LED Status     | Description   |
|----------------|---|
| Blink at 1 Hz  | The module is discoverable and waiting for a connection.  |
| Blink at 10 Hz | The module is in command mode.                            |
| Solid          | The module is connected to another device over Bluetooth. |

## 5.0 COMPLIANCE INFORMATION

Table 5-1 and Table 5-2 describe the RN41XV and RN42XV module's compliance information, respectively.

**TABLE 5-1: RN41XV COMPLIANCE INFORMATION**

| Category      | Country                 | Standard   |
|---------------|-------------------------|--|
| Radio         | USA<br>FCC ID:          | FCC CFR47 Part 15 C, para 15.247                 |
|               |                         | T9J-R41-1  |
|               | Europe                  | EN 300 328-1                                     |
|               |                         | EN 300 328-2 2.4GHz                              |
|               | Canada<br>IC Canada ID: | IC RSS-210 low power comm. device<br>6514A-RN411 |
| EMC           | USA                     | FCC CFR47 Part 15 subclass B                     |
|               | Europe                  | EN 55022 Class B radiated                        |
|               |                         | EN61000-4-2 ESD immunity                         |
|               |                         | EN61000-4-3 radiated field                       |
|               |                         | EN61000-4-6 RF immunity                          |
|               |                         | EN61000-4-8 power magnetic immunity              |
| Bluetooth     | LISTED                  | B013180  |
| Environmental | RoHS                    | RoHS compliant                                   |

**TABLE 5-2: RN42XV COMPLIANCE INFORMATION**

| Category              | Country    | Standard                            |
|-----------------------|------------|-------------------------------------|
| Radio                 | USA        | FCC Part 15 Subpart B: 2008 Class B |
|                       |            | FCC CRF Title 47 Part 15 Subpart C  |
|                       | FCC ID:    | T9J-RN42                            |
|                       | Europe     | ETSI EN 301 489-1 V1.8.1            |
|                       |            | ETSI EN 301 489-17 V2.1.1           |
|                       |            | ETSI EN 300 328 V1.7.1              |
|                       | Canada     | IC RSS-210 low power comm. device   |
| Certification Number: | 6514A-RN42 |                                     |
| EMC                   | USA        | FCC CFR47 Part 15 subclass B        |
|                       | Europe     | EN 55022 Class B radiated           |
|                       |            | EN61000-4-2 ESD immunity            |
|                       |            | EN61000-4-3 radiated field          |
|                       |            | EN61000-4-6 RF immunity             |
|                       |            | EN61000-4-8 power magnetic immunity |
| Bluetooth             | BQB LISTED | B014867- SPP and DUN profiles       |
| Environmental         | RoHS       | RoHS compliant                      |



## 6.0 ORDERING INFORMATION

Table 6-1 provides ordering information.

**TABLE 6-1: ORDERING INFORMATION**

| Part Number   | Description                       |
|---|-----------------------------------|
| RN41XVC-I/RM  | RN41 XV footprint, chip antenna.  |
| RN41XVU-I/RM  | RN41 XV footprint, U.FL. antenna. |
| RN42XVP-I/RM  | RN42 XV footprint, PCB antenna.   |
| RN42XVU-I/RM  | RN42 XV footprint, U.FL. antenna. |
| For other configurations, contact Roving Networks directly. |                                   |

Go to <http://www.rovingnetworks.com> for current pricing and a list of distributors carrying Roving Networks products.

Table 6-2 provides information on related products that work with the RN41XV and RN42XV.

**TABLE 6-2: RELATED PRODUCTS**

| Part Number | Description  |
|-------------|--|
| RN-XV-EK    | Evaluation platform for the RN41XV or RN42XV module. Used for learning and demonstrating WiFly commands and Roving Networks hardware capabilities. |
| RN-XV-RD2   | Evaluation platform for the RN41XV or RN42XV module. Contains 2 10-amp, 250 V relays.  |

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