

User Guide for Remote Control RC4921401/01BRP; RC4921402/01BRP

Purpose:

The purpose of this document is to define and identify the operation manual of project Vantiva RC4921401/01BRP; RC4921402/01BRP RCU. The Vantiva RC4921401/01BRP; RC4921402/01BRP RCU, will be referred to in this document, as the “RCU”. This RCU is transmitting BLE / IR for Set Up Box.

Out Of Box Experience

First time inserting batteries,

- 1) The RCU is unpaired.
- 2) No Simple Setup Data.
- 3) All keys are STB keys.
- 4) SSU Key Map function does not work

(1). Manual Pairing

Press and hold (<<Home + BACK>>), keys for at least 3 seconds. RCU will then enter discoverable mode.

(2).Clear Pairing

Press and hold (<<Home + VOL->>) for at least 3 seconds, During the initial 3 seconds, the LED will remain off. The RCU erases its pairing data, and the STB control medium automatically restores to STB-IR mode. After LED performs a confirmation blink.



RC4921401/01BRP



RC4921402/01BRP

1. General Product Description

1.1 Overview

This remote control is primarily designed with Bluetooth SIG standards (www.bluetooth.com) to control the host device, with following application features:

- The RCU has 14 keys, BLE transceiver, IR transmitter, Red LED indicator, Find Me, Buzzer, backlight and Accelerometer.
- The RCU supports BLE (HID keys & SCI OTA), TV-IR (via SSU), IR Blaster/Control.

1.2 Control STB

The RCU can be set-up to control a RF STB.

1.2.1 Control STB – BLE

The RF platform is BLE, using HOGP (HID Over GATT Profile) as the top layer.

Before the RCU can control the STB, the RCU must pair with the STB first.

1.3 Control TV – IR

IR can be used to control a TV via IR Blast function after being configured via Omnis's Simple Setup. Prior to this, the RCU needs to be paired to the STB.

2. Product Requirements

2.1 Factory Default Settings (Out-of-Box State)

The Out-of-Box condition here refers to the RCU condition when out of factory or after factory reset:

- 5) The RCU is unpaired.
- 6) No Simple Setup Data.
- 7) All keys are STB keys.
- 8) SSU Key Map function does not work

2.2 Data Retention

Data retention is required for the RCU, to maintain all settings previously done in case of changing batteries. Below are the data that will be stored in non-volatile memory:

- 1) BLE pairing data.
- 2) IR Simple Setup TV DB.

2.3 Low Voltage Detection

The RCU will measure the battery voltage level.

Low voltage detection will be triggered after a signal key is pressed in normal mode. However, this will not stop the RCU from operating. The RCU will still be able to operate normally.

The RCU BLE profile supports battery level notification service. The BLE profile will be responsible for notification to STB when battery level is requested from STB.

RCU will not report the battery level initiatively. The host should read this value by itself based on Bluetooth SIG Battery Service specification.

When RCU has entered Low Voltage:

- It still can fire key code. However, the performance under Low Voltage may be reduced.
- Upon key press when not in any set-up mode: the LED gives a Low Voltage warning blink.
- All operations that require Flash writing operation are blocked under Low Voltage. The operations that will be blocked by Low Voltage are pairing, factory reset, OTA, Simple Setup, Clear SSU data, Clear pairing.
- If user attempts to operate manual pairing or factory reset via combo key press, the LED gives a warning blink to indicate the operation is rejected due to the Low Voltage Status.

The battery level is considered as Low Voltage state after voltage is $<2.5V$.

2.4 Key Code Tables

2.4.1 RF Profiles and Reports

All STB RF key codes are transmitted through BLE HOGP profile, using usage page of either Keyboard (0x07) or Consumer Control (0x0C).

Keyboard Keys

Report ID = 0x01

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Key Modifier							
Byte 1	Reserved							
Byte 2	Keycode 1							
Byte 3	Keycode 2							
Byte 4	Keycode 3							
Byte 5	Keycode 4							
Byte 6	Keycode 5							
Byte 7	Keycode 6							

Consumer Control

Report ID = 0x02

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Consumer Control Code1 (LSB)							
Byte 1	Consumer Control Code1 (MSB)							
Byte 2	Consumer Control Code2 (LSB)							
Byte 3	Consumer Control Code2 (MSB)							

2.4.2 Advertising Package

Undirected Advertising (for pairing):

Data Block	Byte	Value	Description
Adv Type Flags	Byte0	0x02	Length of the following payload bytes in this data block
	Byte1	0x01	The data type = Advertising Type Flags
	Byte2	0x05	LIMITED_DISCOVERABLE(0x01) EDR_NOT_SUPPORTED(0x04)
Appearance	Byte3	0x03	Length of the following payload bytes in this data block
	Byte4	0x19	The data type = Appearance
	Byte5	0x80	LSB of Appearance value (0x0180=Generic Remote Control)
	Byte6	0x01	MSB of Appearance value (0x0180=Generic Remote Control)
UUID 16Bits More	Byte7	0x05	Length of the following payload bytes in this data block
	Byte8	0x02	The data type = UUID16_more
	Byte9	0x12	LSB of UUID HID Service (0x1812)
	Byte10	0x18	MSB of UUID HID Service (0x1812)
	Byte11	0x0F	LSB of UUID Battery Service (0x180F)
	Byte12	0x18	MSB of UUID Battery Service (0x180F)
Vendor Information	Byte13	0x05	Length of the following payload bytes in this data block
	Byte14	0xFF	Vendor Information
	Byte15	0x7A	LSB of VID (0x057A)
	Byte16	0x05	MSB of VID (0x057A)
	Byte17	0xAC	LSB of PID (0x00AC)
	Byte18	0x00	MSB of PID (0x00AC)

Scan Response Package:

During pairing (discoverable), the response package to host scan is defined as below:

Element	Byte	Value	Description
Completed Local Name	Byte0	0x06	Length of the following payload bytes in this data block
	Byte1	0x09	The data type = Completed Local Name
	Byte2	0x52	ASCII code of character 'R'
	Byte3	0x43	ASCII code of character 'C'
	Byte4	0x34	ASCII code of character '4'
	Byte5	0x30	ASCII code of character '0'
	Byte6	0x30	ASCII code of character '0'

Directed Advertising (for reconnecting):

The directed advertising package can only contain MAC address of RCU and host w/o any other data. It is used for reconnecting to the paired host.

2.4.3 STB RF Key Code Table

Below key codes are defined in form of: usage page / usage code (in hexadecimal). For HID keyboard keys: usage page = 0x07; and for HID consumer control keys, usage page = 0x0C.

1 TV 0x0C/0x6B	2 Voice 0x0C/0x221	3 Power 0x0C/0x30
4 Up 0x0C/0x42		
5 Left 0x0C/0x44	6 OK 0x0C/0x41	7 Right 0x0C/0x45
8 Down 0x0C/0x43		
9 Back 0x0C/0x224		
		10 Home 0x0C/0x223
11 VOL+ 0x0C/0xE9		
		12 Call 0x0C/0x8C
13 VOL- 0x0C/0xEA		
		14 EndCall 0x0C/0x226

2.5 BLE Mode

2.5.1 BLE Parameters

<PART I>. BLE Names and IDs:

- **Device Name** : "RC400".
- **Manufacturer Name**: "Omni Remotes"
- **Vendor ID**: 0x057A (Omni Remotes)
- **Product ID** : 0x00AC

<PART II>. Connection Parameters:

- **Connection Interval**: 9 (1.25ms x 9 = 11.25ms)
- **Slave Latency**: 49
- **Supervision Timeout**: 300 (10ms x 300 = 3s)

Note: RCU will send the request of these link parameters upon link established. In BLE communication, the requested connection parameters are up to host to either accept or just reject, so the actual parameters applied may differ than the requested value defined above. The different connection parameters will impact BLE response and power consumption. OMNI recommends STB side to always accept and apply above parameters to get most optimized performance of BLE response (especially OTA) and power saving.

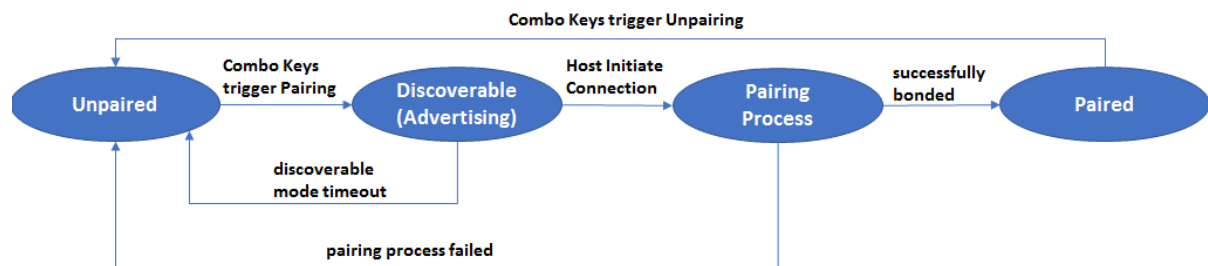
<PART III>. Timeout Parameters:

- **Discoverable (pairing) Mode Timeout**: 60s
- **Reconnecting Timeout**: 1.28s *2

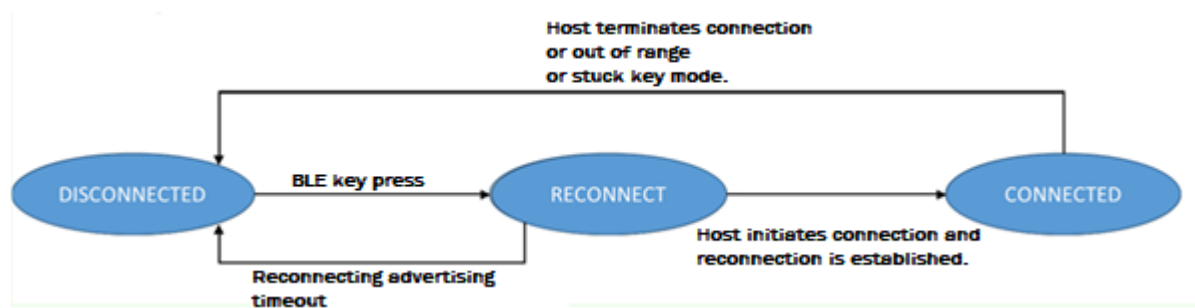
2.5.2 BLE State Diagram

At any time, the remote only can pair with one STB.

Refer to below flowchart of RCU's pairing state diagram.



In STB-BLE mode, RCU will keep connected as long as connection to host is available. RCU enters sleeping after host terminates connection (Host is off or out of range). It is waken up from sleeping by any key press.



2.5.3 Advertising and Connect

When the RCU is in pairing mode, it will begin advertising. When a nearby Central starts scanning, and initiate a connection, the RCU will pair with it. The bonding data will be stored into the non-volatile memory only after pairing is successful.

The Secure Simple Pairing shall employ the “just works” for the pairing process. i.e. no authentication code key-in is needed for pairing.

2.5.4 Auto Pairing

RCU can start auto pairing if it is not paired:

- 1) Press a key, RCU starts undirected advertising packets for pairing. LED will blink.
- 2) If pairing is successful, LED will provide a Pairing Success blink.
- 3) If pairing is failed, LED will provide a Pairing Failure blink.
- 4) The discoverable mode timeout is 60s. In case no pairing is triggered during the timeout period, RCU stops advertising. LED provides a Pairing Failure blink.

2.5.5 Manual RF Pairing

The user can still trigger RCU pairing if it has been paired. Manual pairing can put RCU into discoverable mode (start undirected advertising). Below is the process of manual pairing:

- 1) Press the <<HOME + BACK>> simultaneously for 3 seconds, RCU starts undirected advertising packets for pairing. LED will blink.
- 2) If pairing is successful, LED will provide a Pairing Success blink.
- 3) If pairing is failed, LED will provide a Pairing Failure blink.
- 4) The discoverable mode timeout is 60s. In case no pairing is triggered during the timeout period, RCU stops advertising. LED provides a Pairing Failure blink.

2.6 LED Operations

LED blink mode definition:

Setup Action	Timing
Quick Blink	50ms on, 50ms off
Short Blink	250ms on, 250ms off
Long Blink	500ms on, 500ms off

LED behaves as below under different scenarios:

Setup Action	Timing
Boot up	Lit up for 2 seconds.
Pairing	Short blinks.
Pairing Success	Lit up for 1 second.
Pairing Failure	5 quick blinks
OTA	Long Blink
LVD warning	5 short blinks
Setup Confirmation	Lit on for 1 second
Setup failure	5 quick blinks

Note:

- 1) Key Press in User Mode:**
LED is turned on for key press to send BLE command.
- 2) Simple Setup Mode:**
LED will be lit for 200ms on IR code transmission.
- 3) IR Blast**
No LED is turned on to send IR code.
- 4) SSU Key Map**
LED provides a quick blink on BLE command transmission.
LED turns on when IR code is sent and turn off when the IR transmission is stopped.

2.7 Setup Features

2.7.1 General

All Setup features are meant to change the settings of the RCU. Each feature is triggered by a special combo keys. An overview of the Setup features and the corresponding key-press is shown in the table below.

Notation: < > normal key-press, << >> hold these keys for 3 seconds.

Setup Feature	Combo Keys
Start Pairing	<<HOME + BACK>>
Clear Pairing Table	<<HOME + VOL->>
Factory Reset	<<HOME + OK>>
Clear SSU data	<<HOME + VOL+>>

- Before entering setup mode via combo keys, RCU will firstly check if battery voltage is at LVD status. Setup modes are only allowed to enter when battery is not LVD status, otherwise RCU returns to user mode w/o active setup mode.

2.7.2 Clear Pairing Table

<< HOME + VOL->>

1. Press << HOME + VOL->> simultaneously for 3 seconds. During the initial 3 seconds, all LEDs will remain off.
2. The RCU erases its pairing data. LED performs a Setup Confirmation blink.

2.7.3 Factory Reset

<< HOME + OK >>

1. Press << HOME + OK >> simultaneously for 3 seconds. During the initial 3 seconds, all LEDs will remain off.
2. The RCU deletes all settings and returns to factory default mode.

LED performs a Setup Confirmation blink.

2.7.4 Clear SSU Data

<< HOME + VOL+ >>

1. Press << HOME + VOL+ >> simultaneously for 3 seconds. During the initial 3 seconds, all LEDs will remain off.
2. RCU deletes all SSU data, LED performs a Setup Confirmation blink.

2.8 FindMe

In BLE Mode, the FindMe feature will be implemented by using the Immediate Alert Service. The service and characteristic UUIDs are listed in GATT Services UUIDs.

2.8.1 Alert Levels are Settings

Alert Level	Buzzer	LED indication	Buzzer Stop Condition
No Alert (default)	OFF	OFF	N.A.
Mild Alert	* 2.75KHz * Medium Volume * Envelope of 0.5Hz (50/50)	OFF	* Timeout after 30 seconds * User presses any key (no key commands will be sent) * BLE connection is lost
High Alert	* 2.75KHz * Maximum volume * Envelope of 1Hz (70/30)	OFF	* Timeout after 30 seconds. * User presses any key (no key commands will be sent) * BLE connection is lost.

2.8.2 Find Me Latency

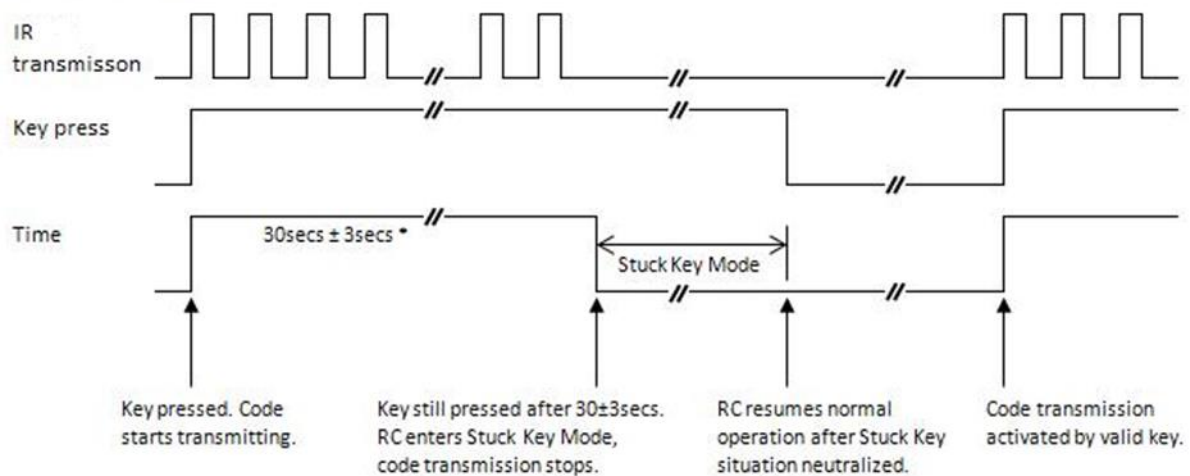
In the event the RCU is paired but disconnected due the following reasons:

- STB Powered Off
- STB enter deep sleep mode
- RCU goes out of effective Bluetooth range

RCU will start LDC Direct advertisement of 100ms at interval of every 5 seconds.

2.9 Stuck Key Timeout

STUCK KEY TIMEOUT



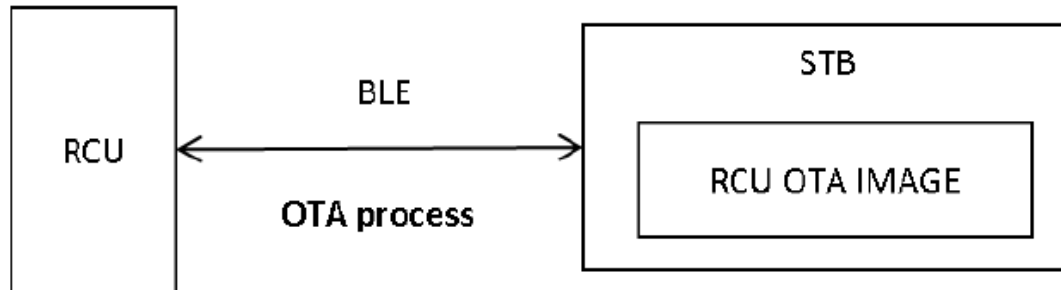
* Stuck Key Timeout is typical 30secs, actual timing depends on the protocol transmitted.

Stuck Key Timeout is used to conserve battery life. When a key is being pressed continuously for **30seconds (+/- 3seconds)**, the RCU will stop all IR/RF key codes transmission automatically; and it will resume operation only after all keys are released.

During SSU brand-search, while hold <MUTE> to perform searching, it will disable stuck key timer for this case so that a long-time search is allowed.

2.10 OTA

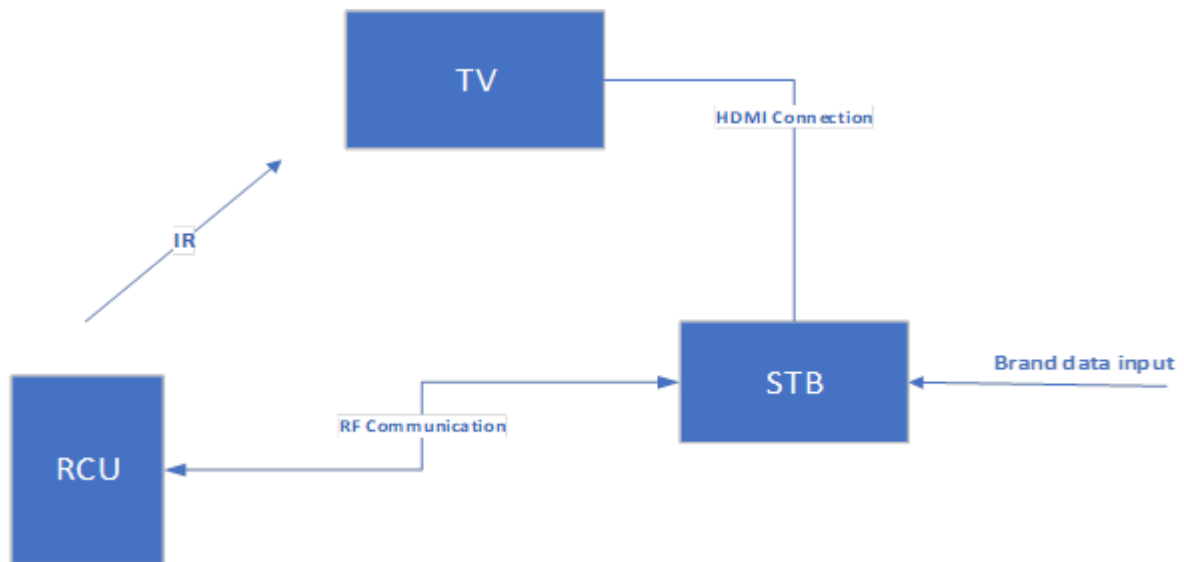
The RCU software supports upgrade via OTA (Over-The-Air).



From diagram above, the STB can transfer the RCU firmware by the BLE link. The OTA process can be triggered by the user using the RCU or by the STB itself. The RCU OTA IMAGE need to be downloaded into the STB itself. After the OTA is completed, the RCU will have a new firmware. The RCU OTA IMAGE will be available via the Android System settings.

2.11 SIMPLE SETUP

The automatic (background) SSU will attempt to configure TV Setup by sending the TV IR binary code to the remote control. This is achieved via HDMI-EDID detection where the STB detects the TV Brand and Model and sends the matching data to the remote control. Once Simple Setup sets up successfully, it assigns the TV control keys.



In the event the Background Setup is not successful, user (e.g., Installer) will configure Simple Setup manually.

By pressing and holding the "OK" & "End Call" keys for > 3 seconds, the RCU will send the HID Consumer Control Command (0x0C, 0x07) to notify the host to launch the SSU Manual Setup application.

2.12 IR Blast

After SSU configuration, the user can use voice control to send TV IR Code. Each time, the RCU will send 3 frames of IR code.

The process of voice and translation to an actual SSU IR blast command is outside the scope of this RCU software specification.

Following diagram illustrates this mechanism.



Following table is the IR function/codes supported by RCU.

Upon triggered by System / Vantiva application via predefined Android Intent, SSU service will send BLE command to RCU, to transmit the corresponding IR codes.

When RCU receive a BLE command to transmit these IR codes, it will transmit 3 frames by default, to simulate an IR key press.

TV Key function
TV Power
Volume Up
Volume Down
Mute
TV Input
Left
Right
Up
Down
OK
EXIT
LIVE TV

2.13 Special Key Handling (After Simple Setup)

After SSU configuration, the following functions in the table will send out both BLE and IR keycodes.

Functions	After SSU
Power	TV IR Power + 0x0C/0x30
Vol+	TV IR Vol Up + 0x0C/0xE9
Vol-	TV IR Vol Down + 0x0C/0xEA

2.14 GATT Service and UUID

Function	GATT Service/Characteristic	UUID
Battery Level Notification	Battery Service	0x180F
Device Information	Device Information Service	0x180A
BLE Key Commands	HID Service	0x1812
OTA	OTA Service	0x34, 0x79, 0xe5, 0x84, 0x08, 0x62, 0x82, 0x9b, 0x2e, 0x40, 0xaf, 0x76, 0x85, 0xe1, 0xc0, 0xcb
Find Me	Immediate Alert Service	0x1802
Simple Setup	Simple Setup Service	0x71, 0x01, 0x11, 0x79, 0x9E, 0xCD, 0x72, 0x8E, 0x08, 0x47, 0xDA, 0xEF, 0xCB, 0x51, 0x8D, 0xC8
Accelerometer	Accelerometer Service	0x79, 0x79, 0x00, 0x01, 0x79, 0x79, 0x79, 0x15, 0x00, 0x03, 0x08, 0x87, 0x19, 0x24, 0x22, 0x45

2.15 Backlighting and Accelerometer

The Accelerometer is associated with the Backlight feature. It enables the Backlight upon sensing dynamic movement or vibration.

Backlighting	<ol style="list-style-type: none">1. Backlight can be enabled with a key press or accelerometer interrupt.2. The backlight will remain ON until 5 seconds.3. Each subsequent key press within the 5s shall reset the timer.4. During operational mode like Programming mode, pairing, etc. Backlight shall lit for 5 seconds and then turn off as and when buttons are pressed for programming model. .5. During BLE Auto reconnection backlight will NOT be lit.6. Backlight feature will be inactive during Low voltage or LVD.
Accelerometer	<ol style="list-style-type: none">1. Backlight is enabled on any key press or accelerometer interrupt.2. If the Backlight is already enabled, subsequent accelerometer interrupts are ignored.3. If enabled by accelerometer interrupt, the backlight will remain ON for 5s.4. Each subsequent key press within the 5s shall reset the timer.5. “Fast Acceleration” of the RCU shall also enable the Backlight. The “Fast Acceleration” range shall be calibrated when fully assembled units are available.6. Accelerometer gets Enabled/Active when Controller is in Sleep mode or Remote is untouched7. Accelerometer generates interrupt on identification of movement or Vibration of the Remote8. Accelerometer will be inactive during IR/RF transmission9. Accelerometer will be inactive during Programming mode10. Accelerometer will be inactive during Pair/Unpair mode11. Accelerometer will be inactive during OTA12. Accelerometer will be inactive during Alert like FindMe13. Accelerometer will be inactive during Low Voltage or LVD

2.16 Accelerometer Service

Accelerometer Service UUID:

0x79, 0x79, 0x00, 0x01, 0x79, 0x79, 0x79, 0x15, 0x00, 0x03, 0x08, 0x87, 0x19, 0x24, 0x22, 0x45

Accelerometer character interrupt UUID (notify):

0x79, 0x79, 0x00, 0x02, 0x79, 0x79, 0x79, 0x15, 0x00, 0x03, 0x08, 0x87, 0x19, 0x24, 0x22, 0x45

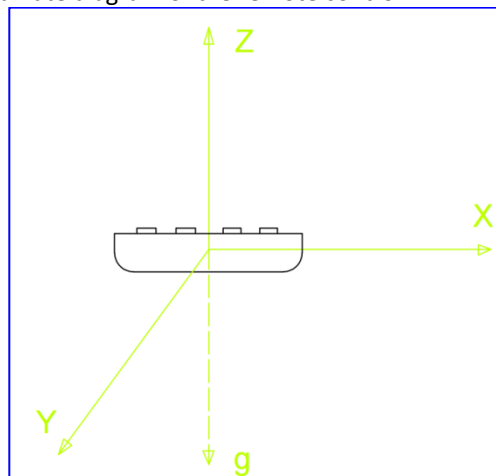
Accelerometer character orientation UUID (read only):

0x79, 0x79, 0x00, 0x03, 0x79, 0x79, 0x79, 0x15, 0x00, 0x03, 0x08, 0x87, 0x19, 0x24, 0x22, 0x45

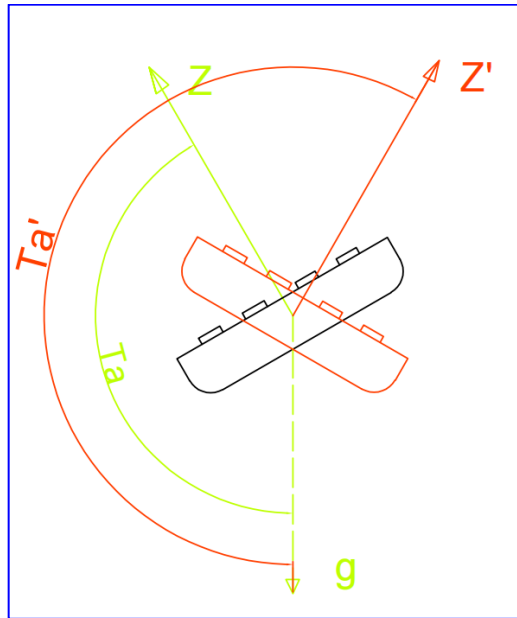
Character	Definition	Description
Accelerometer character interrupt	1 Byte (0 ~ 3): 0, Unknown/tilted 1, Obverse 2, Reverse	Indicates RC orientation change, triggers interrupt notify
Accelerometer character orientation	1 Byte (0 ~ 3): 0, Unknown/tilted 1, Obverse 2, Reverse	Indicates current orientation.

Orientation Definition Detailed Explanation:

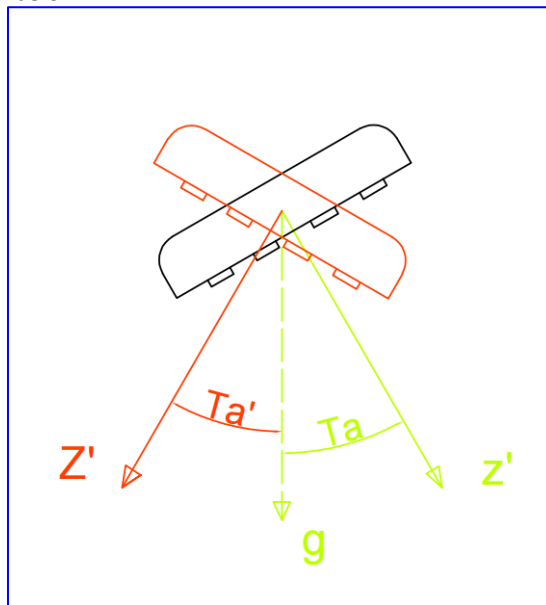
1. Three-dimensional coordinate diagram of the remote control.



2. The definition of obverse is when the angle between the Z-axis and the gravity vector g is within the range of $150^\circ \pm \text{Error}$ to $210^\circ \pm \text{Error}$. In this condition, the remote control is in the obverse state. See the diagram below:



3. The definition of reverse is when the angle between the Z-axis and the gravity vector g is within the range of 0° to $30^\circ \pm \text{Error}$ or $330^\circ \pm \text{Error}$ to 360° . In this condition, the remote control is in the reverse state. See the diagram below:



4. Apart from the angles defined for the obverse and reverse states, all other angles are considered as an Unknown/tilted state.
5. Error is less than or equal to 15° .

3. Product Requirements

3.1 Factory Default Settings (Out-of-Box State).

- 1) The RCU is not paired and the BLE pairing table is empty.
- 2) The RCU is at IR mode, sends Monitor IR codes.

3.2 Data Retention

The RCU will retain previously stored settings in the event of a power down. Below are the data that will be stored in non-volatile memory:

- 1) Monitor control medium: BLE or IR.
- 2) BLE pairing information.

3.3. Key Code Tables

3.3.1 RF Profiles and Reports

All Monitor RF key codes are transmitted through BLE HOGP profile, the control is based on HID

Consumer page (0x0C) and Keyboard page (0x07).

1). Keyboard Report

Keyboard Report								
Report ID: 0x01								
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Key Modifier							
Byte1	Reserved							
Byte 2	Keycode 1							
Byte 3	Keycode 2							
Byte 4	Keycode 3							
Byte 5	Keycode 4							
Byte 6	Keycode 5							
Byte 7	Keycode 6							

2). Consumer Report

Consumer Report								
Report ID: 0x02								
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Consumer Control Code1 (LSB)							
Byte 1	Consumer Control Code1 (MSB)							
Byte 2	Consumer Control Code2 (LSB)							
Byte 3	Consumer Control Code2 (MSB)							

3) Monitor RF Key Code Table IR Protocol: RC6 Mode 6A,

Carrier Frequency: 36Khz ; Customer ID: 0x8011H

System/command: 002(Decimal)

1	Input 094		2	Power 012	
		3	GOOGLE ASSISTANT 095		
		4	UP 088		
5	LEFT 090	6	OK 092	7	RIGHT 091
		8	DOWN 089		
9	BACK 085	10	HOME 080	11	VOL + 016
12	SETTINGS 084	13	MUTE 013	14	VOL - 017
15	Prime video 119			16	YouTube 121
17	NETFLIX 124			18	APPS 120

3.4 . BLE Mode

3.4.1 BLE Parameters

<I>. Device Info:

- Device Name: "VANTIVA RC4111801"
- Vendor ID: 0x057A (Omni)
- Product ID: 0x00A7

Note: At any one time, the RCU can only pair with 1 Monitor. The RCU keeps connection if the Monitor is turned on and within BLE effective distance with the RCU.

<II>. Connection Parameters:

- Connection Interval: 8 (1.25ms x 8 = 10ms)
- Slave Latency: 99
- Supervision Timeout: 4 seconds

Note: RCU will send the request of the link parameters upon link establishment. In BLE communication, the requested connection parameters will be up to the host to either accept or reject, so the actual parameters applied may differ from the requested value defined above.

Different connection parameters will impact BLE response and power consumption. OMNI recommends Monitor side to always accept and apply the above parameters for the most optimized performance for BLE response and power saving.

3.5 Connection Behaviors

Once a remote and Monitor are paired, the BLE link will be kept maintained (using the connection parameters in section 5.4.1)

If the host and remote disconnects, the following occurs:

1) After disconnecting, the RCU continuously transmits direct advertising at low duty cycle for 5sec

(no LED blink). After 5 seconds, remote goes to Step 2. This process is abort if RCU gets connected within seconds.

2) RCU enters Sleep mode until the next user keypress. The process will start again from Step 1.

3.6. Battery management

Battery Level (%)	function
>30%	full functional
<30%	IR and BLE, NO Voice, NO OTA
0%	NO IR, BLE and Voice

Low Voltage Detection

1) If RC V(battery) is $\leq 2.1V$, fast blink LED for 2s to indicate battery low: Do not send RF to reconnect. Do not fire IR.

2) If RC V(battery) is $> 2.3V$, do normal operation (IR, BLE).

3) If RC V(battery) is $2.1V < V(\text{battery}) \leq 2.3V$, transmit IR/BLE low battery message upon user press keys:

- Case 1: RC is unpaired, user use RC as normal IR RC (don't pair RC with any TV). If RC V(battery) is $2.1V < V(\text{battery}) \leq 2.3V$, send battery low key (000.195) via IR key code per 10 key presses.
- Case 2: RC is paired, paired TV is not connected. (RC was used to control another TV). If RC V(battery) is $2.1V < V(\text{battery}) \leq 2.3V$, send battery low key (000.195) via IR key code per 10 key presses.
- Case 3: RC is paired, paired TV is connected. If RC V(battery) is $2.1V < V(\text{battery}) \leq 2.3V$, send battery low via IR & BT HID alternatively every 10 key presses.

Example:

10th key press sends IR battery Low keycode (000.195).

20th key press sends battery low (0x71) command in HID keyboard format.

30th key press sends IR battery Low keycode (000.195).

40th key press sends battery low (0x71) command in HID keyboard format.

3.7 LED Operations

3.7.1 LED Configuration



3.7.2 LED Behavior

Setup Action	LED	Timing
IR key press	Red	Blink at 2 times at 50ms interval
BLE key press	Red	100ms ON
Voice	Red	Static ON during Voice activity
BLE pairing	Red	Static ON when combo key is pressed, blink at 50% duty cycle (250ms LED ON time)
Error blink	Red	4 x 50ms ON / 50ms OFF

3.8 Remote Control Setups

3.8.1 General

The Setup features stated in this section changes the settings, activate a unique feature. Each feature is triggered by a set of unique combo keys.

Setup Feature	Combo Keys
Pairing / Re-Pairing	[BACK] + [HOME] for 3s
Factory Reset	[OK] + [MUTE] for 3s
Google Bug Report	[OK] + [BACK] more than 1s
Google Accessibility Shortcut	[DOWN] + [BACK] more than 1s

All setup modes can be triggered no matter Monitor control medium is RF or IR.

- Before entering setup mode via combo keys entry, the RCU will check if battery voltage is at LVD status. Setup modes will not be triggered if battery is at LVD status. In such an event, the LEDs will notify the user through the LVD blink. The RCU will then return to user mode.

3.8.2 Pairing/Re-Pairing (IR or BLE)

The RCU shall only be able to pair with one Monitor at any one time.

The Secure Simple Pairing shall employ the “just works” for the pairing process.

The RCU acts as a BLE slave device.

After paired with host successfully, the pairing data will be bonded into the NVM so that the pairing won't be lost after batteries change.

Press and hold <BACK + HOME> keys for at least 3 seconds. RCU will then enter discoverable mode:

1. RCU is only allowed to pair to maximum one host. Once the pairing combo keys takes effect, RCU will firstly terminate the present connection.
2. RCU then enters discoverable mode, sends out undirected advertising for pairing. The LED blinks during the whole discoverable state.
3. Once RCU is successfully paired with the host: the LED performs Confirmation blinking.
4. In case RCU has not gotten paired with any host after discoverable timeout, or pairing process is failed: the LED performs an error blink to indicate RCU was not paired.
5. During the discoverable period while not paired yet and before timeout, it is allowed for user to abort the discoverable state by pressing <BACK> key or <HOME> key. RCU stops pairing and remains unpaired state.

3.8.3 Google Bug Report

<< OK + BACK >>

1. Press <<OK+ BACK>> simultaneously for 1 second, RCU will send OK and BACK combo RFcode to Monitor.
 - if RC is not connected to TV, send IR code 000.157 as long as the keys are keep pressed.
 - If RC is paired and connected with TV, send BLE hid consumer control code 0xEC.
 - Key IR Code RF code Back+ OK 000.157 0x0C/0xEC
2. For several seconds, Monitor will generate BUG REPORT, and send to google service (only request for android O and above).

3.8.4 Google Accessibility Shortcut

<< DOWN + BACK >>

1. Press <<DOWN+ BACK>> simultaneously for 1 second, RCU will send DOWN and BACK combo RF code to Monitor.
 - IF RC is not connected, the RC transmits will transmit 000.114 command (transmit only 1 RC frame code) via IR.
 - IF RC is connected, transmit 0xED via BT command (consumer Control HID 0X0C).

Key	IR Code	RF code
BACK + DOWN	000.114	0x0C/0xED

2. The Monitor received the code form RCU will turn on/off the Accessibility Shortcut function.

3.9 Voice Function

RCU features a button to activate the Voice Search application to search for content by speaking through the remote's built-in microphone.

The RCU supports one-way voice transferred from RCU to host.

Google Android-R GATT voice - for host that runs Android-R (ATV11 voice spec. version 1.0);

3.9.1 Voice over GATT for Android R

Press and released <voice> key to open the voice function, RCU will close the voice function After receiving the stop command sent by the host.

3.10 Battery Voltage Monitor

LVD check will be triggered after a signal key is released in user mode.

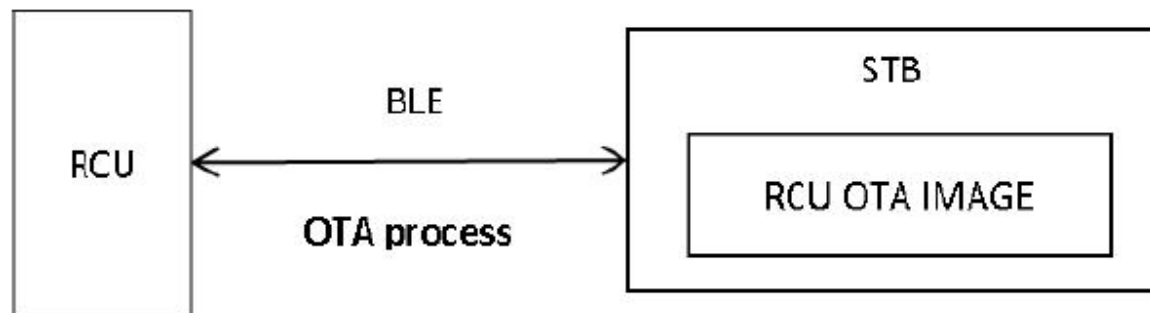
In BLE mode and IR mode, when the LVD is detected (battery voltage<2.3V), upon key-release when not in any set-up mode: the BATTERY LOW-LED gives a warning blink (see 5.6). While RCU works in BLE mode, it supports Bluetooth standard service of battery level notification. The paired host is then able to get battery level of the RCU. The battery level report is described as below:

Battery Level Report								
Report ID: 0x05								
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Battery Level in percentage (0 ~ 100%)							

3.11 OTA

OTA update shall only be initiated upon the user (i.e., the installer) request. No “background” or auto OTA firmware updates is supported.

The RCU software supports upgrade via OTA (Over-The-Air).



From diagram above, the Monitor can transfer the RCU firmware by the BLE link.

The OTA process can be triggered by the user using the RCU or by the Monitor itself.

The RCU OTA IMAGE need to be downloaded into the Monitor itself. After the OTA is completed, the

RCU will have a new firmware. The RCU OTA IMAGE will be available via the Android System settings.

FCC ID:2AGOFRC492A
IC:24503-RC492A

Statement:

FCC Caution:

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.

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

NOTE: 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.

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

- English:

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-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.

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

RF exposure statement:

The equipment complies with IC Radiation exposure limit set forth for uncontrolled environment. The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

- French:

Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes aux RSS (RSS) d'Innovation, Sciences et Développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes:

- (1) Cet appareil ne doit pas causer d'interférences.
- (2) Cet appareil doit accepter toutes les interférences, y compris celles susceptibles de provoquer un fonctionnement indésirable de l'appareil.

Tout changement ou modification non expressément approuvé par la partie responsable de la conformité pourrait annuler l'autorité de l'utilisateur à utiliser l'équipement.

Déclaration d'exposition RF:

L'équipement est conforme à la limite d'exposition aux radiations de la IC établie pour un environnement non contrôlé. L' appareil a été évalué pour répondre aux exigences générales en matière d' exposition aux RF. L' appareil peut être utilisé en condition d' exposition portable sans restriction.