



APAC SKB RCU 2018

Product Specification

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APAC SKB High-End RCU 2018

Product Specification

Revision History

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Rev	Date			
Rev A	02/14/2019	All	Initial Customer Release	

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1 Introduction

1.1 Purpose & Description

This document describes the product requirements for SKB SR01 RCU 2018 (High-end, Simple)

1.2 Product Feature Summary

- New SKB design (by SKB and C3X)
- UE878 based design
- BLE (HID, GATT)
- Voice (Voice over HID, mSBC)
- IR (Default TV combo mode, IR back up mode)
- OTA
- ~~Raise to talk (Accelerometer, IR Proximity Sensor)~~
- Buzzer
- ~~Adaptive Control~~
- BT Classic (CSR8630, A2DP) – Audio Streaming
- Quickset - One touch view by <All Power> key, Auto setup

1.3 Host Information

This RCU shall support SKB Android TV STB

2 Reference Documentation

2.1 Customer Documentation

2.1.1 RCU Spec Requirement

2.2 UEI Standard Documentation (as applicable)

- Spec 0001, Rev 2, General Cosmetic Specification
- Spec 0003, Rev 23, Mechanical Standard for Design and Testing of Hand-held Remote Control (HRC)
- Spec 0004, Rev 9, Silicon Rubber Keypad, Poly-dome, and Metal Dome Specification
- Spec 0005, Rev 3, Environmental Specification – Drop Test
- Spec 0007, Rev 3, Carbon Key
- Spec 0020, Rev C, ESD
- Spec 0010, Rev 3, Marking

2.3 Performance Requirements

2.3.1 RF Range

50 meters minimum, open field.

2.3.2 Transmit Power

Conducted transmit power with transmit power setting to maximum, measured at antenna feed-point:

Parameter	Condition	Min	Typ	Max	Unit
TX Power	BLE		6.5	-	dBm

2.3.3 Receive Power

Conducted receive sensitivity measured at antenna matching input, shielded room

Parameter	Condition	Min	Typ	Max	Unit
RX Sensitivity	BLE		-92	-	dBm

2.3.4 IR Range and Angle Requirements

Transmission range depends upon the receive angle and the sensitivity of the receiver.

Requirements:

1. IR Angle and Range tests are based on an NEC carrier based code.
2. Fresh batteries shall be used for verification.
3. 1 TX LED facing TOP
4. 1 RX LED facing TOP
5. 2 TX LED facing BACK

Head on Range: 33 Feet (in the horizontal plane).

2.3.5 IR Carrier Frequency

The RCU will support IR protocols with frequencies up to 455 kHz.

2.3.5.1 IR Carrier Frequency Accuracy

The IR Carrier Frequency Tolerance is IR code-dependent. Unless otherwise specified, the following tolerances shall be observed:

1. IR code T0810: $f_{\text{Carrier}} = 40\text{KHz}$, the Tolerance shall be $\pm 2\%$
2. IR code C5557(NEC-based): $f_{\text{Carrier}} = 38\text{KHz}$, the Tolerance shall be $\pm 3\%$
3. IR code C1877: $f_{\text{Carrier}} = 56.9\text{KHz}$, the Tolerance shall be $\pm 3\%$
4. $56.9\text{KHz} < f_{\text{Carrier}} \leq 455\text{KHz}$, the Tolerance shall be $\pm 5\%$

2.3.6 IR Lens

Power loss due to the IR lens will be less than or equal to 1.0 dB.

2.3.7 Voice

2.3.7.1 SKB Voice Spec

- 120byte mSBC (16KHz/16bit)

2.3.7.2 Voice Quality Requirements

This section describes requirements for the PCM audio data measured after software equalization filters (high-pass, low-pass, and equalization).

Optimized for Google voice recognition system. If used with another target, the below parameters will need to be adjusted per requirements of the voice recognition system.

Item	Requirement
Sample Rate	16 kHz
Sample Size	16 bits
Channels	1 channel
Frequency Response (after software EQ is applied)	+/- 3dB from 100 Hz – 4 kHz, +/- 5dB from 4kHz – 7 kHz
Dynamic Range	> 59 dB
Sensitivity	90 dB SPL @ 1kHz will produce RMS of 2500 for 16 bit sample (-19.34 dBFS)
DC Offset	DC offset shall be avoided
Linearity	Amplitude should linearly track input SPL changes over at least a 30dB range from -18dB to +12dB
THD	< 1% @ 90 dB SPL measured at 1kHz at the microphone < 5% @ 90 dB SPL measured at 1kHz entire system

2.3.8 Battery life

Battery life shall be 6 months using Alkaline AA batteries and based on the following usage profile:

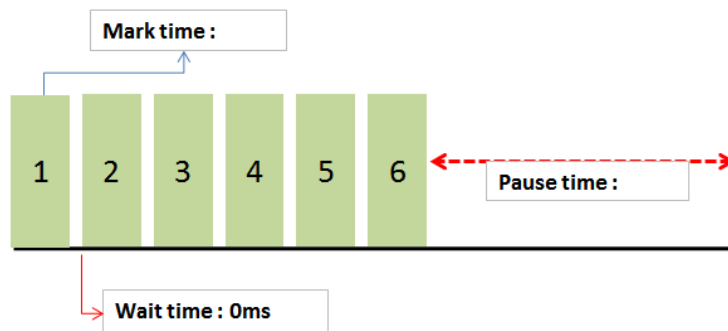
IR	75 key presses per day (0.5 s duration)
RF	100 key presses per day (0.5 s duration)
Motion	10 min of activity per day (120 sessions of 5 s)
Audio Streaming	60 minute per week
Voice	1.5 min a day (30 sessions of 3 s)

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Finder	10 activations per month at 10 s each
Standby	18 hours of standby sync per day
Battery Life Status	3 events per day

2.3.9 Remote Finder

- RCU shall support the remote finder via BLE FindMe profile using the BLE immediate alert service.
- RCU shall activate the buzzer no more than 3 seconds when the alert level is set to one and BLE is paired.
- RCU shall de-activate the buzzer when the alert level is set to zero and BLE is paired.
- RCU shall de-activate the buzzer when any key press is detected and the buzzer is activated. IR or RF key can be transmitted when key press is used to deactivate the buzzer.
- RCU shall de-activate the buzzer when ear-jack is inserted or when ear-jack is removed. Ear-jack insert will trigger the Audio Streaming based on the defined scenario
- RCU shall activate the buzzer based on the following sequence where each number represents a specific frequency. All frequencies will have DUTY_CYCLE defined by the following table.
- RCU shall repeat the following sequence for 60seconds if key press was not detected.
- RCU shall be able to test the remote finder feature and activate the buzzer sequence by pressing the Buzzer Test buttons defined in the Key Function Table.
- When buzzer is activated, RCU shall turn on Backlight as well, regardless of Backlight On/Off status

Buzzer 1-Frame 출력 파형


Parameter	Value	Unit
Mark Time	100	Milliseconds
Wait Time	0	Milliseconds
Pause Time	1000	Milliseconds
1	1319	Hz
2	1479	Hz
3	1661	Hz
4	1754	Hz
5	1980	Hz
6	2220	Hz
DUTY_CYCLE	50	Percent

- Test Mode
 - Pressing <<MUTE>> + <<123>> for 3 seconds shall activate the buzzer sound test until any key is pressed
- Buzzer SPL Requirement
 - Measure the SPL 10cm from the left side of RCU
 - SPL Min Level shall be around 84dB
 - Test Criteria - TBD by EE team and updated EATP in detail

3 Software Requirements

The software shall be based on the UE878 platform. It shall be able to communicate to the following STB configurations:

- STB with Android KitKat 4.4.x with BT Classic and BLE 4.0
- STB with Android Lollipop with BT Classic and BLE 4.2
- STB with Android Marshmallow with BT Classic and BLE 4.2
- STB with Android Oreo with BT Classic and BLE 4.2

The RCU software shall support the following features:

- BLE 4.0 and BLE 4.2 via UE878
- BT Classic via CSR8630
- Voice upstream via BLE 4.2 or BLE 4.0
- Audio downstream via BT Classic
- Universal IR for TV for selected keys (TV Power On/Off/Toggle, Volume +/-, Input)
- OTA for upgrading the firmware via BLE. CSR8630 configuration upgrade will not be supported
- Remote Finder
- Battery Monitor
- UEI Quickset 3.4 features (OTV, Auto Setup, and control)
- IR assisted pairing

3.1 Definitions

3.1.1 Timings

Stuck Key Timeout	120s	The remote control can continuously send IR for this duration of time in normal operating mode when a key is held down. After this duration, the RCU will stop transmitting IR and requires all keys to be released in order to process the next key press. This feature is intended to save the battery life and protect the IR diode. (30s for TV keys, TV Power, TV Input, TV Vol Up and Down)
Programming Timeout	10s	The remote will exit programming state if no user action is performed for this duration.
Code search Interval	3s	This is the approximate interval between successive test signals that are transmitted during brand search and automatic code search.
Macro playback delay for Power key	1.5s	If Power key is part of macro playback, a 1.5s delay is automatically added.
Macro playback delay	300ms	This is the delay between successive IR key transmissions during macro playback.

3.1.2 LED Timings

Parameter	On Duration	Off Duration (when blinking more than 1 time)	Units
SHORT_BLINK	100	100	milliseconds
LONG_BLINK	250	750	milliseconds
NORMAL_BLINK	250	250	milliseconds

3.1.2.1 LED feedback

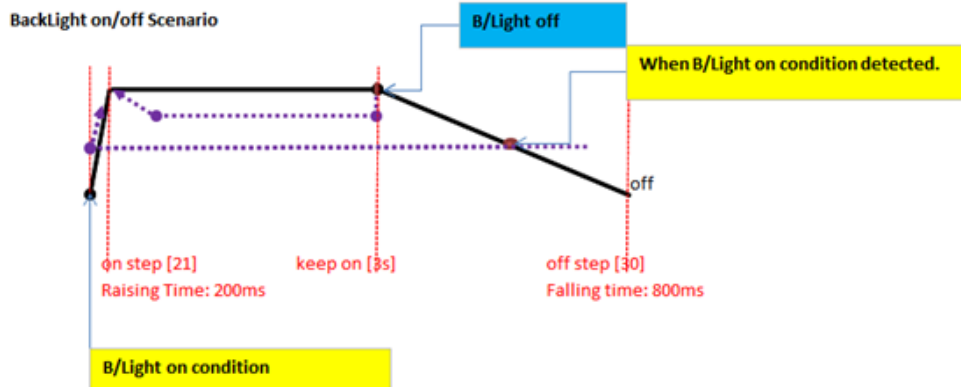
RCU event	Green LED feedback
Boot up	SHORT_BLINK 2 times
BLE transmitting signal (including special key codes)	SHORT_BLINK once
BLE is paired successfully with the host	SHORT_BLINK 5 times
BLE is un-pairs successfully with the host	SHORT_BLINK 5 times
BLE is transmitting advertisement packets	LONG_BLINK continuously
Transmitting IR signal triggered by a key press	LED ON until the key released

3.1.3 Backlight

- Operation Condition : Backlight shall work only the battery level is above 2.4V
- Backlight feature shall be enabled or disabled by the toggle key press <<MUTE>> + <<KIDS>>
 - When Backlight feature is enabled, LED shall blink 2 times (SHORT_BLINK)
 - When Backlight feature is disabled, LED shall blink 4 times (SHORT_BLINK)
- RCU shall NOT turn on the back light when Find Me feature is activated

Parameter	Duration	Units
RAISING_TIME	200	milliseconds
ON_TIME	3000	milliseconds
FALLING_TIME	800	milliseconds

- If RCU detects movement at any time, then raise the duty to the max and start ON_TIME duration again.
- However, when A2DP is connected (Audio Streaming is activated), RCU shall NOT turn on the back light by movement, but by Key Press (On and Off timing is the same)
- Please refer to the below diagram



3.1.4 Key Press Definitions

3.1.4.1 Key Sequence Legend

Item	Symbol	Description
1	< >	Press and release key
2	<< >>	Press and hold key down for a minimum of 3 seconds
3	<<< >>>	Press and keep holding down until desired results are obtained
4	→	Continue on to next step

3.2 IR Configuration

3.2.1 Default Devices & Settings

Device	Default Code
Cable	BLE Data + IR for Power Key C5443 + C5444(for alternative mode, Mode2) <i>Refer to 8.3.4.2 Key table (Use SendIRPattern for P5)</i>
TV	T2051 / T1860 (Samsung and LG Combo)

3.2.2 Library Requirements

3.2.2.1 STB Codeset

- Default STB codeset is C5443 (SKB IR Mode), and C5444 can be set as Mode 2 manually
- Follow UEI Exec. 090
- However, Such keys, like <All Power>, <Home>, use the combo signal to send the SKB-specific IR code (this is handled by RCU FW separately)
- <HOME> key requires Break code (not All other keys should not have Break code)

3.2.2.2 TV Codesets

- No TV codesets required in RCU side.
- TV Codeset shall be supported by QS

3.2.3 Device Mode Mapping

Device	Default Code	Device Type
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Universal TV	T	1
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3.3 BLE Configuration

3.3.1 BLE and BT Classic Local Device Configuration

Each Bluetooth device contains a unique MAC address called BD address (Bluetooth Device address) which is taken from ranges assigned by IEEE. The below MAC Address is assigned by UEI PM.

We need to keep using the following MAC address range

MAC Address Range:

Chip	Mac Address Start	Mac Address End
UE878	9CAC6D 000000	9CAC6D 07A151
CSR	9CAC6D 07A152	9CAC6D 0F4240

RCU shall have a VID and PID defined from the following:

VID (Vendor ID)	0x06E7
PID (Product ID)	0x8127

3.3.2 Service/Profile

3.3.2.1 GAP – Generic Access Profile

- RCU shall support the following characteristics in the GAP Service.

Characteristic	UUID	Value	Description
Device Name	0x2A00	XXX_BA01_XXX	RCU BLE Device Named
Appearance	0x2A01	0x0180	Generic Remote Control

3.3.2.2 GATT – Generic Attribute Profile

- RCU shall support the following characteristics in the GATT service.

Characteristic	UUID	Value	Description
System ID	0x2A23	<CAI> 0xFFFE <OUI>	<CAI> is the last 3 bytes of the BLE MAC address. <OUI> is the first 3 bytes of the BLE MAC address.
Model Number	0x2A24	--	RCU Model Number in ASCII
Firmware Revision	0x2A26	<Major>.<Minor>.<Release>	RCU Bootloader revision in ASCII
Hardware Revision	0x2A27	NA	RCU Hardware revision in ASCII
Software Revision	0x2A28	ZZZZ.XX.YY	ZZZZ = Remote Solution or Movon FW No XX = X-release revision (e.g. 01 for X1) YY = release minor revision (Alpha release)
Manufacturer Name	0x2A29	--	RCU Manufacturer Name
PnP ID	0x2A50	0x02 <VID, PID, Product	USB VID, PID, and UEI product

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		Version>	version.
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3.3.2.3 HOGP – HID Over GATT Profile

- RCU shall support the following characteristics in the HOGP service.

Characteristic	UUID	Value	Description
HID Information	0x2A4A	0x0111, 0x00, 0x01	USB HID version, Country Code, Flags
Report Map	0x2A4B	0x05 0x01 0x09 0x06 0xA1 etc.	HID format information
Protocol Mode	0x2A4E	0x01	Report Protocol Mode

3.3.2.4 Battery

- RCU shall support the following characteristics in the Battery service.

Characteristic	UUID	Value	Description
Battery Level	0x2A19	0-100	RCU Battery Level in percentage

3.3.2.5 Find Me Profile

- RCU shall support the following characteristics in the Immediate Alert Service.

Characteristic	UUID	Value	Description
Alert Level	0x2A06	0-2	RCU Alert Level

3.3.3 Connectivity
3.3.3.1 Advertising / Pairing

- RCU shall support BLE “Just Works” pairing mechanism by setting IO capabilities as No Input/No Output.
- RCU shall start sending BLE advertisement packets if it has no pairing information and the user hold the pairing button(s) defined by PAIR_BUTTONS for PAIR_BUTTON_DURATION.
- RCU shall send BLE advertisement packets with interval defined by PAIR_ADV_INTERVAL for PAIR_ADV_DURATION. RCU will stop sending advertisement packet if it is successfully paired with the host before the PAIR_ADV_DURATION expires.
- ~~RCU can shall ignore all key pressed when sending the BLE advertisement packets until PAIR_ADV_DURATION expires.~~

Parameter	Value	Unit
PAIR_BUTTONS	<<Mic>> or <<MUTE>> + <<MENU>> or Connecting ear-jack	RCU Key(s)
PAIR_BUTTON_DURATION	- One click for <<MIC>> - 3 for <<MUTE>> + <<MENU>>	Clicks Seconds
PAIR_ADV_INTERVAL	50	Milliseconds
PAIR_ADV_DURATION	20	Seconds

- RCU shall send BLE advertisement packet no longer than 31 bytes.
- RCU shall send BLE advertisement packet based on the Advertisement Packet Format.

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- RCU is paired and has pairing information but NOT connected to the STB, if user press <<MIC>> button or connecting ear-jack to trigger pairing start, then RCU shall send IR_RCU_NOT_CONN_SR (Refer to 8.3.4 BLE Key Table) to STB, then STB will show pop-up message to the user

Advertisement Packet Format:

Data Field	Length	Value	Description
Flag	0x02	0x01, 0x05	Limited Discoverable, No BR/EDR
Appearance	0x03	0x19, 0x0180	Generic Remote Control
Service Length	0x03	0x02, 0x1812	HID
Local Name	0x13	0x09, 0x42, 0x55, 0x45, 0x5f, 0x53, 0x52, 0x30, 0x31 0x5f, 0x??, 0x??, 0x??	'XXX_BA01_YYY' Device Name in ASCII. B: Btv UE: Universal Electronic SR01: UHD_HDR Bluetooth LE RCU XXX : BRM(Remote Solution) or BMM (Movon) YYY: Last three nibbles of UE878 MAC_ADDRESS

- RCU shall respond to BLE scan response request from the host based on Scan Response Packet Format.

Scan Response Packet Format:

Data Field	Length	Value	Description
Local Name	0x13	0x09, 0x42, 0x55, 0x45, 0x5f, 0x53, 0x52, 0x30, 0x31 0x5f, 0x??, 0x??, 0x??	'XXX_SR01_YYY' Device Name in ASCII. B: Btv UE: Universal Electronic SR01: UHD_HDR Bluetooth LE RCU XXX : BRM(Remote Solution) or BMM (Movon) YYY: Last three nibbles of UE878 MAC_ADDRESS

- RCU shall support the remote finder via BLE FindMe profile using the BLE immediate alert service
- RCU shall advertise device name **BRM(or BMM)_Audio_BA01** for the Bluetooth Classic (CSR8630) used for the Audio Downstream.
- RCU shall advertise Bluetooth Classic only when the headset is detected. This is to save power of the RCU.

3.3.3.2 Connections

- RCU shall store the BLE pairing information when it is successfully paired with the host.
- RCU shall maintain the active connection with connection parameter defined by CONNECTION_INTERVAL, SLAVE_LATENCY, and SUPERVISION_TIMEOUT.

Parameter	Idle / Voice	During OTA	Unit
CONNECTION_INTERVAL	7.5	16.25	Milliseconds
SLAVE_LATENCY	199	0	Number of times
SUPERVISION_TIMEOUT	10	6.5	Seconds

3.3.3.3 Reconnection

- RCU shall start sending BLE directed advertisement packets when it is not connected to the host or detects any STB keys with prior pairing information. (* Any TV Key press[TV PWR,TV I/P,TV V+,TV V-] Rcu is not sending ADV_DIR packets to reconnect with host)
- Step #1
 - RCU shall send high duty direct advertisement packets in RECONNECT_HD_ADV_DURATION time with RECONNECT_HD_ADV_INTERVAL for RECONNECT_HD_ADV_MAX_TIMES, when RCU is not connected and detects a key press with prior pairing information. RCU will stop sending high duty direct advertisement packets if it successfully reconnects with the host before the RECONNECT_HD_ADV_DURATION and RECONNECT_HD_ADV_MAX_TIMES expires.
- Step #2
 - RCU shall continuously send low duty direct advertisement packets in RECONNECT_LD_ADV_DURATION time with RECONNECT_LD_ADV_INTERVAL, when it is not connected. RCU will stop sending low duty direct advertisement packets if it successfully reconnects with the host.
- Step #3
 - RCU shall continuously send low duty direct advertisement packets in RECONNECT_IDLE_LD_ADV_DURATION time with RECONNECT_IDLE_LD_ADV_INTERVAL, when it is not connected. RCU will stop sending idle low duty direct advertisement packets if it successfully reconnects with the host.
- RCU shall transmit the key report associated with the key pressed once the connection is re-established.

Step	Parameter	Value	Unit
1	RECONNECT_HD_ADV_INTERVAL	1.87	Milliseconds
	RECONNECT_HD_ADV_DURATION	1.28	Seconds
	RECONNECT_HD_ADV_MAX_TIMES	1	times
2	RECONNECT_LD_ADV_INTERVAL	30	Milliseconds
	RECONNECT_LD_ADV_DURATION	5	Seconds
3	RECONNECT_IDLE_LD_ADV_INTERVAL	1.87(1 cycle)	Milliseconds
	RECONNECT_IDLE_LD_ADV_DURATION	1.5	Seconds

3.3.3.4 Paring / Connection timing information

- NA

3.3.3.5 Un-Pairing

- RCU shall terminate an active link when the user hold the un-pairing button(s) defined by UNPAIR_BUTTONS for UNPAIR_BUTTON_DURATION.
- RCU shall clear the pairing information when the link is terminated. Key press will no longer trigger a reconnection.

Parameter	Value	Unit
UNPAIR_BUTTONS	<<MUTE>> + <<Home>>	RCU Key(s)
UNPAIR_BUTTON_DURATION	3	Seconds

3.3.3.6 Voice

- RCU shall maintain the active connection with connection parameter defined by VOICE_CONNECTION_INTERVAL, VOICE_SLAVE_LATENCY, and VOICE_SUPERVISION_TIMEOUT in voice transmission.

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Parameter	Value	Unit
VOICE_CONNECTION_INTERVAL	7.5	Milliseconds
VOICE_SLAVE_LATENCY	0	Number of times
VOICE_SUPERVISION_TIMEOUT	10	Seconds

3.3.3.7 OTA

- RCU shall maintain the active connection with connection parameter defined by OTA_CONNECTION_INTERVAL, OTA_SLAVE_LATENCY, and OTA_SUPERVISION_TIMEOUT in OTA operation

Parameter	Value	Unit
OTA_CONNECTION_INTERVAL	7.5	Milliseconds
OTA_SLAVE_LATENCY	0	Number of times
VOICE_SUPERVISION_TIMEOUT	10	Seconds

3.3.4 BLE Key
3.3.4.1 Transmission

- RCU shall send the specific data based on the key function table defined in following section
- RCU shall always transmit keys with IR data independent of the BLE connection status for keys that do not have HID data defined in the key function table.
- RCU shall send the BLE key report when the BLE is paired. Otherwise, it will send the IR data based on the RCU MODE.
- RCU shall send the BLE key report when the key is pressed and BLE is paired.
- RCU shall send the BLE key release report (0xFFFF) when the key is released or the STUCK_KEY_TIMEOUT has expired and BLE is paired.
- RCU shall transmit the IR data continuously when the key is pressed. It will stop transmitting either when the key is released or the STUCK_KEY_TIMEOUT has expired.
- RCU shall only send either the RF data or the IR data associated with the first button when two buttons are pressed. This includes situation when two buttons are pressed then the first button is released, RCU will not send the RF data or IR data of the second button.

3.3.4.2 Key Function Table

Please refer to the separate IR DB document

3.3.4.3 Drag Mode

- The RCU shall provide the special IR key code to support Android Web Browser
- When any key of the two combo keys is released, then RCU shall send BREAK signal

Key Name	Scan code	Android Key code
Drag Mode (Up)	0x136	KEYCODE_BUTTON_L1
Drag Mode (Down)	0x137	KEYCODE_BUTTON_R1
Drag Mode (Left)	0x138	KEYCODE_BUTTON_L2
Drag Mode (Right)	0x139	KEYCODE_BUTTON_R2

3.3.5 Voice Upstream

- RCU shall send the HID Key report associated with the VOICE_BUTTON and HID key release report when the VOICE_BUTTON is pressed and released. When the host receives the VOICE_BUTTON key report, the host shall send a REQUEST_VOICE packet to the RCU.
- RCU shall start streaming the voice data to the host when it receives the REQUEST_VOICE packet.
- RCU shall stop streaming the voice data when it receives a REQUEST_VOICE_STOP packet from the host even if the VOICE_BUTTON is still pressed. This gives the host the ability to stop the voice upstream when no voice data is detected. The VOICE_BUTTON would need to be depressed and pressed again to initiate the voice stream again.
- RCU shall stop streaming the voice data to the host if it does not receive a REQUEST_VOICE_STOP packet from the host after the VOICE_DURATION.

Parameter	Value	Unit
VOICE_BUTTON	<<Mic>>	RCU Key
VOICE_DURATION	10	Seconds

3.3.5.1 Voice Search Flow

RCU		STB
Voice Start	→	Received
Received (LED ON)	←	Send MIC START
Transmit Voice data	→	Received
Received (LED OFF)	←	Send MIC STOP

RCU shall send Voice Start on Normal/LVD condition, but not sending Voice Start on EMPTY Battery Mode

3.3.5.2 Voice Key and Data

* HID Voice Start code on ATT - Report ID(0x85)

NUM	Field	Description	Values	Size	Direction
1	Opcode	Notification	0x1B	1byte	RCU -> STB
2	Att Handle	Handle	0x0000 ~ 0xFFFF	2byte	
3	Payload	Reserved	0x00	1byte	
4		Voice start	0x23	1byte	
5		Keycode 2	0x00	1byte	

* HID Mic Start on ATT - Report ID(0x85)

NUM	Field	Description	Values	Size	Direction
1	Opcode	Write Request	0x12	1byte	STB -> RCU
2	Att Handle	Handle	0x0000 ~ 0xFFFF	2byte	
3	Payload	Reserved	0x00	1byte	
4		MIC Start	0x26	1byte	
5		Keycode 2	0x00	1byte	

* HID Mic Stop on ATT - Report ID(0x85)

NUM	Field	Description	Values	Size	Direction
1	Opcode	Write Request	0x12	1byte	STB -> RCU
2	Att Handle	Handle	0x0000 ~ 0xFFFF	2byte	
3	Payload	Reserved	0x00	1byte	
4		MIC Stop	0x27	1byte	
5		Keycode 2	0x00	1byte	

* Voice data on ATT - Report ID(0xF8)

NUM	Field	Description	Values	Size	Direction
1	Opcode	Notification	0x1B	1byte	RCU -> STB
2	Att Handle	Handle	0x0000 ~ 0xFFFF	2byte	
3	Payload	Voice data	0xXX....	120byte	

3.4 Audio Downstream

- RCU shall attempt to establish the BT Classic connect with the last connected host when the headset is detected.
- RCU shall send BT Classic advertisement when headset is detected and it has not previously connected with a host.
- RCU shall send BT Classic advertisement when headset is detected and it cannot connect with the previously connected host.
- RCU shall notify the host either via IR or BLE indicating headset is detected and BT Classic is activated.
- RCU shall disconnect the audio stream when the un-paired button defined in Key Function Table is pressed. User would need to disconnect the headset and connect the headset again to initiate the audio downstream again.
- When STB is turned off and A2DP was disconnected from STB, RCU shall wait for 35 seconds to reconnect to A2DP, but after 35 seconds, RCU shall not be trying to reconnect to A2DP when STB is turned on again.
 - STB Disconnect A2DP – Audio streaming is stopped
 - If STB is turned on
 - Within 35 seconds – RCU reconnect to A2DP
 - After 35 seconds – RCU shall not reconnect to A2DP

3.4.1 Ear-jack Scenario

- When ear-jack is connected, RCU shall following the below scenario.

When Ear-jack is plugged	RCU is NOT connected		BLE is Paired and Connected	
	RCU has no paired Info	RCU has paired info	BLE Mode by <<*>> + <<1>>	BLE Mode by <<*>> + <<2>>

Product Specification

Battery is Normal	Send [Pairing] IR Key	Send IR Code - #63 (IR_RCU_NOT_CONNECTED)	Earjack insert (BT)	Earjack insert (IR)
Low	No Action	Low Batt. Code (IR)	Low Batt. Code (BT)	Low Batt. Code (IR)
Empty	No Action	Empty Batt. Code (IR)	Empty Batt. Code (BT)	Empty Batt. Code (IR)

3.4.2 Audio Tones

- When “A2DP connected” – A2DP source is connected, CSR shall play the following Tones
 - “Connected 3 beep Rising Tone” – 48ms C6 D6 A6

3.5 Battery Monitor

- RCU shall report battery status via HID standard Battery Service when BLE is connected
- RCU shall notify the host the battery level automatically when a voltage change triggers a battery state change based on the following table.
- RCU shall shutdown the audio streaming, if connected, and notify the host when the battery state changes to Low State.
- RCU shall not enable the audio streaming when the headset is detected during Low Battery State.

State	VDD Level	Battery Condition	Behavior
Good SKB_NORMAL	>2.4V	$VDD > V_{WARNING}$	All operations are allowed
$V_{WARNING}$ SKB_LOW	2.4V	$V_{WARNING} \geq VDD > V_{CRITICAL}$	Please refer to 8.5.1 Low Battery Mode for the Behavior
$V_{CRITICAL}$ SKB_EMPTY	2.2V	$V_{CRITICAL} \geq VDD > V_{STOP}$	Please refer to 8.5.2 Empty Battery Mode for the Behavior
V_{STOP} SKB_EMPTY	2.0V	$VDD \leq V_{STOP}$	Same as $V_{CRITICAL}$ RCU keep working until it dies – no cut off voltage
$V_{RESTART}$	2.6V	$VDD > V_{RESTART}$	Lower voltage can be switched back to Good or OK state on detecting $V_{RESTART}$

- RCU shall report battery level when requested from the host or notification based on the following conversion table:

Battery Level (%)	Battery Voltage (V)
100	$3.0 \leq V$
90	$2.9 \leq V < 3.0$
80	$2.8 \leq V < 2.9$
70	$2.7 \leq V < 2.8$
60	$2.6 \leq V < 2.7$
50	$2.5 \leq V < 2.6$
40	$2.4 \leq V < 2.5$
30	$2.3 \leq V < 2.4$
20	$2.2 \leq V < 2.3$
10	$2.1 \leq V < 2.2$
0	$V < 2.1$

- RCU should send battery information via IR whenever <<Home>> key is released.
- In IR Mode, send IR signal defined in 8.3.4.2, and in BLE mode use battery service

3.5.1 Low Battery Mode

- RCU shall turn on RED LED instead GREEN LED, while any key is pressed
- BT / IR mode is unchanged
- IR Mode (model1 and mode2) is unchanged.
- Buzzer shall be working in this mode
- RCU shall stop Audio BT Streaming – But, if Audio streaming is already on going, then RCU keep streaming
- When ear jack is inserted, RCU shall send Low Voltage Battery Level Code via IR when in IR code or BT when in BT mode (* Then, STB will show popup on screen)
- OTA is not available in this mode (* This is STB Spec)
- In IR learning mode, Green and Red will replace each other for all LED feedback
- All programming features entry are allowed

3.5.2 Empty Battery Mode

- RCU shall turn on RED LED instead GREEN LED, while any key is pressed
- BT / IR mode is unchanged
- IR Mode (model1 and mode2) is unchanged.
- Buzzer shall be working in this mode
- RCU shall stop Audio BT Streaming even when user is playing audio
- When ear jack is inserted, RCU shall send Empty Voltage Battery Level Code via IR when in IR code or BT when in BT mode (* Then, STB will show popup on screen)
- OTA is not available in this mode (*This is STB Spec)
- In IR learning mode, Green and Red will replace each other for all LED feedback
- All programming features entry are allowed, except the below features by scenario
 - Repairing – Not allowed
 - MFG reset – Not allowed
 - IR FTM – Not allowed

3.6 Standard Features

3.6.1 Manufacturing Reset

- Press <<MUTE>> + <<GUIDE>> for 3 seconds to reset the RCU to Factory default
- The RCU shall clear the pairing information
- The RCU shall clear the device codes
- The RCU shall SHORT_BLINK four times when the manufacture reset is successful, otherwise, LONG_BLINK one time.
- This works in Normal/LVD/Empty battery status, but no LED blinks on Empty Batt status

~~3.6.2 Software Version Verification~~

- ~~This feature used to check the software version label (8 digits)~~
- ~~Press <<STB Power>>+<<TV Input>> for 3 seconds, Green LED will short blinks twice~~
- ~~Press <TV Input> to show the first digits, second press for second digits, and so on~~
- ~~Count the Green LED blinks for each <TV Input> press, number of counts is the digit number~~
- ~~This verification mode will exit under any of the following condition, without LED prompt.~~

Product Specification

- ~~Completed the sequential key press (<TV Input> pressed 8 times)~~
- ~~Pressed other keys~~
- ~~Time out by 1 minute~~

3.6.3 IR learning

This RCU shall support IR learning, which frequency ranges from 20 up to 56KHz, and the distance shall be in the range from 5cm ~ 10 ㄷ.

- This RCU have Four keys capable for learning the IR from a teacher RCU, they are: <TV Power>, <TV input>, <TV Vol +> and <TV Vol ->
- The following setup will use <Key_for_learning> represent the desired key for learning.

3.6.3.1 IR learning setup

- Press <<TV Power>> + <<OK>> for 3 sec to enter IR learning mode. Green LED will turn on until exit
- Press <Key_for_learning> to wait IR signal from teaching RCU. Green LED blinks off 1 second.
 - Hold teaching remote close to IR lens, press the key to be taught on teaching remote
 - Green LED short blinks 3 times indicates a successful learning
 - Red LED short blinks 3 times indicates learning failure, it may due to invalid capture or timeout (15 sec)
 - When waiting IR, pressing any keys on RCU will not do interruption
- After learning (regardless successful or not), press <Key_for_learning> for next learning
- Pressing keys not capable for learning (except <OK>) will blinks the Red LED 5 times
- After finish learning, press <OK> to exit. Green LED will short blinks 3 times then turn off
- If no key pressed for 1 min, the IR learning mode will timeout and exit. Green LED will short blinks 3 times then turn off

3.7 Quickset

- Please refer to the separate document

3.8 OTA

- The RCU shall support OTA from the host. CSR8630 configuration will not be upgradable.
- The RCU shall reboot itself when the OTA transfer is completed.
- The RCU shall validate the new firmware image for any bit flip or transfer error via CRC. It will only boot the new firmware image if it is validated, otherwise, it shall boot the current running image.

3.8.1 OTA Scenario

- When OTA App request to report battery level (BAS), RCU shall send battery level information to STB
- (STB will activate OTA only when the battery level is above 2.4V)
- When starting OTA, RCU shall turn on Green LED, and turn off Backlight
- After OTA, RCU shall show the OTA result by LED blinks. If the OTA file version and RCU version are the same, then RCU shall blink OTA_FAIL

OTA_SUCCESS	GREEN LED	250ms interval	3 Times
OTA_FAIL	RED LED	250ms interval	3 Times

- During OTA process, all key press, including Voice key shall not be working

3.8.2 OTA Vendor code

- To distinguish FW image files by RCU vendor, STB shall be checking the following information from OTA header

Product Specification

- Header: FF 00 FF FF 70 43 00 00
- 7043 is BUE_SR01 RCU / **BRM-BA01 and BMM-BA01 use different No**
- 00 00 is RCU version

3.8.3 OTA Image file

- OTA Image file name shall be BUE_SR01.bin
- Then, STB will include this image file into the system for OTA update.