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1. Application Range

This technical specification was made by Remote Solution for IR/BLE Remote Control of Humax D'live.

2. Specification

2-1 Appearance

- a. There should be no issue for Button Locking
- b. There should be no stiff and looseness when opening or closing the battery cover
- c. There should be no issue for attachment of label
- d. There should be no spread of printing in RCU
- e. There should be no warpage in RCU
- f. There should be no electricity issue because of deformation of Spring
- g. Edge of Spring should be rounded
- h. Spring should be horizontal when inserting the battery
- i. There should be no sharpness in case
- j. The Printing of product should be same as product specification

2-2 Characteristics of framework

2-2-1 Exploded diagram of remote control

- a. Component of Remote control should be match up with drawing
- b. There should be no issue for soldering after disassemble of remote control
- c. There should be no contact between component
- d. Printing of PCB should be same with drawing
- e. There should be no Flux in carbon paste
- f. There should be no Pb dirt in PCB

2-2-2 Characteristics of rubber contact

- a. Operation : There should be no issue when pressing the keys vertically
- b. Operation : Metal Dome will be pressed with power of $140g \pm 20g$
- c. Working distance of button: 0.5 ± 0.1 mm
- d. Returning of rubber button: It will be more than 40% of Operation [Measured with middle of Key]
- e. Weight : There should be no defects in RCU when pressing the button vertically with power of 3Kg for 3 second

2-2-3 Characteristics of battery

- a. There should be no issue when inserting or subtracting of battery
- b. There should be no issue for current after inserting the battery
- c. There should be no electricity issue after inserting or subtracting of battery for 100 times
- d. electrode : The gap of electrode from + to - should be less than 0.4mm
- e. There should be no electricity flow once battery is inserted by opposite way
- f. There should be no deformation after 24 hours once battery is inserted by opposite way
- g. Battery should be compatible other maker
[Compatibility of size : AAA(L=44.2~43.4mm, $\Phi 10.5 \sim 9.5$) , AA (L=50.5~49.0mm , $\Phi 14.5 \sim 13.5$)]

2-2-4 Characteristics of RCU Assembly

- ① Dimension : Dimension should be meet specification
- ② The gap should be less than 0.3mm after assemble of RCU - GAP of key top and side knob should be less than 0.6mm
- ③ Gap : The Gap should be less than 0.4mm after assembly of Battery Cover
- ④ Product Size : 160mm x 44.6mm x 21T

2-3 Electrical characteristics

2-3-1 leakage current

- a. Less than about 35uA with BLE pairing Mode at DC 3.0V

Measure the current, after leaving for 1 minute with switch [OFF] of transmitter remote controller

2-3-2 Operating current

- a. IR Operating Part

IR operation current should be less than 45mA by applying 3.0V battery.

Test IR Protocol : NEC

If the IR Format is not NEC, the measured current may be different.

- BLUETOOTH LE Part

-> Less than about 10mA at D.C 3.0V

2-3-3 Operating voltage

DC 2.2V ~ 3.4V (Alkaline Battery "AAA" * 2ea)

2-3-4 Oscillation

- Main oscillation clock frequency:40MHz,+/- 10PPMat D.C 3.0V
- Sub oscillation clock frequency: 32.768 Khz ±20PPM at D.C 3.0V

2-3-5 IR LED Specification

Parameter	Symbol	Test Conditions	Min	TYP	Max	Unit
Radiant Intensity	I _e	I _F =70mA	27.2	74.63	-	mW/sr
Forward Voltage	V _F	I _F =70mA	-	1.6	1.8	V
Reverse Current	I _R	V _R =5V	-	-	100	μA
Peak Wavelength	λ _p	I _F =70mA	-	940	-	nm
Spectral Line Half- Width	Δλ	I _F =70mA	-	50	-	nm
Viewing Angle	2θ _{1/2}	I _F =70mA	-	30	-	deg

-. This item can be replaced with an equivalent item by the appropriate 4M Process of D'live and RS.

2-3-6 Indicate LED Specification

- RED / YellowGreen Dual Color

Parameter	Symbol	Test Conditions	Color	Min	TYP	Max	Unit
Forward Voltage	V _F	I _F =20mA	YellowGreen	-	2.0	2.6	V
			Red	-	2.0	2.6	
Luminous Intensity	I _v	I _F =20mA	YellowGreen	18.5	35.0	-	mcd
			Red	63.0	100	-	
Reverse Current	I _R	V _R =5V	YellowGreen	-	-	100	μA
			Red	-	-	100	
Peak Wavelength	λ _p	I _F =20mA	YellowGreen	-	570	-	nm
			Red	-	630	-	
Dominant Wave Length	λ _d	I _F =20mA	YellowGreen	566	-	576	nm
			Red	615	-	625	
Spectral Line Half- Width	Δλ	I _F =20mA	YellowGreen	-	30	-	nm
			Red	-	17	-	
Viewing Angle	2θ _{1/2}	I _F =20mA	YellowGreen	-	120	-	deg
			Red	-	120	-	

-. This item can be replaced with an equivalent item by the appropriate 4M Process of D'live and RS.

2-3-7 Operating distance and pointing angle

- RF MODE

-> STRAIGHT : Min 30 m

-> POINTING ANGLE (45°) : Min 25m

- IR MODE

-> STRAIGHT : Min 10 m

-> POINTING ANGLE , Right, Left, Up, Down(30°) : Min 7m

2-3-8 VOICE Test

- 1) It will be sending a sine sound of the sound source 1KHz with the remote control in Artificial mouth or speaker
- 2) MIC for remote control, is input to 1KHz sound source, via the BT of the remote control transmits a 1KHz of DATA to the set-top box
- 3) Sound Level : -27.0 ± 5dB, THD(distortion) : MAX 3%

2-3-9 RCU used capacity (BATTERY LIFE) (LR03)

- Battery life should be at least 12 month under

No	Functions	Count/day		Operating Time		Current	Unit	Remark
1	IR Transmit	100	th	0.5	sec	45	mA	100 Key press/ day (0.5 Sec)
2	RF Transmit	100	th	0.5	sec	10	mA	100 Key Press /day (0.5 Sec)
3	Device LED	200	th	0.5	sec	7	mA	1 + 2
4	Voice Function	10	th	6	sec	15	mA	-
5	Leakage current	1	th	86400	sec	0.04	mA	RF paired

2-3-10 Certificate requirement

- Remote controller have passed the Bluetooth Certification and KC Certification.

2-3-10-1 Bluetooth Certification

- BLUETOOTH LE SIG Certificate
- Profile : HOGP

2-3-10-2 KC Certification

- Certification No : R-CRI-RMB-RM-R01
- KN 301 489-1/-17
- KN 61000-4-2
- KN 61000-4-3

3-2. RF Protocol.

1. Device : Realtek RTL8762AK**2. GATT-Based Specifications**

HID over GATT Profile

- HIDS(HID Service)
- BAS(Battery Service)
- DIS(Device Information Service)

VOICE over GATT Profile

- ATV Service

OTA over GATT Profile (Silent OTA)

3. Device Name

DLIVE OTT RCU

4. GAP Appearance Value

0x0180 : Generic Remote Control

5. BD Address

ex) 8C 08 8B xx xx xx(8C 08 8B assigned by RS)

6. Method of pairing

Just Works

7. Connection Parameters

Connection Interval Min : 8

Connection Interval Max : 10

Slave Latency : 120

SuperVision Timeout : 10 sec

8. Audio Feature

Audio Sampling at 8kHz, 16bits, compressed using ADPCM codec.(Compression rate is 4:1),

Push & Release Talk

9. DIS

Manufacturer Name : Remote Solution Ltd.

Model Number : DLIVE OTT RCU

Firmware Revision : yyymmdd (the date of the firmware release in yy/mm/dd format)

Software Revision : yyymmdd (the date of the ir database release in yy/mm/dd format)

System ID : 0x8C088BXXXXXX0000 (BD_ADDR the Bluetooth device address)

PnP ID :

- Vendor ID Source : 0x01 (BT)
- Vendor ID : 0x005D (Realtek Semiconductor Corporation)
- Product ID : 0x0001
- Product Ver : 0.0.1

10. OTA AES Key

- 52 43 38 39 5f 44 4c 49 56 45 5f 34 4b 5f 4f 54 54 5f 42 4f 58 5f 52 43 55 5f 52 45 4d 4f 54 45

*** Consumer on ATT - Report ID(0x10)**

NUM	Field	Description	Values	Size	Direction
1	Opcode	Notification	0x1B	1byte	RCU → STB
2	Att Handle	Handle	0x0000 ~ 0xFFFF	2byte	
3	Att Value	Keycode 1	Consumer Usage ID	2byte	

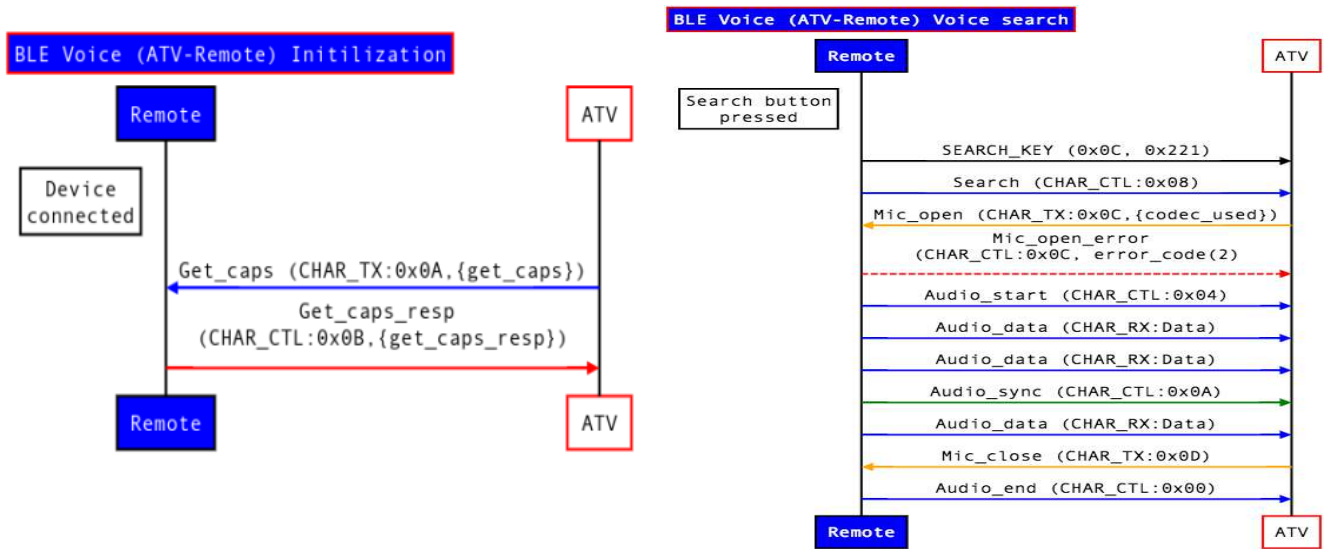
*** Voice Report On ATT - UUID (0xAB5E)**

NUM	Field	Description	Values	Size	Direction
1	Opcode	Notification	0x1B	1byte	RCU → STB
2	Att Handle	Handle	0x0000 ~ 0xFFFF	2byte	
3	Att Value	Sequence	0x0000 ~ 0xFFFF	2byte	
3	Att Value	ID	0x00	1byte	
3	Att Value	Prev pred	0x0000 ~ 0xFFFF	2byte	
3	Att Value	Index	0x00 ~ 0xFF	1byte	
3	Att Value	ADPCM data	0x00 ~ 0xFF	128byte	

11. GATT Profile UUIDs for ATV Voice Service

Type	Short-form	UUID	Properties
ATV Voice Service	ATVV_SERVICE_UUID	AB5E0001-5A21-4F05-BC7D-AF01F617B664	
Write Characteristic	ATVV_CHAR_TX	AB5E0002-5A21-4F05-BC7D-AF01F617B664	Write
Read Characteristic	ATVV_CHAR_RX	AB5E0003-5A21-4F05-BC7D-AF01F617B664	Notify
Control Characteristic	ATVV_CHAR_CTL	AB5E0004-5A21-4F05-BC7D-AF01F617B664	Notify

12. Sequence Diagrams



13. Audio frame

The data rate is [16KHz] 8KHz at 16bits per sample so [256kbps] 128kbps raw and then compressed 4:1 to [64kbps] 32kbps (ADPCM)

The firmware for the remote should include software to encode the raw audio data usingan IMA/DVI ADPCM encoder with a 4:1 compression ratio.

Audio frame is of 134 bytes containing encoded audio data of 128 bytes and a 6 byteheader.

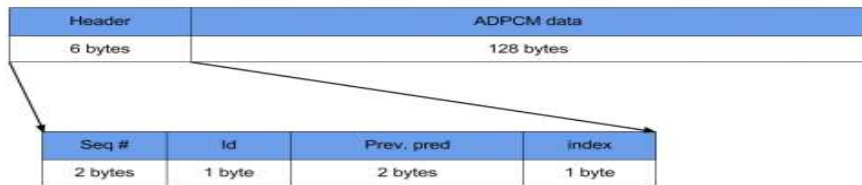
Each audio frame holds [16ms] 32ms of compressed audio.

8Khz/16Bit:

$$(128 * 8)/(4 * 8k) = 32ms$$

16Khz/16Bit:

$$(128 * 8)/(4 * 16k) = 16ms$$



Header type	
Seq #	Sequence number of audio frame. Monotonically increasing until rollover.
Id	Remote control id. Will expand on this. [TODO]
Prev pred	Previous predicted ADPCM value
Index	Index into step size table

*(Option) When transmitted over the air, the audio frames are fragmented into 20 byte notifications, this means that each audio frame is sent as (at least) 7 notifications.

4. RELIABILITY TEST

4-1 Remote Controller Assembly

4-1-1 Fundamental Performance

- Operation Current / Stand-by Current / Operating Voltage / Performance / Exterior

※ Judgement : Should meet Specification
Should be no issue no operation

4-1-2 High Temperature Operating Test

A. Temperature : $50 \pm 3^{\circ}\text{C}$

B. Time : 24 Hours

4-1-3 Low Temperature Operating Test

A. Temperature : $-5 \pm 3^{\circ}\text{C}$

B. Time : 24 Hours

4-1-4 High Temperature & Humid Operating Test

A. Temperature : $50 \pm 3^{\circ}\text{C}$

B. Humidity : 90 ~ 95%

C. Time : 24 Hours

4-1-5 High Temperature Storage Test

A. Temperature : $70 \pm 3^{\circ}\text{C}$

B. Time : 48 Hours

C. Time after leaving for 1 hour at normal temperature.

4-1-6 Low Temperature Storage Test

A. Temperature : $-20 \pm 3^{\circ}\text{C}$

B. Time : 48 Hours

C. Time after leaving for 1 hour at normal temperature.

4-1-7 High Temperature & Humid Storage Test

A. Temperature : $-20^{\circ}\text{C} \sim 70^{\circ}\text{C}$

B. DWELL Time : 30min

C. Cycle : 50 cycles

D. Time after leaving for 1 hour at normal temperature.

※ Judgement : Should be no issue for operation
Should match current spec after test
Should be no damage or de-form on cosmetic feature

4-1-6 Vibration test

- Vibration width : 1.5mm

- Test Period : 10~55Hz(7.5min) → 55Hz(6Hours) → 55~10Hz(7.5min)

- Each direction(X,Y,Z)

※ Judgement : Should have no functional issue
Current should meet spec
Should be no damage or de-form
Should not be tear of PE bag, scratch on product

4-1-7 Drop test

- Drop units 1 time of 6 sides at 76cm height on the Hard wooden plate

※ Judgement : Should be No component tear, damage
Should be able to assemble again if case is opened re-assembled unit should be operatable

4-1-8 ESD Test

- $\pm 4\text{kV}$, 1Hz, 10 Times Contact discharge

- $\pm 8\text{kV}$, 1Hz, 10 Times Air Contact discharge

※ Judgement : Should be no issue for operation

4-1-9 Button Life Time

- Once Per second for 300,000 cycles
- ※ Judgement : Should be no issue for operation
Should match current spec after test
Should be no damage or de-form on cosmetic feature

4-1-10 Button Alcohol test

- After falling 3-4 drops of ethyl alcohol(99.9%) on surface, clean surface 200 times with 500g force
- ※ Judgement : Print should not be erased after test

4-1-11 Alcohol test

- After falling 3~4 drops of ethyl alcohol(99.9%) on mold surface, clean surface 50 times with 500g force
- ※ Judgement : Print should not be erased after test

4-1-12 Cross Cut Test

- After the cross cut, take off OPP tape suddenly
- ※ Judgement : Print should not be wear & tear

4-1-13 Altitude tests

- Operating Altitude : Operating Altitude -60 meters to 3,700 meters
- Storage Temperature Altitude : Altitude -60 meters to 13,000 meters, -40°C to 70°C (non-powered storage)
- ※ Judgement : Should be no issue for operation

4-1-14 Liquid and oil resistance

- Solvent and Cleaning Solution Resistance
 - : The Remote MUST NOT be deformed, discolored or disfigured in any way by the application of 409 All Purpose Cleaner with 0.3% Alkyl dimethyl benzyl ammonium chloride, or Windex with Ammonia-D to any exposed surfaces.
- Resistance to hand cream
 - : Apply the following liquids individually and the confirm appearance after keeping them in a normal ambient condition for 96 hours.
- ※ Judgement : Should be no isse for operation
Print should not be erased after test

4-1-15 Liquid Spill

- The Remote MUST function as specified after having eight ounces of a common non-sugared beverage poured over the keypad, shaken off, then given 48 Hours to dray.
- ※ Judgement : Should be no isse for operation

4-1-16 Bluetooth distance test.

- Measure RSSI value based on a master sample.
 - Test an object at an angle of 45 degrees between STB and RCU.
- Distance specification is 25m in Bluetooth Communication Standard.
 - Actual distance is more than 25m. Check 10 times key press. No fail on each key performance.
- ※ Judgement : Should meet specification

9. User Manual

[HUMAX] DLIVE OTT BOX RCU 동작 시나리오

1. PAIRING 시나리오

1.1. 페어링 시도

- 리모컨이 UnPaired 된 상태에서 [OK]키와 [HOME]키를 동시에 5초간 누르면 Pairing IR Trigger 3 Frame을 송출하고 Pairing을 시도한다.
- 최대 30초 동안 Un-Direct Advertising을 시도하며 약 330ms마다 Green LED가 Blink 한다.

1.2. 페어링 성공

- 리모컨과 STB이 Pairing 에 성공했을 경우 리모컨은 Green LED를 약 150ms간격으로 빠르게 3번 Blink하고 Pairing 프로세스가 종료된다.
- Pairing 성공여부 시점 판단은 모든 Client Characteristic Configuration을 받은 이후에 판단한다.

1.3. 페어링 실패

- Pairing 실패 시 리모컨은 LED Blink를 멈추고 이전 상태로 복귀한다.

2. UNPAIRING 시나리오

- 리모컨의 [OK]키와 [BACK]키를 동시에 5초간 누르면 UnPairing을 수행한다.
- 리모컨은 Pairing 정보를 삭제하고 Green LED를 약 250ms간격으로 3번 Blink 후 UnPairing을 종료한다.
- UnPairing 수행시 STB와의 동기를 맞추기위해 Unpair Code를 전송한다.
- 리모컨은 STB과의 Connection 상태에 관계없이 언제든지 자체적으로 UnPairing 할 수 있다.

3. Key 동작 시나리오

3.1. 기본 키 동작

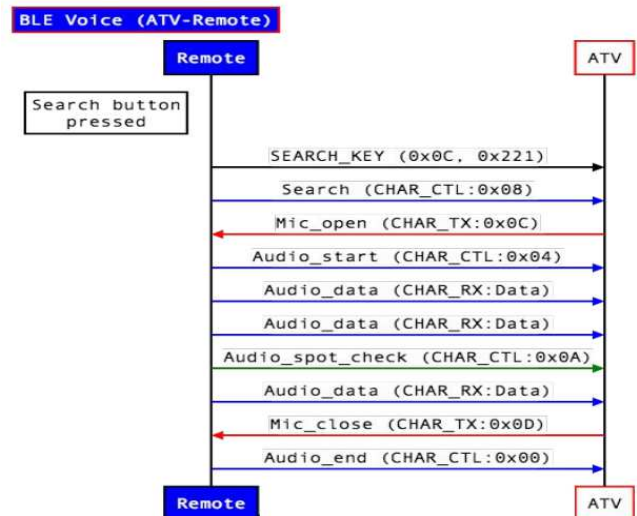
- 리모컨의 키가 눌릴 때 리모컨은 Connection상태에 따라 IR 또는 RF로 동작하며 LED가 ON된다. (Pairing 시도 중 키입력에 대한 LED Action은 없음)
- 동시에 두 키 이상의 키가 눌렸을 경우에 IR송출은 중지된다.
- 동시에 두 키 이상의 키가 눌렸을 경우에 Release 코드가 전송된다. (RF로 동작했을 경우)
- 두 개의 키가 눌러진 상태에서 한 키를 놓으면, 누른상태의 남은 키의 Data가 송출된다.
- 리모컨의 키가 약 1분 이상 눌렸을 경우 리모컨의 전원소모를 최소화하기 위해 코드 송출이 중지된다.

3.2. BT 상태에 따른 키 동작

- Connected 상태일 때 TV키를 제외한 모든 키는 RF로 동작한다. (TV키 : TV power, Source, Vol+/-, Mute)
- Disconnected 상태 일 때, Any키 입력시 Re-Connect 하기 위해 10초간 Direct Advertising을 수행한다.

4. 음성 검색 동작 시나리오

- [Goole Assistant] 버튼을 누르면 리모컨은 음성검색 기능 활성화를 위한 Code를 STB으로 전송한다.
- 리모컨은 STB로부터 Mic Open Command를 수신하면 Green LED가 ON되고 음성 패킷 전송을 시작한다.
- 리모컨은 STB 로부터 Mic Close Command가 수신되면 음성 패킷 전송이 종료되고 LED가 Off된다.
- 만약 STB이 Mic Close Command를 보내주지 않더라도 리모컨은 약 30초 TimeOut 이후 자체적으로 음성패킷 전송을 종료한다.



5. Battery 시나리오

- STB은 배터리 정보가 필요할 때 리모컨으로부터 배터리 값을 Read 할 수 있다.
- Battery 정보 : Battery level(2.0V~3.0V)의 Percentage[%] (0x00~0x64)
ex) 배터리 표

V	%
3.1	100%
3.0	100%
2.85	85%
2.64	64%
2.35	35%
2.0	0%
1.95	0%

6. Bluetooth Connection 시나리오

- Connection 완료 후 리모컨과 STB이 어떤 이유로 인해 Disconnect된 경우 리모컨은 Re-Connection (Direct Advertising)을 시도한다.
- Re-Connection (Direct Advertising) 시도는 약 11초간 수행한다.
- Re-Connection (Direct Advertising) 을 실패했을 경우 리모컨은 배터리 소모를 줄이기 위해 Sleep 모드로 진입한다.
- 이후 사용자에게 의해 키 입력이 있을 경우에 리모컨은 다시 약 11초 동안 Re-Connection (Direct Advertising)을 시도한다.
- 리모컨이 Re-Connection 을 하는 약 11초동안 수행하는 Direct Advertising은 아래와 같이 두단계 구분되어진다
 - 1 step : 총 1초간 약 1.6ms 마다 Direct Advertising 을 수행 (Fast)
 - 2 step : 총 10초간 약 20ms 마다 Direct Advertising 을 수행 (Slow)

7. TV 설정

7.1. Auto-Search 방법

- 7.1.1. [TV Power] key와 [OK] key를 약 5초간 누름 ---- Red LED On (set mode 진입)
- 7.1.2. [Navi UP] 또는 [Navi Down] key를 누름 ---- TV power code 출력 및 Red LED 1회 Blink 후 LED On 상태 유지.
- 7.1.3. [OK] key 입력 ---- 완료(Red LED 3회 Blink 후 꺼짐)
- TV setting mode에서 20초간 다른 입력이 없으면 LED Off 되면서 Set mode 해제됨.
- 관계없는 키 입력시 무시한다.

7.2. TV 설정 초기화

- 7.2.1. [TV Power] key와 [BACK] key를 약 5초간 누름

8. Code Read Out

- 현재 리모컨에 설정된 TV의 설정번호를 LED 로 Display 한다.
- [TV Power] key와 [OK] key를 약 5초간 누름 ---- Red LED On (set mode 진입)
- [DLIVE] key 누름
- Red LED에서 현재 설정 된 번호 100자리, 10자리, 1자리 차례로 Blink 함.
- "0"이면 0.1초 간격으로 5회 Blink 하고 "1 ~ 9"는 0.3초 간격으로 Blink 횟수로 한다.

예) 023번이 설정되어 있을 경우 LED동작
 예) step 1 : 빠르게 LED 5회 Blink
 step 2 : LED 2회 Blink
 step 3 : LED 3회 Blink

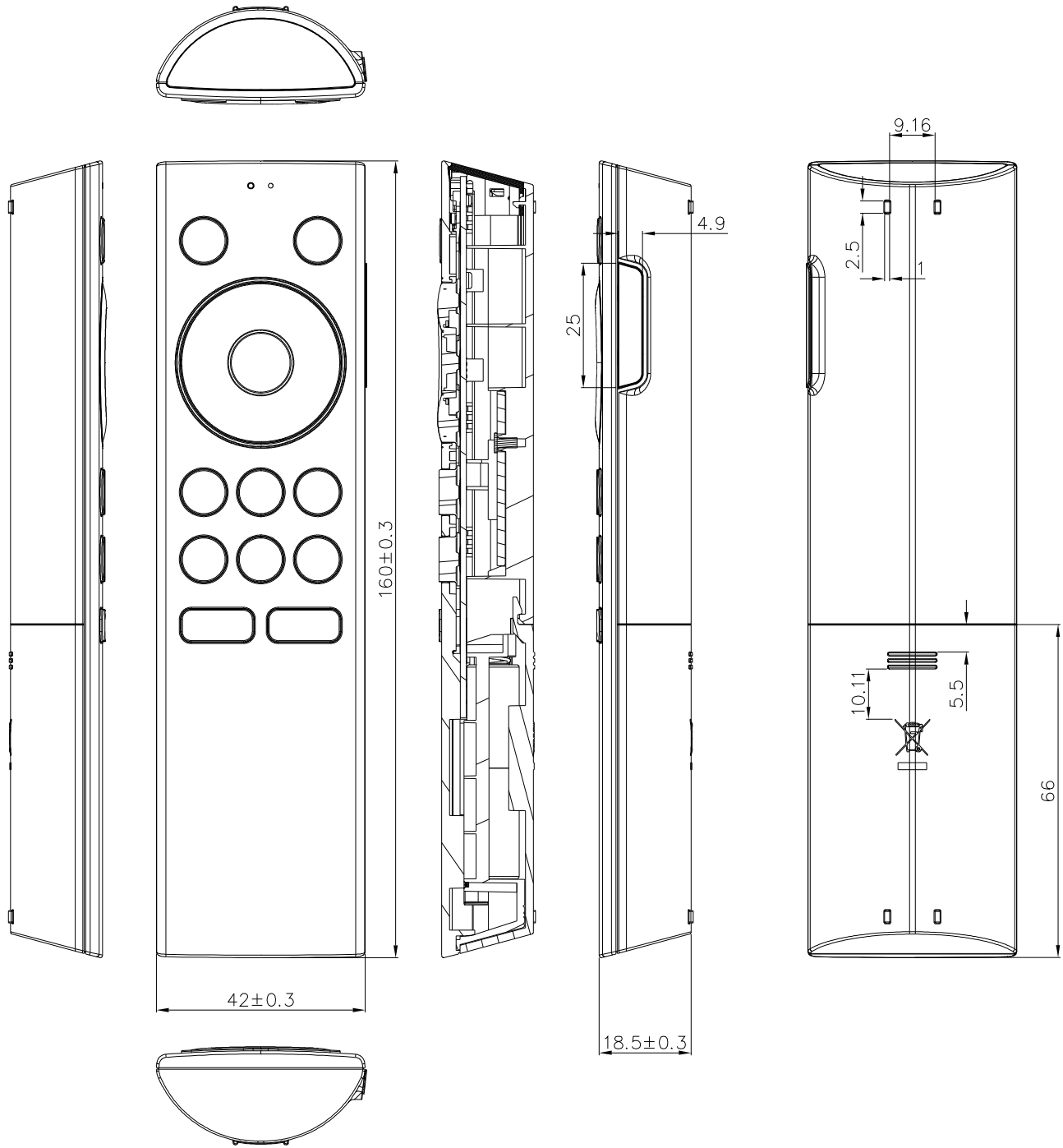
9. Couch Function

- 임의의 키가 연속으로 눌러지고 있을 때 배터리 소모를 줄이기 위해 1분이 경과되면 리모컨의 출력을 멈춘다.
- Connected 상태일 때, 키 입력시 RF 로 송출되며 1분 후 Release 코드를 송출한다.
- UnPaired 상태거나 또는 Disconnected 상태일 때, 키 입력시 IR로 송출되며 1분 후 IR 송출이 중지된다.

10. Factory Default

- [STB Power] key와 [BACK] key를 동시에 약 5초간 누름
- 약 5초 후 Indicate ALL LED가 3회 Blink 하면서 초기화 상태로 됨.
- TV Default 는 삼성, LG Batch Code로 출력됨.

11. Assembly Diagram (UNIT : mm)



FCC Caution

§ 15.19 Labelling 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.

§ 15.21 Information to user.

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

§ 15.105 Information to the user.

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 terference 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.

*** RF warning for Portable device:**

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

MAKER : REMOTE SOLUTION HK

CHECK				APPROVAL
회로 개발	기구 팀	소프트팀	디자인팀	연구소장
김락환 책임 리성평 연구원	민경진 책임 김정호 연구원	김동학 전임	홍현 선임	김재원 이사
2018.07.24	2018.07.24	2018.07.24	2018.07.24	2018.07.24

DATE : 2018. 07.24