MoveaTV™ BLE REMOTE USER GUIDE

INTRODUCTION

MoveaTV remote user guide is a reference document for developers for evaluating the use of our motion technology for interactive TV applications, and investigating the integration of motion into product designs.

This document also explains remote behavior.

REMOTE FUNCTIONALITIES

MoveaTV remote Reference Kit has been designed to show extended capabilities of motion technology.

Including:

- **Embedded or hosted accurate in-air pointing**
- **Embedded or hosted accurate in-air gaming**
- **Embedded or advanced hosted gesture recognition**
- **Static configuration depending on available sensors**
- **Real-time Gyroscope bias calibration**
- **Dynamic activation of roll compensation**
- **Dynamic activation of flip detection feature**
- **Dynamic configuration of gaming parameters**
-

Motion activation / Pairing (double click)

Mode change

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FEATURES

POINTING

MoveaTV remote reference kit computes dx/dy mouse data, thanks to the Air Motion Library (embedded) or by sending raw data to the SmartMotion Server (hosted). It provides pixel-level accuracy, smooth displacement, and tremor cancelation for best-in-class performance and ease of use.

The pointing computation can be performed from 2-axis Gyro, 2-axis Gyro + 3-axis Acc, or 3-axis Gyro + 3-axis Acc sensors data fusion.

The raw sensor feature is compatible with any sensors combination, up to 9-axis sensors (3-axis Gyro, Acc and Mag) data fusion.

Note: You can enable 'AirMotionLib' with **Green + 7** key sequences (see 6 for more information.)

GAMING

MoveaTV BLE remote reference kit computes x/y joystick position, thanks to the Air Gaming Library (embedded) or by sending raw data to the SmartMotion Server (hosted). It provides high-accuracy, high reactivity and smooth movement for best-in-class performance and ease of use.

The gaming can be performed with 3-axis Acc + Gyro sensors data fusion.

Note: You can enable 'AirGamingLib' with Green + 8 key sequences (see 6 for more information).

ROLL COMPENSATION

MoveaTV BLE remote reference kit implements the roll compensation feature, allowing the user's movement to be reproduced on the screen, independently from the device roll rotation.

For a semi-dynamic roll-compensation, 3-axis Acc + 2-axis Gyro are necessary. For a full-dynamic roll-compensation, 3-axis Acc + 3-axis Gyro are necessary.

The computation is either made by the Air Motion Library (embedded) or by sending raw data to the SmartMotion Server (hosted).

Note: You can switch on or off the roll compensation feature with Green + 2 key sequence (see 6 for more information).

EASYCLICK

This feature allows user to perform more accurate and stable mouse clicks for a better experience.

On click press or release, the algorithm will freeze the pointer (i.e. force dX and dY values to zero) for a pre-defined amount of time to remove undesired movement (button pressing side-effect).

To avoid freezing pointer when not needed (e.g. while performing drag n' drop operations), device movement quantity is monitored: if it moves enough after a click, pointer will be released before specified timeout.

Left Click

Right Click

CALIBRATION

MoveaTV BLE remote reference kit implements a calibration routine which computes gyroscope offsets values in real time.

If the device is considered static for a certain amount of time (4 seconds), new gyroscope offsets values are computed and a buzzer will ring to signal the remote is calibrated.

The user has 15 seconds to calibrate the remote and if time is up, he hears 3 short beeps. Time is reset if the Green + 1 key sequence is performed.

Note: The new offsets will be saved into the EEPROM only if the Green + 1 key sequence is performed (see 6 for more information) and successful calibration.

GESTURE RECOGNITION

Gesture recognition is processed by the Air Motion Library (swipes), or by the SmartMotion Server (advanced gesture recognition).

Gesture Trigger (press, move then release).

FLIP DETECTION

The flip detection algorithm is used to detect a flip from a 3- axis accelerometer motion sensor. The library can detect if the device lays on its front side (buttons toward the sky) or back side.

When in pointing mode, if flip detection is enabled, and if remote lays on its back side, then remote stops sending mouse data until remote is flipped back.

When in raw sensor mode, if flip detection is enabled, and if remote lays on its back side, then remote sends special code inside frame “key press” field to indicate remote state, but it keeps on sending data unlike pointing mode. This is up to host application to interpret “key press” field and discard the frame or not whenever remote is flipped.

Note: The library can be turned on or off dynamically by pressing the Green + 5 key sequence (see 6 for more information).

IAR PROJECTS DESCRIPTION

DATABASE

All IAR projects are in “\RemoTI 2.0 BLE” directory. The projects are divided in several parts:

Components
Common for all projects, content HAL, OSAL and lib BLE.

Projects\ble\HIDAdvRemote

BLE Remote firmware with pointing, keyboard.

Binaries location:

“Projects\ble\HIDAdvRemote\CC2541\<PROJECT NAME>\Exe” Project name description:

CC2541_* : hardware target (used by remote TI)

- _LIB_POINTING_V03 : with libPointing for 3A3G
- _LIB_POINTING_V03_AGL_V02 : with libPointing (AML) and libGaming (AGL) for 3A3G
- _LIB_POINTING_9AXIS_V03_AGL_V02 : with libPointing and libGaming for 3A3G based on 3A3G3M device (MPU9150)

Projects\ble\ HIDAdvRemoteDongle

ZID dongle firmware

Project name description:

CC2540 : dongle firmware

IAR #DEFINE

POWER_SAVING: Accept µC low power mode

REMOTE_TI: use remote TI key matrix

USE_POINTING_LIB: use air motion lib

USE_POINTING_SENSOR: use raw sensor

USE_GAMING_AGL: use air gaming lib

USE_IMU3000: use IMU3000 gyroscope (I2C only)

USE_KXTF9: use KXTF9 accelerometer (I2C only)

USE_MPU9150: use MPU9150 accelerometer and gyroscope (I2C only)

USE_MAGNETO: use MPU9150 magnetometer for 3A3G3M (I2C only)

USE_FLIP_DETECTION: use flip detection

USE_TRIGGER_FOR_POINTING: use trigger for pointing only in the use case “Pointing Off”, gesture is disabled.

UPGRADE METHOD

WITH IAR

Dongle:

- Plug the probe
- Press Reset key on the probe. The LED should turn green.
- Load the firmware with IAR

Remote:

- Plug the probe
- Press Reset key on the probe. The LED should turn green.
- Load the firmware with IAR

HEX FILE WITH SMARTRF FLASH PROGRAMMER

Remote / Dongle:

- Start SmartRF Flash Programmer (TI software)
- Plug the probe
- Select « Program CCxxxx SoC or MSP430 » (default option)
- In Flash image, select your hex file
- Perform actions

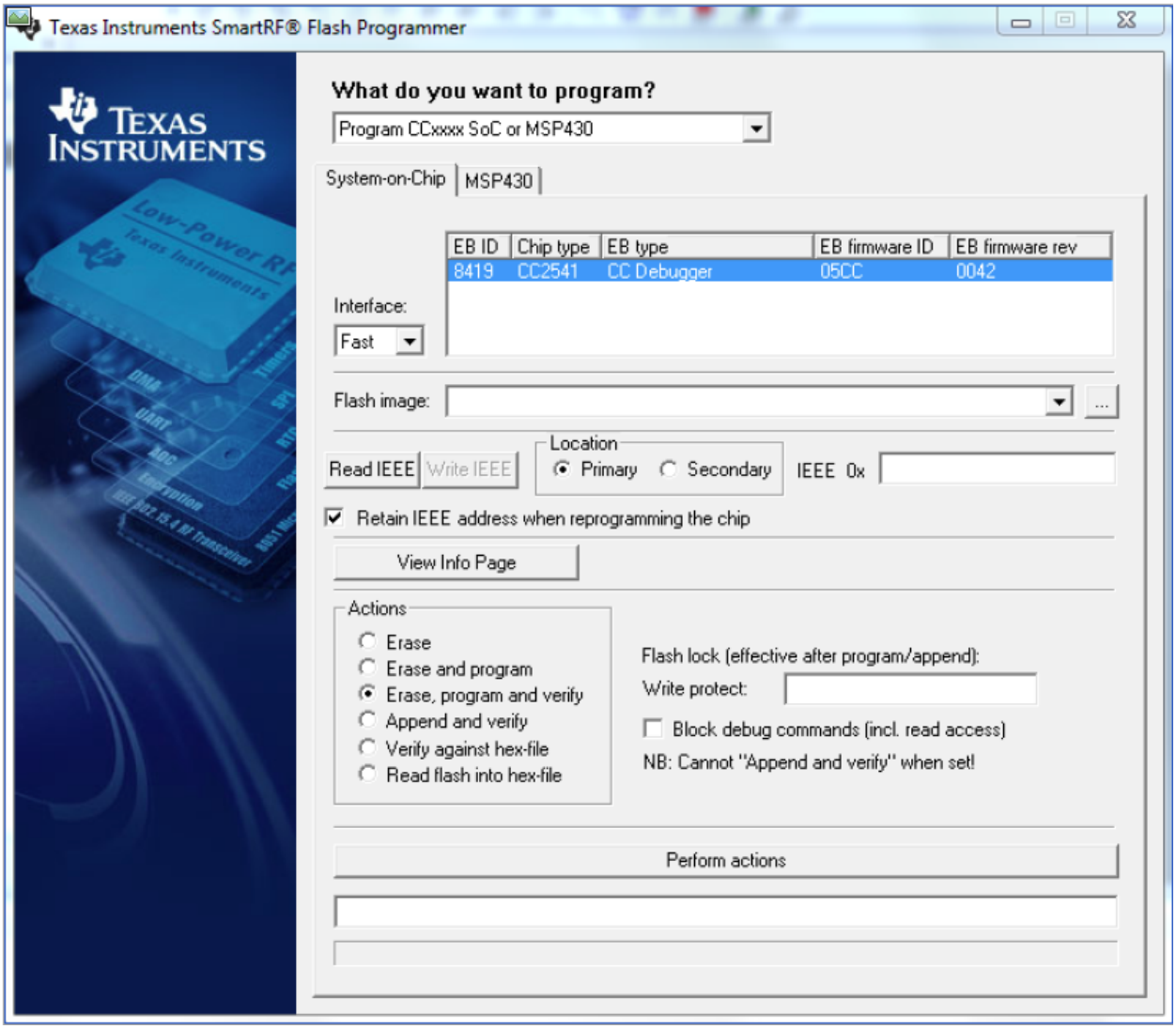


Figure 1: SmartRF Flash Programmer Window

SPECIAL KEY SEQUENCE

Green + 1: Sensor calibration (libPointing), stored in Flash.

Green + 2: Enable/disable Roll-Compensation (libPointing). Default is 'Enabled'.

Green + 3: Change from AirMotionLib to AirGamingLib to RAW sensor (choice saved in Flash).

Green + 4: Enable AirMotionLib extra info frame (see 10.3), disable pointing.

Green + 5: Enable/disable FlipDetectionLib. Default is 'Disabled'.

Green + 6: Switch AirGamingLib joystick max angle between +/- 45° and 90°. Default is '45°'.

Green + 7: Enable AirMotionLib mode (choice saved in Flash).

Green + 8: Enable AirGamingLib mode (choice saved in Flash).

Green + 9: Enable RAW data mode (choice saved in Flash).

Green + Forward + Backward + Yellow: Reset Default Setting (calibration offsets, roll compensation, flip detection, angle AGL)

Rec + Back + Menu + Stop: The time of "Sleep Mode" increase of 5 minutes after this sequence performed. Time possibility : 5/10 minutes

Stop + Menu + Back + Rec: Reset the time of "Sleep Mode". Default is 15 seconds

POINTING TEST

LOAD FIRMWARE

See chapter 5 for details.

PAIR REMOTE

Press left button dongle, green LED start blinking

Press remote trigger button (double-click). If dongle green LED stop blinking and red LED turn on, the remote is paired.

Figure 2: Dongle

Figure 3: Trigger button to pair

BUTTON PRESS TEST

Click “Start->configuration Panel->sound and audio device”

Press remote mute button and check on screen if mute is check

Figure 4: Window sound

CALIBRATE REMOTE

Double click on Movea button to enable the pointing or data transfer.
Put the remote flat on a table. The remote should be still to update the gyroscope offsets.
The calibration should not take more than 5 seconds. You can press Green + 1 to save the offsets.

Figure 5: Remote Movea Button

POINTING TEST

Double click on Movea button to enable pointing and Green + 7 if necessary to enable Mouse mode.
Make square with your mouse pointer. Check if a horizontal displacement corresponds to dX pointer movement and if a vertical displacement corresponds to dY pointer movement.

Figure 6: Pointing test

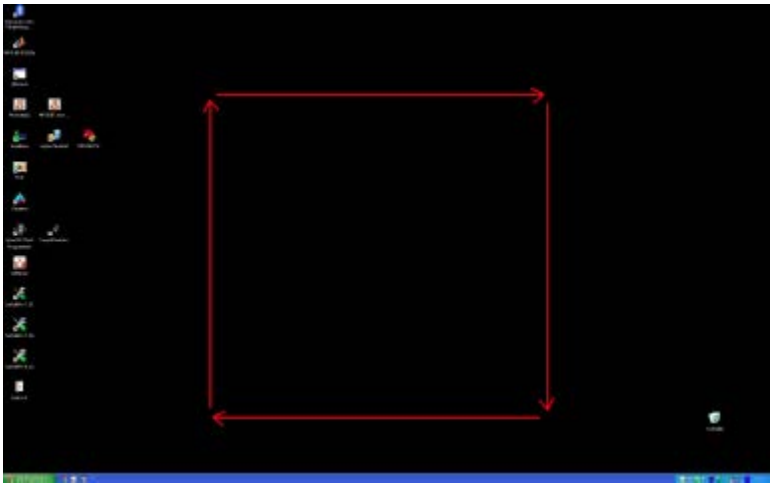


Figure 7: Pointing movement

When performing a square, the cursor should go back to its initial position.

ROLL COMPENSATION TEST

Tilt the remote to be 90 ° axis. And repeat the last step.

Press Green + 2 to enable/disable roll compensation. Default is ‘Enabled’.

Figure 8: Pointing with roll compensation

SWIPES TEST

Swipes gestures are dedicated to web browser. Open Windows Xhrome web browser for example.

Figure 9: Remote Button swipe

To perform a swipe: Press the Movea button, move the remote to describe one of the following gestures, and then release the Movea button. (You can test them in a web browser for example)

Gesture	Action
Left	Previous page
Right	Next page
Up	Page up
Down	Page down
Roll clockwise	Zoom +
Roll counter clockwise	Zoom -

GAMING TEST

LOAD FIRMWARE

See chapter 5 for details.

PAIR REMOTE

Press left button dongle, green LED start blinking.

Press remote trigger button (double-click). If dongle green LED stop blinking and red LED turn on, the remote is paired.

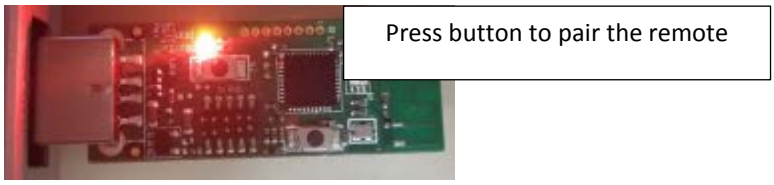


Figure 13: Dongle

Figure 14: Trigger button to pair

GAME CONTROLLER TEST

Double click on Movea button to enable gaming, and Green + 8 if necessary to enable Joystick mode.
Run Game Controller/Properties/Test Windows application.

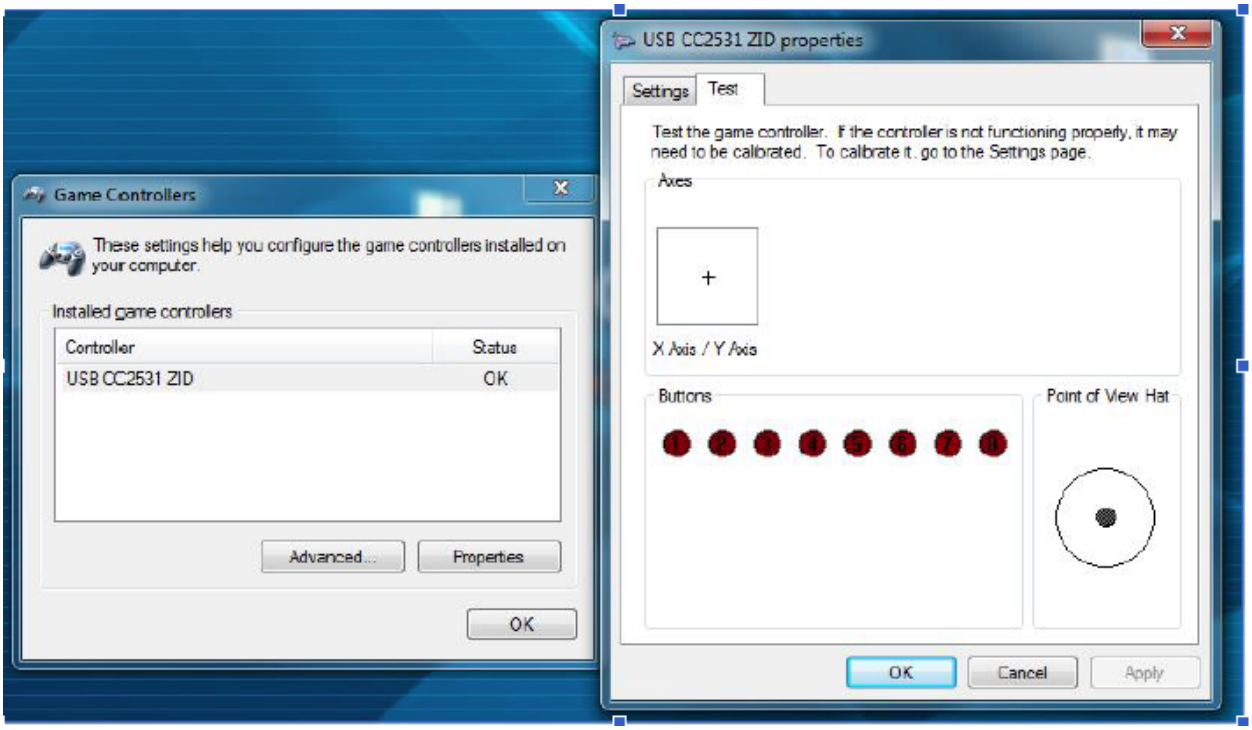


Figure 10: Gaming test

Take and roll remote like a joystick to check X and Y axis gamepad behavior.

Figure 11: How to hold gamepad

Press Green + 6 to switch maximum angle detected for joystick between 45 and 90°. Default is 45°.

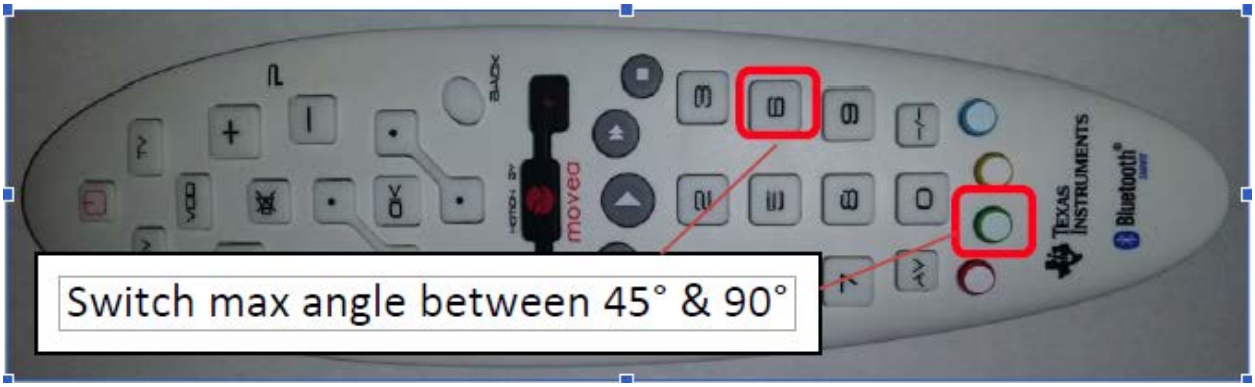


Figure 12: Switch joystick max angle

Repeat rolling operation to check the different sensitivities.

MOVEATV REMOTE TOOL

MoveaTV Remote Tool is a diagnosis tool which is able to monitor raw data sent by the remote.

Open **MoveaTV Remote Tool v07**.

Click on “Connect remote”

Notes:

- This tool only works with raw data. Please switch to raw data mode with **Green + 9** key sequence if required.

- You can monitor the trigger state.

The Flip state is monitored only if the flip detection library is enabled (**Green + 5** key sequence).

- MoveaTV Remote Tool detect if you use 6 Axis or 9 Axis remote.

Figure 13: MoveaTV Remote Tool

ANNEXES

Note: Information in this section is for reference only. Figures may be out of date or inaccurate.

CODE SIZE

CC2541			
_LIB_POINTING_V03	2.1.1	Flash	RAM
		153 739	6 719
_LIB_POINTING_V03_AGL_V02	2.1.1	Flash	RAM
		165 871	6 969
_LIB_POINTING_9AXIS_V03_AGL_V02	2.1.1	Flash	RAM
		166 655	6 999
CC2540			
ZID Dongle		Flash	RAM
		128 296	7 316

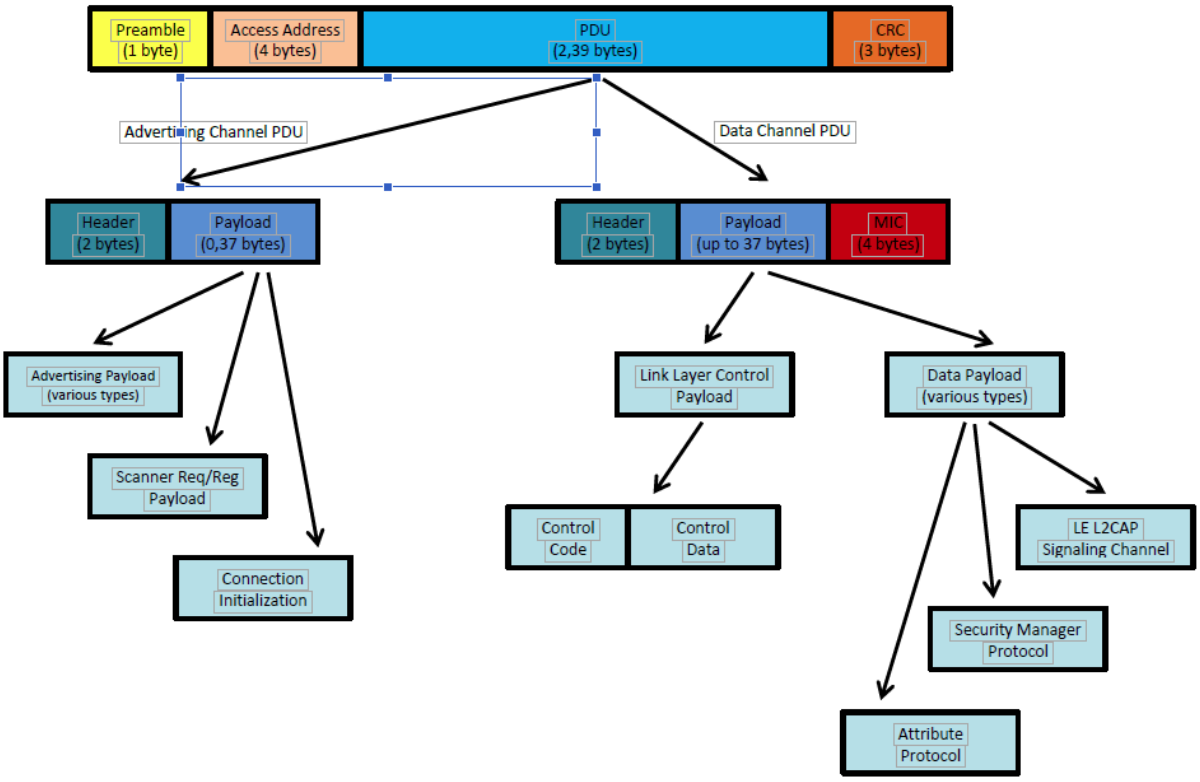
*in Bytes

TOOLS USED

- IAR version 8.30
- SmartRF Flash Programmer
- Ble Device Monitor (.exe)

FRAMES FORMAT

BLE frame format:



Basic BLE over the air packets include a 1 byte preamble, 4 byte access codes correlated with the RF channel number used, a PDU that can be between 2 to 39 bytes and 3 bytes of CRC. Hence the shortest packet would have 80 bits transmitted within 80usec., and the longest packet of 376 bits will be transmitted within less than 0.3 millisecond.

Source: http://www.eetimes.com/document.asp?doc_id=1278927

Payload frame format for raw sensor 6 axis (Movea specific):

0	1	2	3	4	5	6	7	8	9	10	11	12	13
Frame counter	Ax LSB	Ax MSB	Ay LSB	Ay MSB	Az LSB	Az MSB	Gx LSB	Gx MSB	Gy LSB	Gy MSB	Gz LSB	Gz MSB	Key Press

Payload frame format for raw sensor 9 axis (Movea specific):

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Frame counter	Ax LSB	Ax MSB	Ay LSB	Ay MSB	Az LSB	Az MSB	Gx LSB	Gx MSB	Gy LSB	Gy MSB	Gz LSB	Gz MSB	Mx LSB	Mx MSB	My LSB	My MSB	Mz LSB	Mz MSB	Key Press

Payload frame format for air motion lib extra info (Movea specific)

0	1	2	3-4	5-6	7-8	9	10-12	13
Frame counter	dX	dY	AML version	Algo Duration in µs	µC Sleep Duration in µs	Air Motion Status	Remote FW reference kit version	Key Press

Payload frame format for air gaming lib extra info (Movea specific)

0	1	2	3-4	5-6	7-8	9	10-12	13
Frame counter	x	y	AGL version	Algo Duration in µs	µC Sleep Duration in µs	Air Gaming Status	Remote FW reference kit version	Key Press

USB CONFIGURATION

Dongle is configured as an USB2.0 device of HID class.

There are 5 interfaces supported :

- **Endpoint0** used for control transfer. The size of the packet in Endpoint 0 is 32 bytes.

- **Endpoint1** used for generic **keyboard** configured as IN interrupt with keyboard protocol.

- **Endpoint2** used for **consumer electronics** control configured as IN interrupt.

- **Endpoint3** used for **raw** sensor data transfer configured as IN interrupt. The size of the packet is:

  - either 15 bytes for 6-axis sensor as defined in Payload frame format for raw sensor 6 axis and can be identified with report ID 0x1
  - or 21 bytes for 9-axis sensor as defined in Payload frame format for raw sensor 9 axis and can be identified with report ID 0x2
  - or 15 bytes for air motion lib extra information as defined in Payload frame format for air motion lib extra info, which is activated through **Green + 4** and can be identified with report ID 0x1

    - **Endpoint4** used for **mouse** configured as IN interrupt with mouse protocol.
    - **Endpoint5** used for **joystick** configured as IN interrupt with gamepad control including hat switch and 7 buttons.

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