IoT Transmitter

(ARX.IUMS435)   – For FCC Approval

User Manual

Revision 1.5   19/09/25

FCC ID : 2AULC-ARX-IUMS435

CONFIDENTIAL

Aerix co.,Ltd.

1 Basic explains

1.1 Generals

This Document is written for provide general information and test set-up process or conditions describe to the end user of Aerix IUMS Smart IoT wireless data transmitter.

(Please contact response person for this product, if any difficult of setting or special conditions, non-described details in case any.)

[LoRa IUMS sensor network diagram - Example]
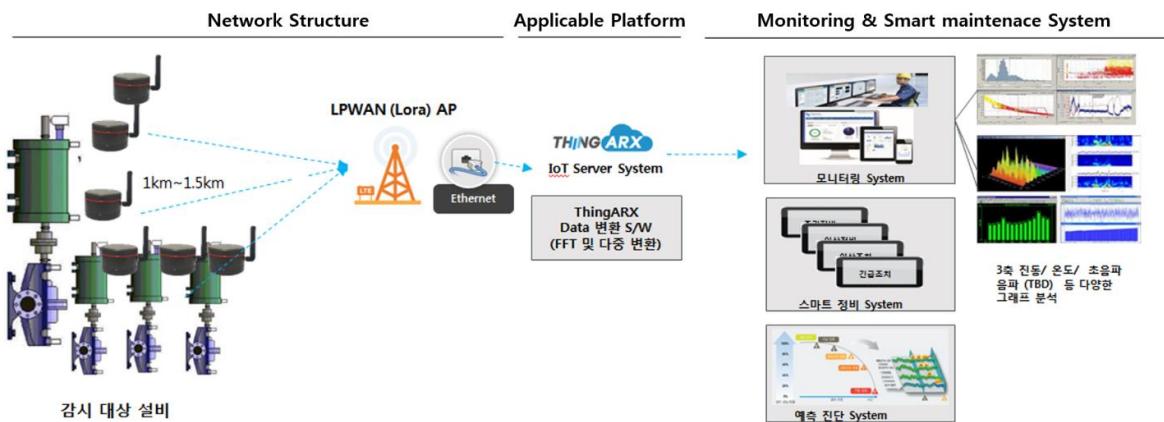
Sensing Data
- Three axis vibration
- Contact Temperature
- Ultrasonic waves, Sound wave

Smart Maintenance System
- Analysis Graphic: Visual Smart maintenance
- Analysis Big-data: realize the cause of unusual vibration
- Person in charge: assign the person in charge and notice the issue
- Accumulate the action: Inspection and action data

Monitoring Analysis
- Monitoring the vibration/temperature/Ultrasonic wave through the Big-data graph
- Three axis time analysis / FFT analysis (2nd upgrade) / ORBIT analysis (2nd upgrade)
- Integrated monitoring: overall monitoring by area/group/region
- Alert alarm system by analysis

Applicable
- Monitoring Condition
- A bearing condition
- Gear condition when acceleration & deceleration
- A bearing lubricant condition (Ultrasonic waves, Sound waves)

1.2 Type of Name

This IoT Data transmit Sensor has some of different type by sensor specifications.

Each Data Transmit Sensors are listed as below table with type of name by categorized operation purpose.

Type of Name	Device Lora Circle type

Vibration / Accelerometer	ARX.IUMS435

1.3 Description of Operation
Mechanical general

This sensor has same circular type of Aliminum metarialic case for main part Which its contain transmitter and power part. (SMA External Antenna Connector, Sensor connector part) For combination for sensors operation an external connector for sensors interface

All sensors use sampe PCBA and can support different functionality by change sensors.

Vibration Sensor designed for detection and gathering data kind of baring mounting block of ID_Fan motror vibration by MPU-6050 MEMS accelerometer made by invensense

As below are description for function and outlines of each group

1.4 Construction or Product

IUMS Systems work with IUMS Sensor device and LoRa AP(Access point), Supervising Server.

1.4.2 ARX.IUMS435 (Device)

Size : 94 x 73 mm(Except Antenna)

Operation Voltage:

- 3.6V DC , C type Li-Socl2 Battery 17A (8,500mA x2)
- 1% accuracy, 3.3V Regulated DC power supplied.
- Sleep current : up to 130 uA
- Low Battery Alert

Sensor Function :

- Fully Calibrated
- Digital output – I2C Interface

- Ultra Low Power Consumption

- Long Term Stability & Durability

Communication Type:

- LPWAN – Lora 917.3 ~ 923.3MHz

- Link budget (up to 145dBm)

- TX Power up to 10dBm

- Transmit sensing data by user configurable period.

- Support LBT

**Enclose Grade:** IP-67 Support

1.5 General specification by Sensors

1.5.1 Vibration Sensor IUMS435

1. Operation General

- Size : 94 x 73 mm, AL Die-casting

- Connection Items: 1 Antenna, SMA Flexible 90° Angle 920MHz 1.5dBi

- Digital MEMS Accelerate meter, 6 Axis – External Probe

- full-scale range of ±2g, ±4g, ±8g, ±16g accuracy

- Mounting Bracket : SUS SS304 & Magnetic

2. Sensor Details

- MEMS Sensor supply by InvenSense USA

- Digital-output triple-axis accelerometer with a programmable full scale range ±4g.

- Integrated 16-bit ADCs enable simultaneous sampling of accelerometers while requiring no external multiplexer

- Accelerometer normal operating current: 500μA

- Low power accelerometer mode current: 10μA at 1.25Hz, 20μA at 5Hz, 60μA at 20Hz, 110μA at 40Hz

- Orientation detection and signaling

  - Tap detection

  - User-programmable interrupts

  - High-G interrupt

  - User self-test

2. ARX. IUMS Set up methord

  - **IUMS435**

Set Device Name
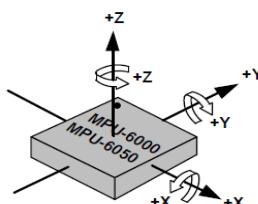
Set Tx duty cycle
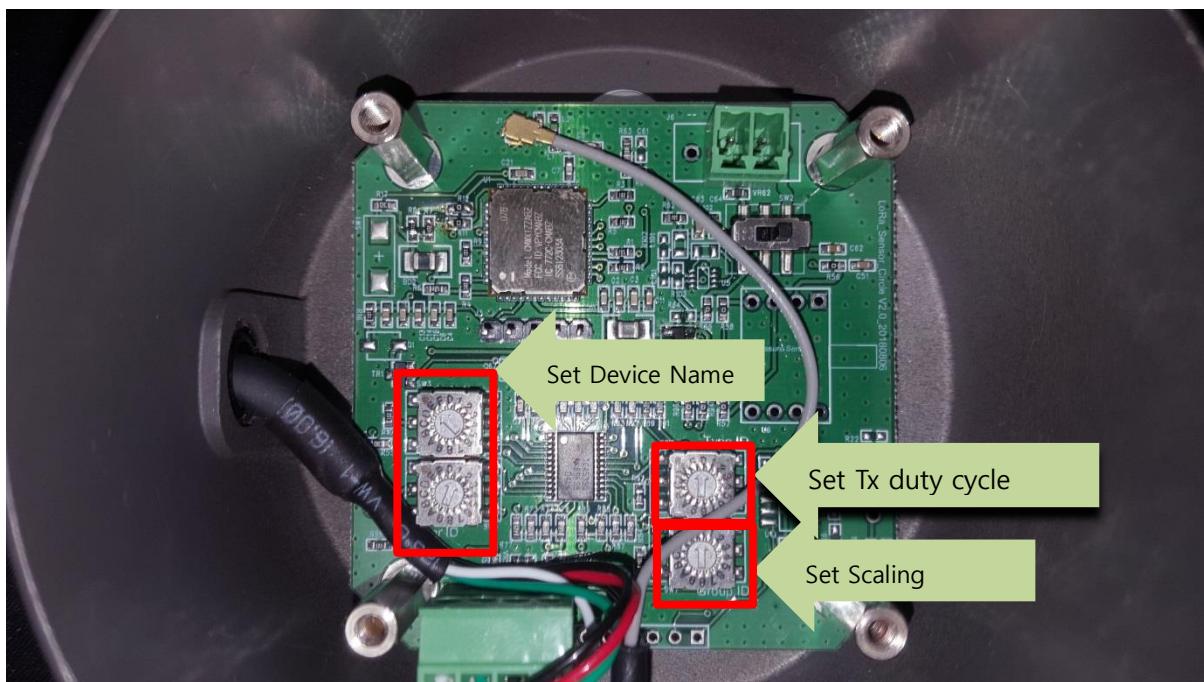
Set Scaling

- For distinguish the sensors are in same AP coverage.

(2) Set Tx Duty Cycle / Tx duty cycle
 - For setting data transmitting duration, can change to 5s, 10s, 60s, 5M, 10M.

(3) Set Scaling
  - Set Sensitivity of vibration to 2g, 4g, 8g, 16g,

3 Specification or Device

3.1 Communication Specification

3.1.1 LoRa module Block diagram
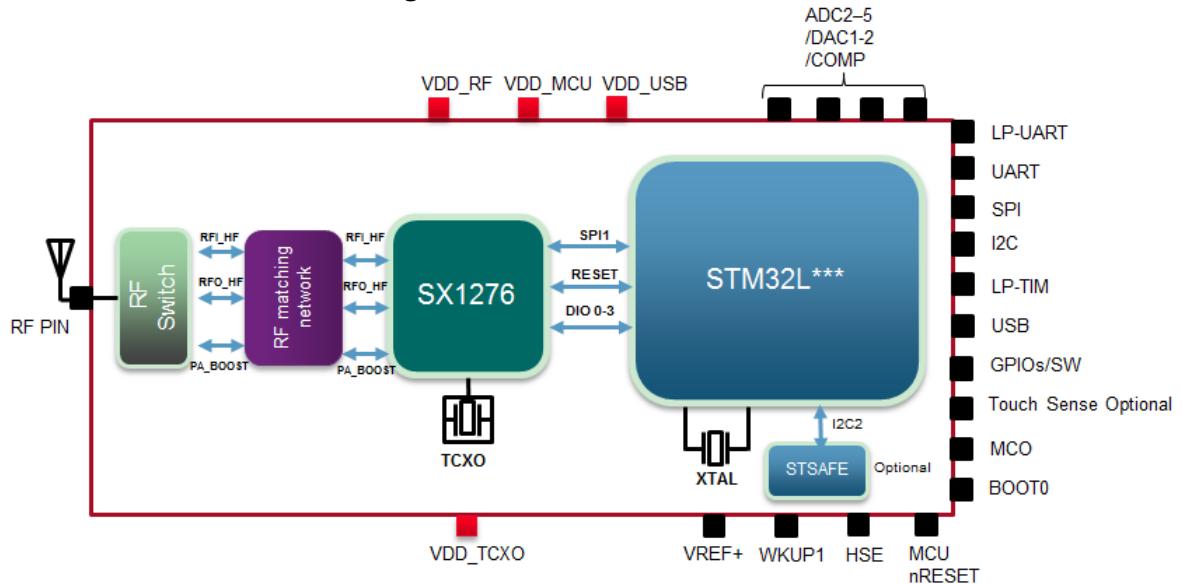
3.1.2 Features

- Interfaces : I2C, UART, USB, SPI

- Main ICs : STM32L, SX1276

- Reference Clocks : Integrated 32MHz clock

  (TCXO with frequency error=±2 ppm) and 32.768KHz clock (frequency error=±20 ppm)

- Supported Frequencies : 917.3 MHz ~ 923.3 MHz

- Module Size : 12.5 mm x 11.6 mm x 1.76 mm (Max)

- Weight : 0.48g (Typ)

- Package : Metal Shield can

- RoHS : This module is compliant with the RoHS directive

- Max. Average Conducted output power: 10 dBm (+/- 0.5 dB)

3.2 Absolute Maximum Ratings

- **Maximum Ratings**

Parameters		Min	Typ	Max	Unit
Storage Temperature		-40	25	+90	degC
Input RF Level		-	-	10	dBm
Supply Voltage	VDD_USB	-0.3	-	3.9	V
	VDD_MCU, VDD_RF, VDD_TCXO	-0.3	-	3.9	V
	VREF+	-0.3	-	V_{DD_MCU}+0.4	V

3.2 Operating Condition

➢ Recommended Operating Conditions

Parameters		Min	Typ	Max	Unit
Operating Temperature		-40	25	+85	degC
Supply Voltage	VDD_USB (USB peripheral used) [1]	3.0	-	3.6	V
	VDD_USB (USB peripheral not used) [1]	$V_{DD\_MCU\_min}$	V_{DD_MCU}	$V_{DD\_MCU\_max}$	V
	VDD_MCU,VDD_RF,VDD_TCXO	2.2 [3]	-	3.6	V
	VREF+ [2]	1.8	-	V_{DD_MCU}	V

3.4 Electrical Characteristics

➢ FSK/OOK Receiver Specification

Symbol	Description	Conditions	Min.	Typ	Max	Unit
RFS_F_HF	LnaBoost is turned on	FDA = 5 kHz, BR = 4.8 kb/s		-117.5		dBm
IDDR	Supply current in Receive mode	LnaBoost Off, band 1		22		mA
		LnaBoost On, band 1		23		mA

➢ FSK/OOK Transmitter Specification

Symbol	Description	Conditions		Min.	Typ	Max	Unit
RF_OP	RF output power in 50 ohms on RFO pin (High efficiency PA)	Programmable with steps	Max		14		dBm
			Min		-5		dBm
RF_OPH	RF output power in 50 ohms on PA_BOOST pin(Regulated PA)	Programmable with 1dB steps	Max		18.5		dBm
			Min		2		dBm
ΔRF_OPH_V	RF output power stability on PA_BOOST pin versus voltage supply.	VDD = 2.2 V to 3.6 V			+/-1		dB
ΔRF_T	RF output power stability versus temperature on PA_BOOST pin.	From T = -40 °C to +85 °C			+/-1.5		dB
IDDT	Supply current in Transmit	RFOP = +20 dBm, on			128		mA
	mode with impedance matching	PA_BOOST					
		RFOP = +17 dBm, on PA_BOOST			106		mA
		RFOP = +14 dBm, on RFO_HF pin			47		mA
		RFOP = + 7 dBm, on RFO_HF pin			34		mA

3.5 LoRa Transceiver Specification

➢ LoRa Receiver Specification

Symbol	Description	Conditions	Min.	Typ	Max	Unit
IDDR_L	Supply current in receiver LoRa mode, LnaBoost off	Band 1, BW = 125 kHz		21.5		mA
		Band 1, BW = 250 kHz		22.2		mA
		Band 1, BW = 500 kHz		23.6		mA
RFS_L125_HF	RF sensitivity, Long-Range Mode, highest LNA gain, LnaBoost for Band1, using split Rx/Tx path 125 kHz bandwidth	SF = 6		-117.5		dBm
		SF = 7		-122.5		dBm
		SF = 8		-125.5		dBm
		SF = 9		-128.5		dBm
		SF = 10		-131.0		dBm
		SF = 11		-133.5		dBm
		SF = 12		-135.5		dBm
RFS_L250_HF	RF sensitivity, Long-Range Mode, highest LNA gain, LnaBoost for Band1, using split Rx/Tx path 250 kHz bandwidth	SF = 6		-114.0		dBm
		SF = 7		-119.0		dBm
		SF = 8		-122.0		dBm
		SF = 9		-125.0		dBm
		SF = 10		-127.5		dBm
		SF = 11		-130.0		dBm
		SF = 12		-133.0		dBm

➢ LoRa Transmitter Specification

Symbol	Description	Conditions	Min.	Typ	Max	Unit
IDDT_L	Supply current in transmitter mode	RFOP setting = 14 dBm		47		mA
		RFOP setting = 10 dBm		36		mA
IDDT_H_L	Supply current in transmitter mode	Using PA_BOOST pin RFOP setting = 20 dBm		128		mA

3.6 Low Power mode current

➢ 3.3V, Temp: Room, TCXO_VDD (pin 48 of the module) is connected to PA12 (Pin1 of the module)

| Mode	Description	Min.	Typ	Max	Unit
Mode0	STM32L0 in Stop mode with RTC (Real Time Clock) [*1] SX1276 in Sleep mode		1.65		uA
Mode1	STM32L0 in Standby mode with RTC (Real Time Clock) [*2] SX1276 in Sleep mode		1.40		uA

4 Firmware download process

4.1 ST-LINK/V2 Link tool

Down load ST-Link/V2 Debugger software and driver form www.st.com.

Can get its by searching STSW-Link004 on the site.

4.2 Wire connection

4.2.1 Header 5Pin
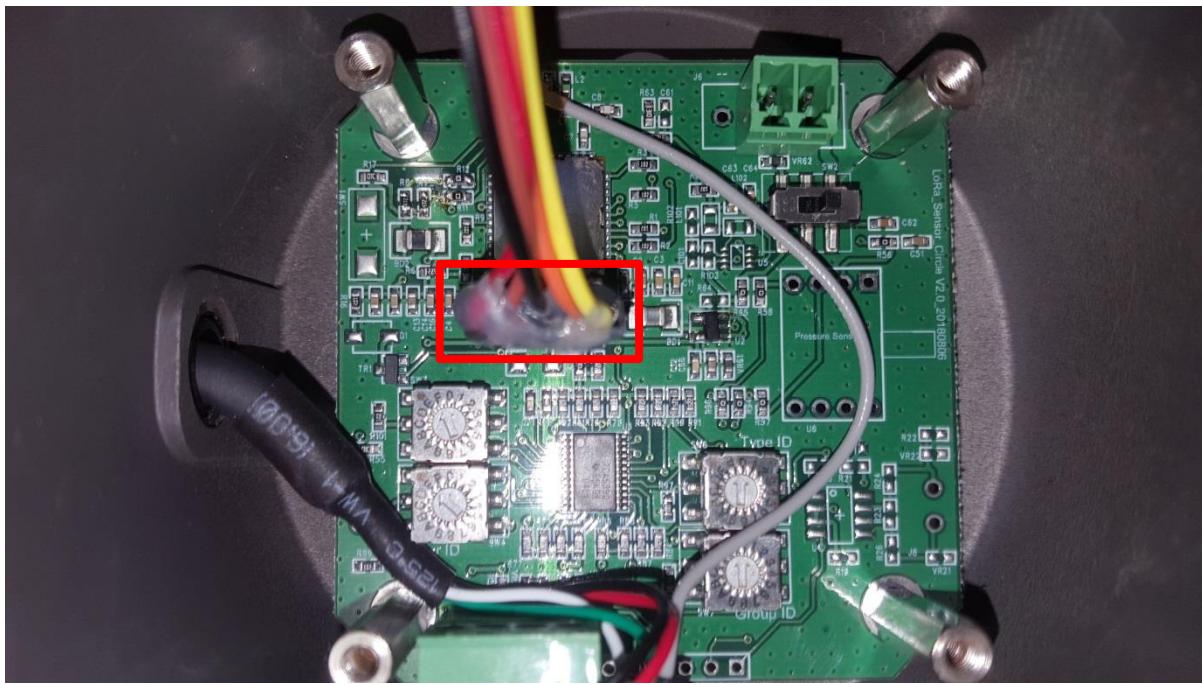
➢ Connection debugger ST-LINK/V2 to J3 of PCBA

4.2.2 STM32 ST-LINK Utility operating screen
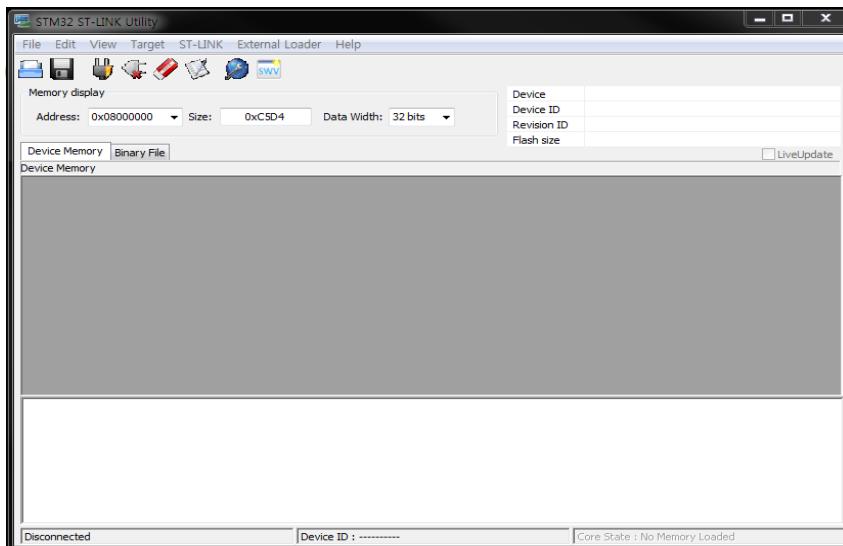
4.2.3 Connect to the target Connection Status
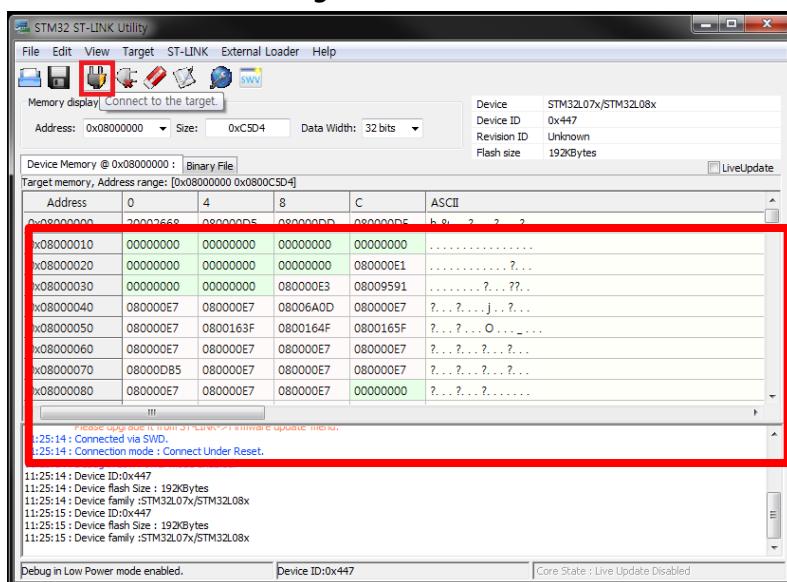

4.2.4 Open file Execution
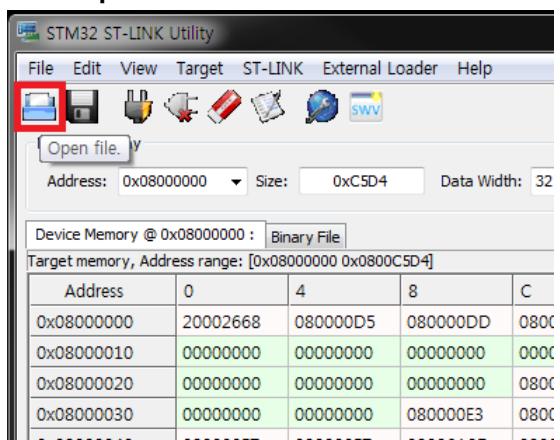
➢ Clock "Open File" Icon which it located upside of 000

4.2.5 Open screen of execution
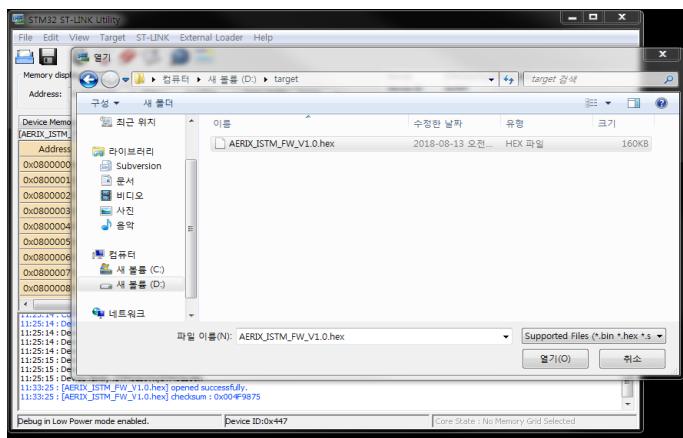
4.2.6 Program verify execution
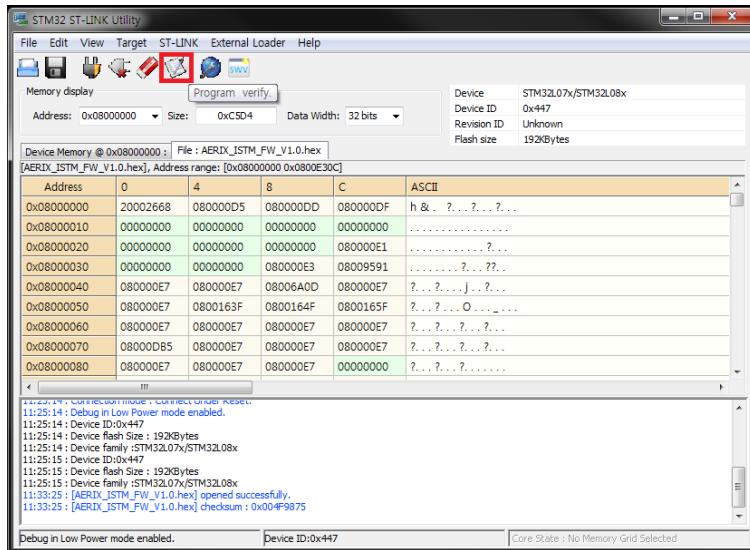
➢ Click "Program verify button

4.2.7 Download Screen when Executed
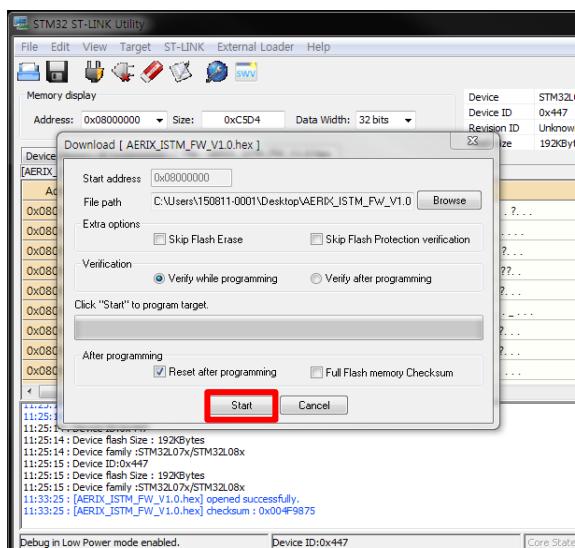
➢ **Click "Start" on the Download window**

4.2.8 Screen of Download Working
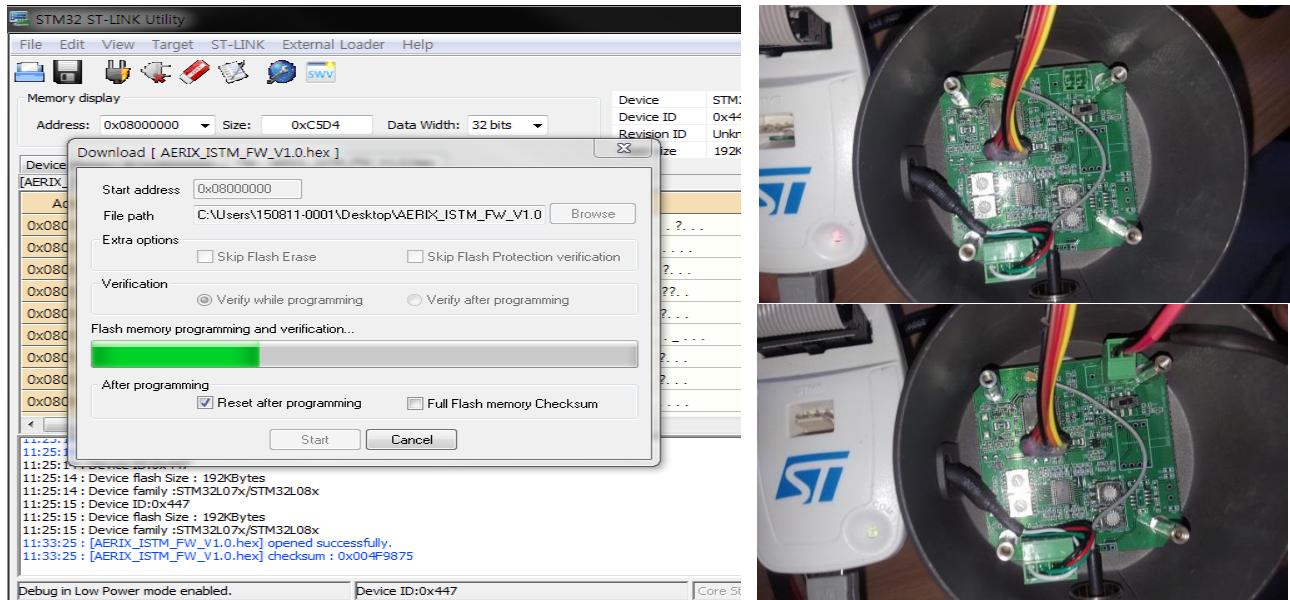
- ➢ Green bar gage indication the progress/
- ➢ Press Reset button on PCBA or power cycling after finished download process.
- .

- Notice -

1. 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

2. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

3. Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

4. The antenna(s) must be installed such that a minimum separation distance of at least 20 cm is maintained between the radiator (antenna) and all persons at all times.

5. Professional Installation
   This device and antenna can only be installed by professionally trained personnel. Antenna should be used the same type and lower gain antenna described below.

   - SMA type Antenna (Dipole antenna)
   - Max. antenna gain: 2.3 dBi

Any new antenna type, higher gain than listed antenna should be met the requirements of FCC rule 15.203 and 2.1043 as permissive change procedure.

6. **Supplier's Declaration of Conformity**
47 CFR § 2.1077 Compliance Information
Responsible Party – U.S. Contact Information
Pulmuone Corporation
Street Address
   - 1 New England Way, Ayer, MA 01432, United States
City, State
   - 1 New England Way, Massachusetts
Zip Code
   - 01432
Telephone number or internet contact information
   - Name : Justin Lee
   - Telephone number : 978.833.9678
   - Internet contact information : Justin.lee@pulmuone.com

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