HARDWARE USER GUIDE

(DOC No. HX6539-A-HWUG(NB-IoT))

HX6539-A(NB-IoT)

WE-I Plus

Preliminary version 01 February, 2021

Revision History

February,2021

Version	Date	Description of changes
01	2021/02/25	New setup.

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1. Introduction

The HX6539-A NB-IoT platform hardware kit enables rapid software development, code porting, software debugging, and profiling for HX6539-A applications. The hardware kit consists of an EVB hardware platform, including pre-installed EVB images of HX6539-A configurations with peripherals.

This document describes the HX6539-A hardware kit and procedures to run the applications on the platform.

2. HX6539-A NB-IoT Platform

2.1. HX6539-A NB-IoT platform system requirement

- NB-IoT board
- Debug board
- Connection cable
  - Micro USB cable: Debug Board **(I²C/SPI/Flash Download)**
  - JTAG probe: ASHLING Opella-XD for ARC™ **(optional)**
- Software tools
  - mw_devkit_arc_Q_2019_12_win_install.exe **(MetaWare Toolset)**
  - HMX-AIOT-NB-G2_GUI **(I²C/CLK/SPI/Flash Download)**
  - teraterm-4.76 **(UART terminal)**
  - OPXDARCv1.2.6.EXE **(ASHLING ICE Driver) (optional)**

2.2. HX6539-A NB-IoT hardware

- NB-IoT board block diagram
  Please note that debug board is not included in the NB-IoT board; please contact Himax sales staff to support.

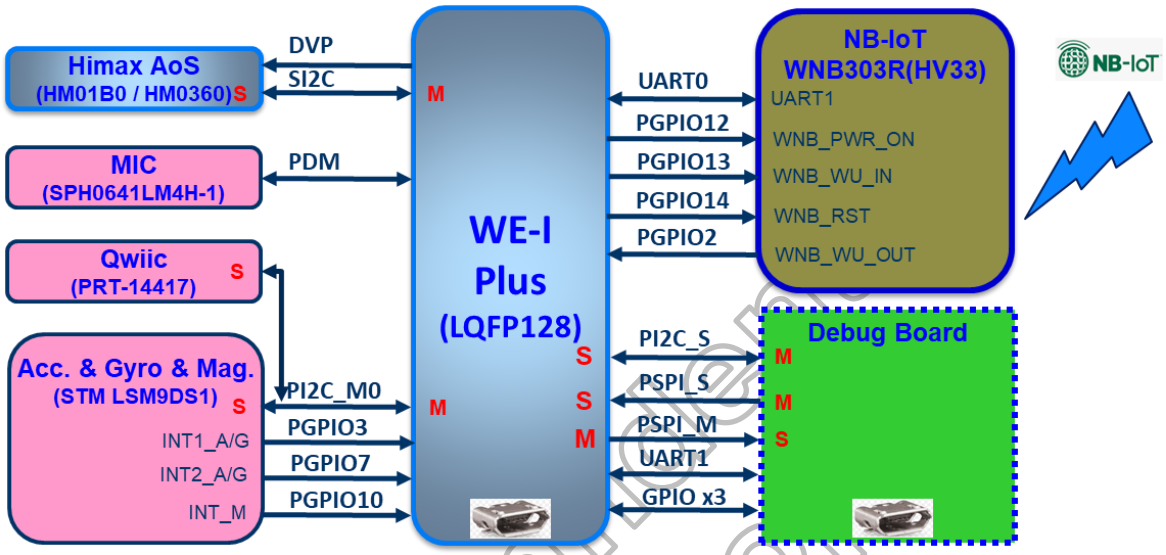


Figure 2.1: NB-IoT board block diagram

- PCB mechanical dimension, board size 40 x 40mm

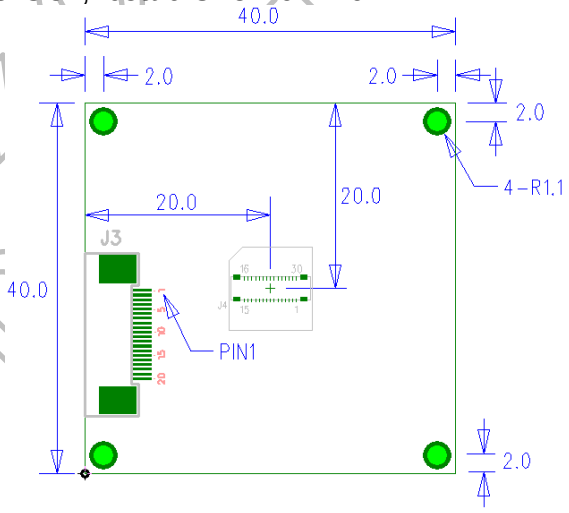


Figure 2.2: NB-IoT board PCB dimension

- NB-IoT board placement

◆ Top View

◆ Bottom View

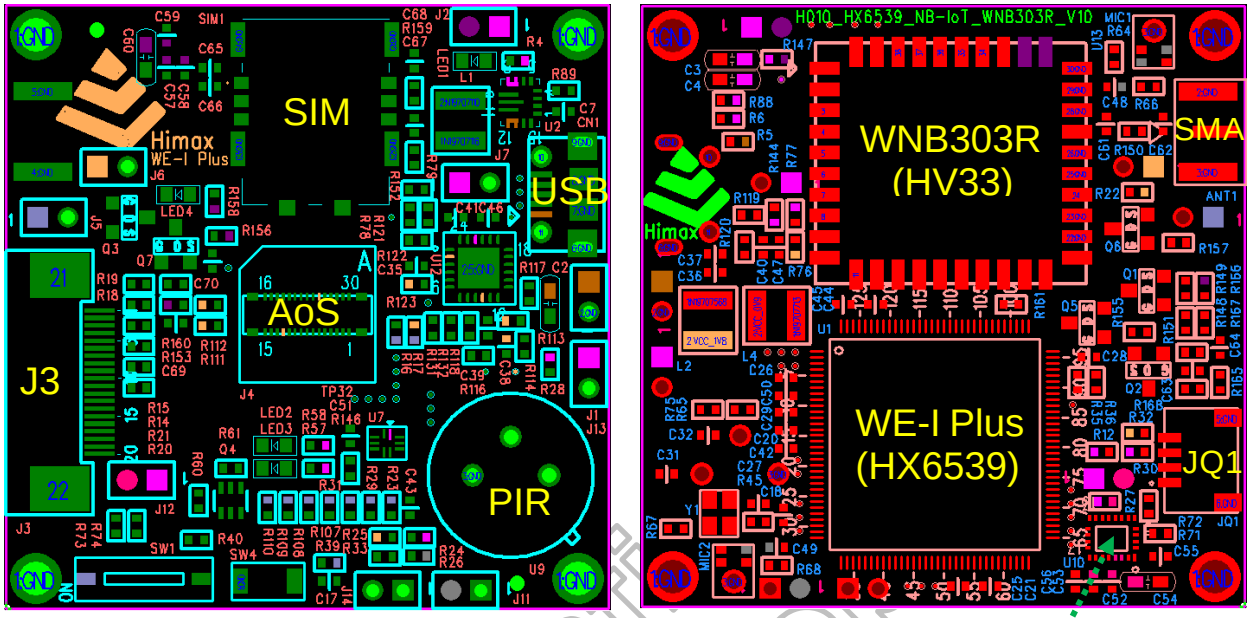


Figure 2.3: NB-IoT board placement

- PCB stack-up

4-Layer: Highs-Speed SIG **(L1)**, GND **(L2)**, VCC **(L3)**, Low-Speed SIG **(L4)**.

4L T=1.6mm						Single-End Impedance W/S	Reference Layers
Stack-up	**Layer**	**Material**	**Type**	**Thickness**	**Unit**	**50Ω ± 10%**	
-	-	S/M	-	0.5	mils	-	-
-	L1	Cu	1/2oz+plating	1.2	mils	4/4 mil	L2
-	-	P.P	-	3	mils	-	-
-	L2	Cu	1oz	1.4	mils	-	-
1.3mm 1/1 (including)	-	Core	FR4	50	mils	-	-
-	L3	Cu	1oz	1.4	mils	-	-
-	-	P.P	-	3	mils	-	-
-	L4	Cu	1/2oz+plating	1.2	mils	4/4 mil	L3
-	-	S/M	-	0.5	mils	-	-
-	-	Thickness	-	62.2	mils	-	-
-	-	-	-	1.58	mm	-	-

Table 2.1: 4-layer PCB stack-up

- FPC20 **(J3)** connector is used to link debug board.

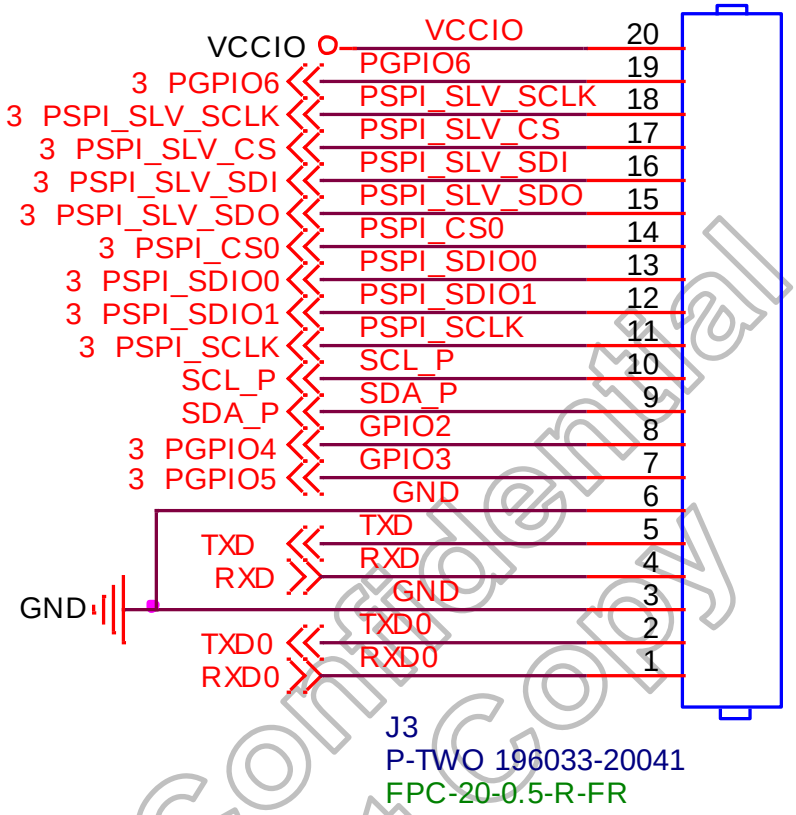


Figure 2.4: NB-IoT board FPC20 (J3) connector

- Qwiic **(JQ1)** is used to link external I2C slave device.

Boards must be 3.3V. You may do an on-board buck or boost to get to a different voltage **(1.8V or 5V, for example)**, but the board must have onboard translation circuitry to work at 3.3V.

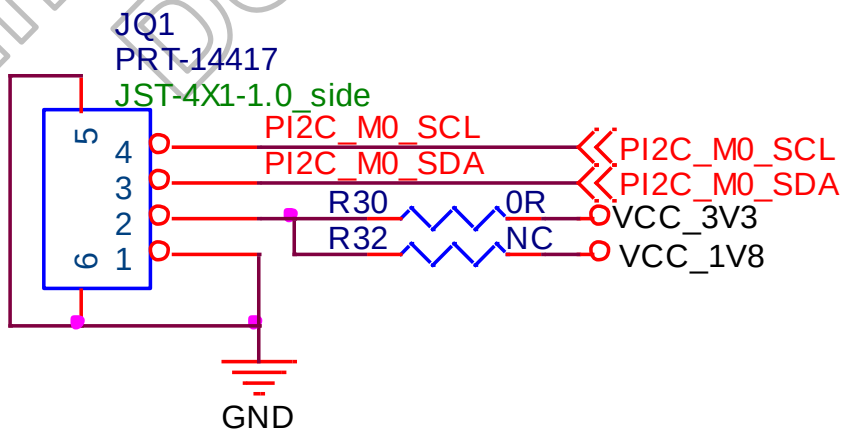


Figure 2.5: NB-IoT board Qwiic (JQ1) connector

- Main Component List

The main components on the NB-IoT board are listed here.

Reference	Part no.	Description
ANT	ANT-LTE-MON-SMA-L	Linx/ Cellular Antennas - GSM, NB-IoT, LTE.
AoS	HM0360	Himax/ 1/6" 640x480 VGA 60FPS CMOS Image Sensor.
	HM01B0	Himax/ 1/11" 320x320 QVGA 60FPS Ultra Low Power CMOS Image Sensor.
ANT1	SMA761-10.5/1.6	Lihyeu/ PCB edge mounting SMA connector.
CN1	105017-0001	Molex/ Micro USB Type B Connector.
JQ1	PRT-14417	SparkFun/ Qwiic JST Connector - SMD 4-Pin.
J3	196033-20041	P-TWO/ FPC 20pin, 0.5pitch, 2.0H.
J4	OK-10F030-04	OCN/ Board to board connector.
MIC1, MIC2	SPH0641LM4H-1	Knowles/ Digital microphones, PDM.
SIM1	1042240820	MOLEX/ nano-SIM card connector.
SW1	TDA01H0SB1R	C&K/ 1.27mm DIP switch SPST.
SW4	B3U-1000P	Omron/ Switch tactile SPST-NO 0.05A 12V.
U1	HX6539_LQFP128	Himax/ WE-I plus LQFP128 package.
U2	TPS63070RNMR	TI/ 2~16V Buck-Boost Converter.
U7	TS3A5223RSWR	TI/ IC 0.5ohm dual SPDT analog switch.
U9	EKMC1607112	Panasonic/ PIR motion sensor 170μA.
U10	LSM9DS1	STM/ 3D accelerometer, 3D gyroscope, 3D magnetometer.
U12	ADP5134ACPZ-R7	ADI/ Dual 1.2A Buck + Dual 300mA LDO.
U13	WNB303R(HV33)	Lite-On/ NB-IoT Module.
Y1	ECS-240-10-36-CKM-TR	ECS/Crystal 24MHz 10ppm 10pF.

Table 2.2: NB-IoT board main component list

- GPIO Function

There are total 15 GPIOs on WE-I Plus IC.

GPIO no.	Direction	Description
PGPIO0	In	N/A.
PGPIO1	In	Digital PIR Sensor.
PGPIO2	In	WNB303R WNB_WU_OUT.
PGPIO3	In	Accelerometer and gyroscope interrupt 1 **(INT1_A/G)**.
PGPIO4	In/Out	Himax debug board **(FTDI_GPIO2)**.
PGPIO5	In/Out	Himax debug board **(FTDI_GPIO3)**.
PGPIO6	In	WE-I Plus direct flash pin **(SPI_SS)**.
PGPIO7	In	Accelerometer and gyroscope interrupt 2 **(INT2_A/G)**.
PGPIO8	Out	WE-I plus status indication **(LED_GREEN)**.
PGPIO9	Out	WE-I plus status indication **(LED_BLUE)**.
PGPIO10	In	Magnetic sensor interrupt **(INT_M)**.
PGPIO11	In	Reserved for WNB303R sleep mode detection.
PGPIO12	Out	WNB303R WNB_PWR_ON.
PGPIO13	Out	WNB303R WNB_WU_IN.
PGPIO14	Out	WNB303R WNB_RST.

Table 2.3: NB-IoT board GPIO function

- Jumpers

There are nine jumpers available for measuring current consumption.

Jumper no.	Operation voltage	Description
J1	2V ~ 16V	The system power is input to the Buck-Boost converter.
J2	3.3V	Lite-on WNB303R power supply input.
J5	1.8V or 3.3V	WE-I Plus PIF IO power **(PIF_IOVDD)**.
J6	1.8V	WE-I Plus IC 1.8V power **(POR, ADC, CLDO, SLDO, PLL, SIF, FLASH)**.
J7	3.3V	Including the following component. a. Dual 1.2A Buck + Dual 300mA LDO. b. WE-I Plus. c. AoS **(HM01B0 or HM0360)**.
J11	1.8V or 3.3V	Microphone power supply.
J12	3.3V	Accelerometer & gyroscope & magnetometer power supply.
J13	3.3V	PIR motion sensor power supply.
J14	1.8V or 3.3V	Accelerometer & gyroscope & magnetometer IO power.

Table 2.4: NB-IoT board jumper

- Jumper position

The nine jumper positions are shown below.

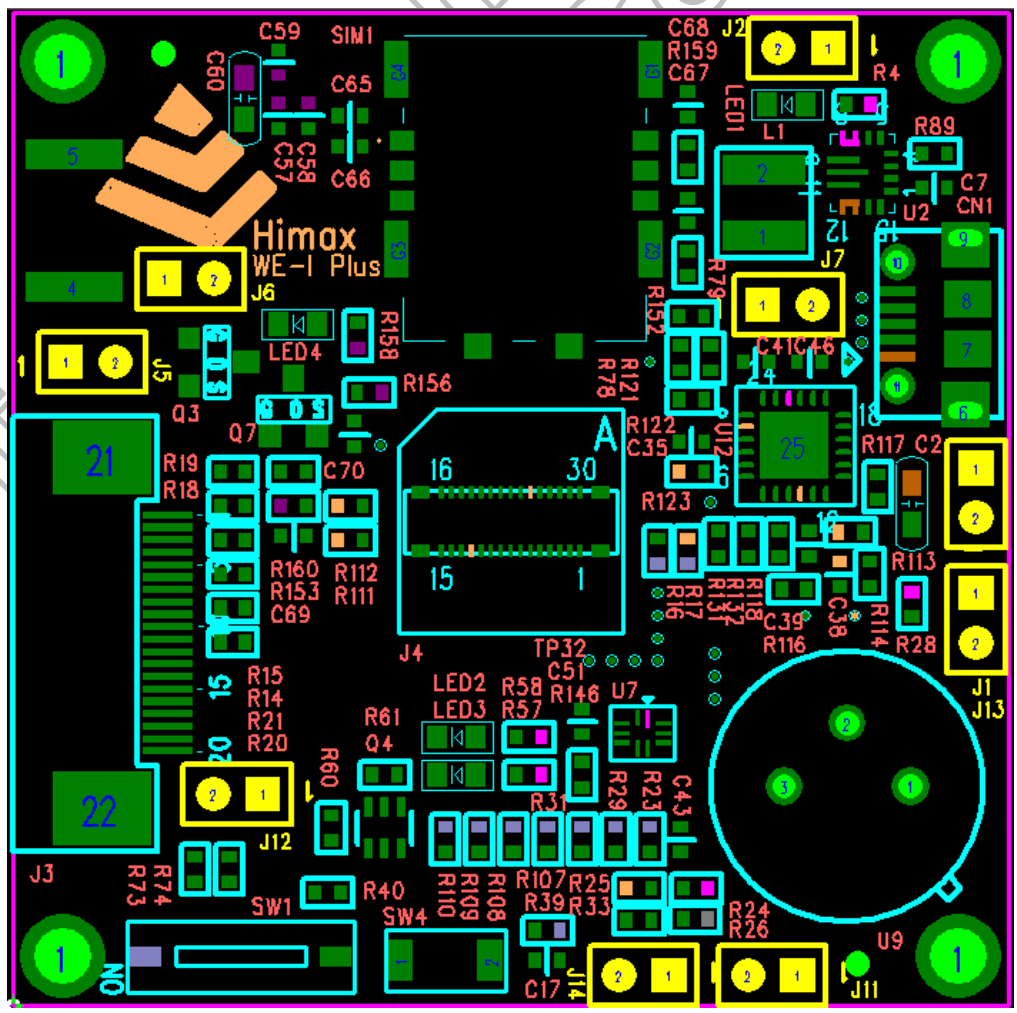


Figure 2.6: NB-IoT board jumper positions

- NB-IoT board LEDs function

  It's recommended that there is no need to mount LED1 & LED4 since the sensitive power consumption. When the user wants to measure system power consumption, please de-solder R4 & R158 which is LED current limiting resistance. If the user wants the lowest power consumption, please program the firmware to turn off LED2 and LED3.

LED no.	Color	Description
LED1	Green	3.3V power supply indication LED.
LED2	Green	WE-I Plus status indication LED.
LED3	Blue	WE-I Plus status indication LED.
LED4	Red	WNB303R network status indication LED. There are 5 frequency status: 1. **(Light OFF)** Power OFF / PSM. 2. **(12Hz)** Module is powering on. 3. **(6Hz)** SIM card is not available or searching the network. 4. **(3Hz)** Data transforming. 5. **(1Hz)** Online.

Table 2.5: NB-IoT board LEDs function

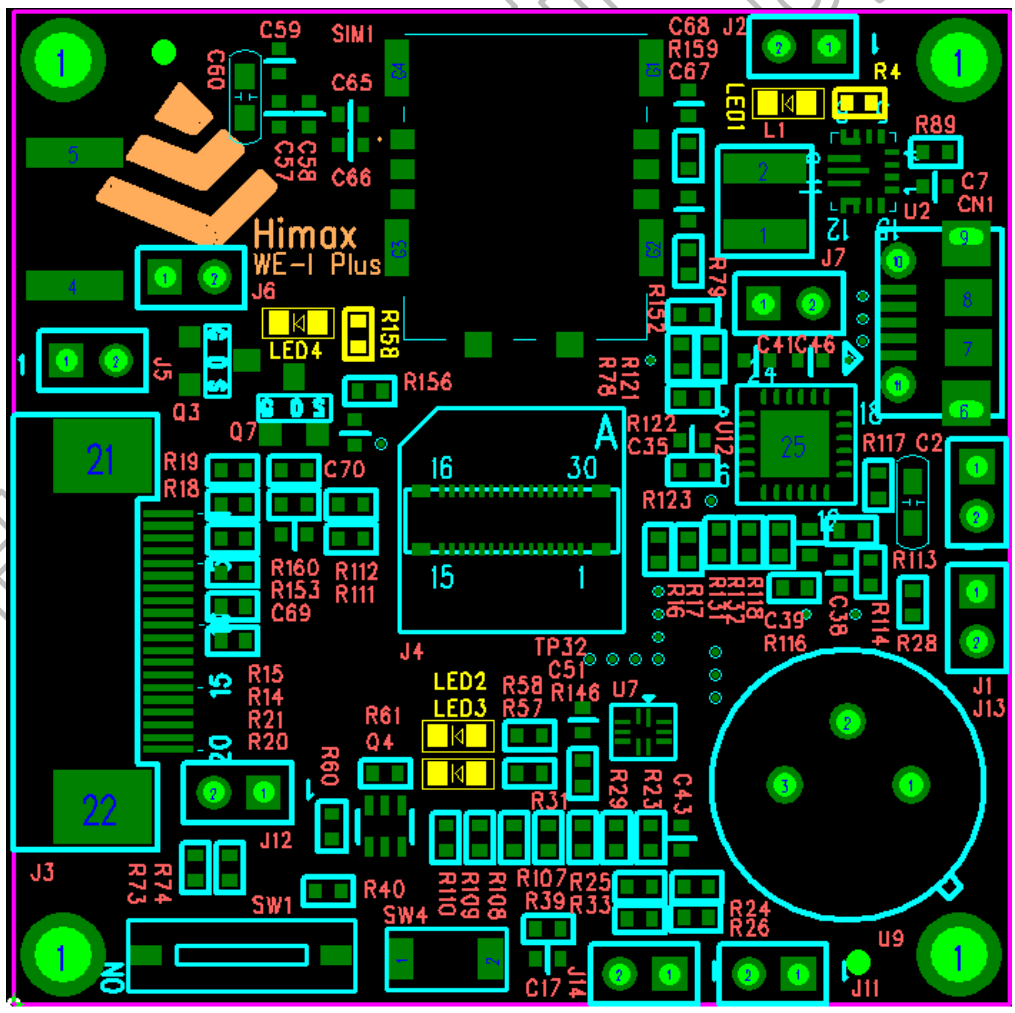


Figure 2.7: NB-IoT board LEDs location

- Debug Board

Figure 2.8: Debug board

◆ Top View

◆ Bottom View

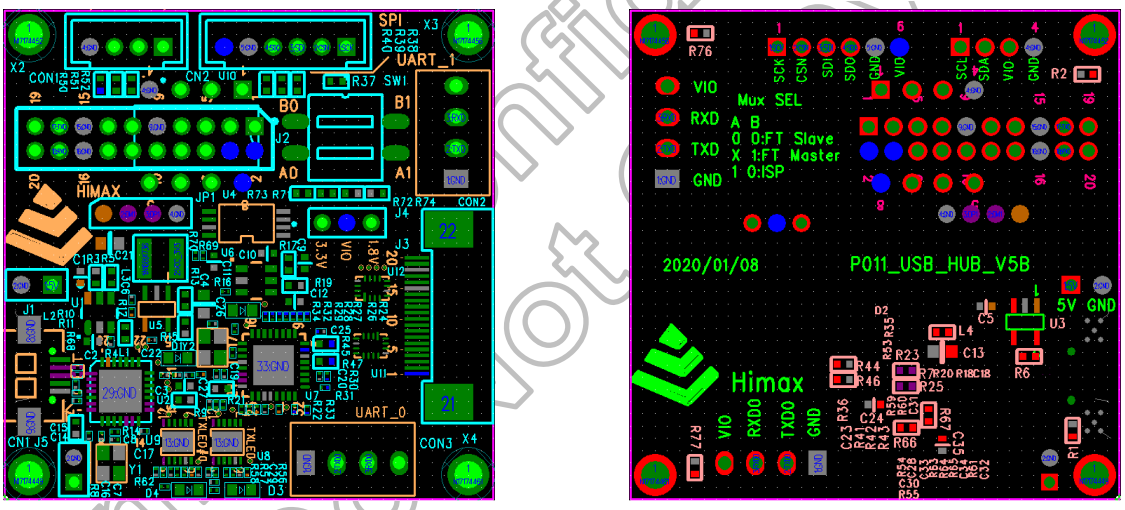


Figure 2.9: Debug board placement

- ASHLING Opella-XD for ARC™

Figure 2.10: ASHLING Opella-XD

2.3. HX6539-A NB-IoT platform setup

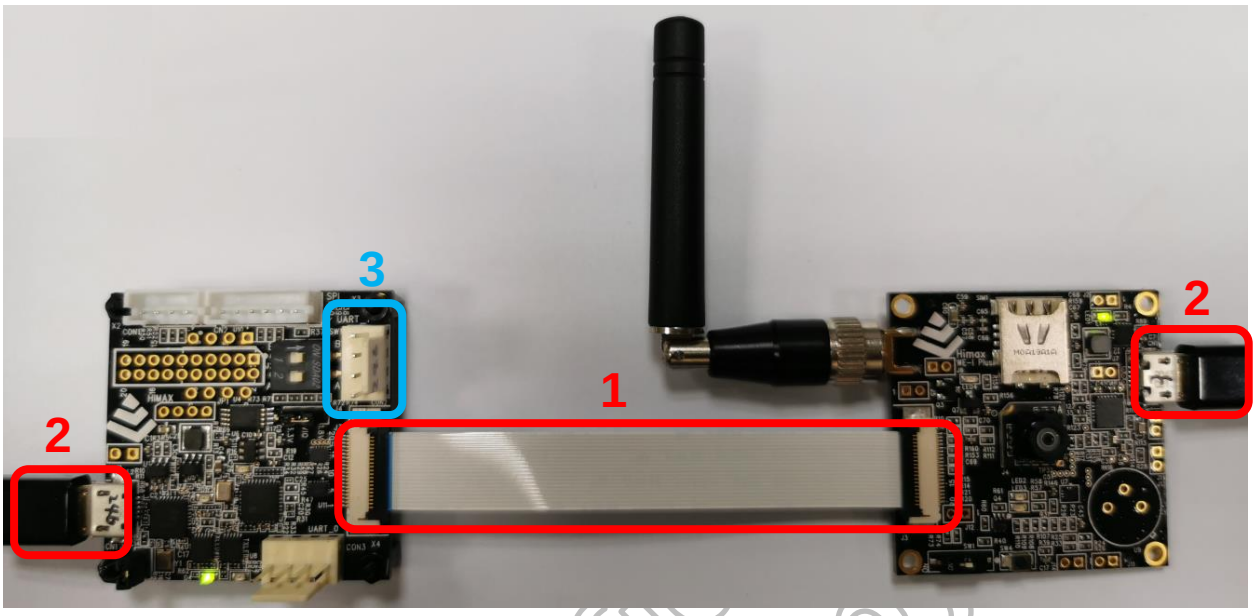


Figure 2.11: HX6539-A NB-IoT platform setup

Item 1. Flex Cable **(20 Pin)**
Item 2. USB Cable **(I²C/SPI/Flash Download)**
Item 3. ASHLING JTAG ICE **(refer to Figure 2.12)**

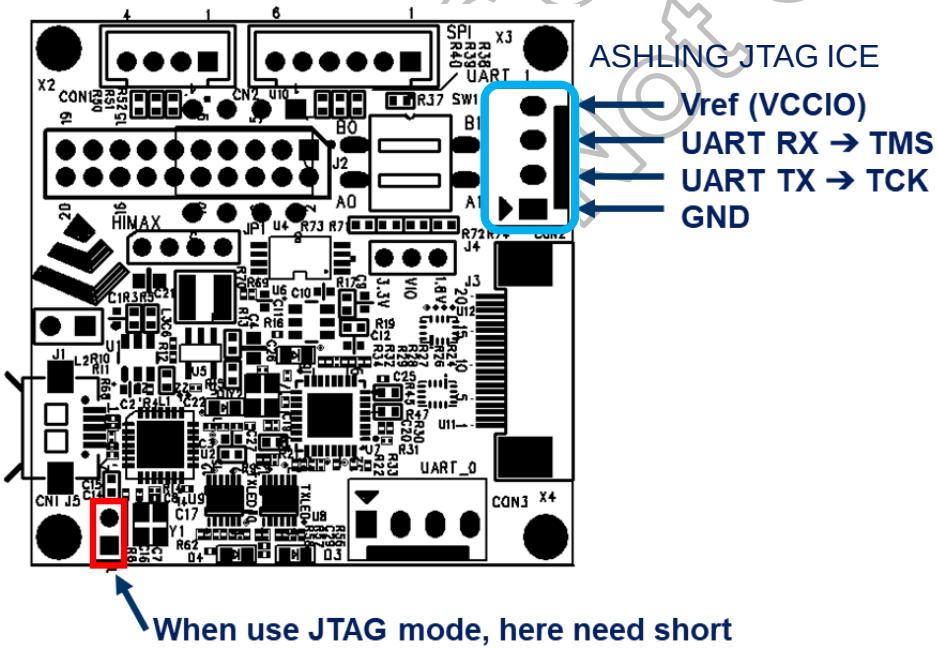


Figure 2.12: ASHLING JTAG ICE

2.4. HX6539-A NB-IoT platform startup

Use the following procedure to startup the HX6539-A NB-IoT platform.

A. Power on EVB
B. Flash image download
C. Reset NB-IoT board
D. Check UART message output

A. Power on EVB

The debug board and NB-IoT are connected to the PC through each USB cable.

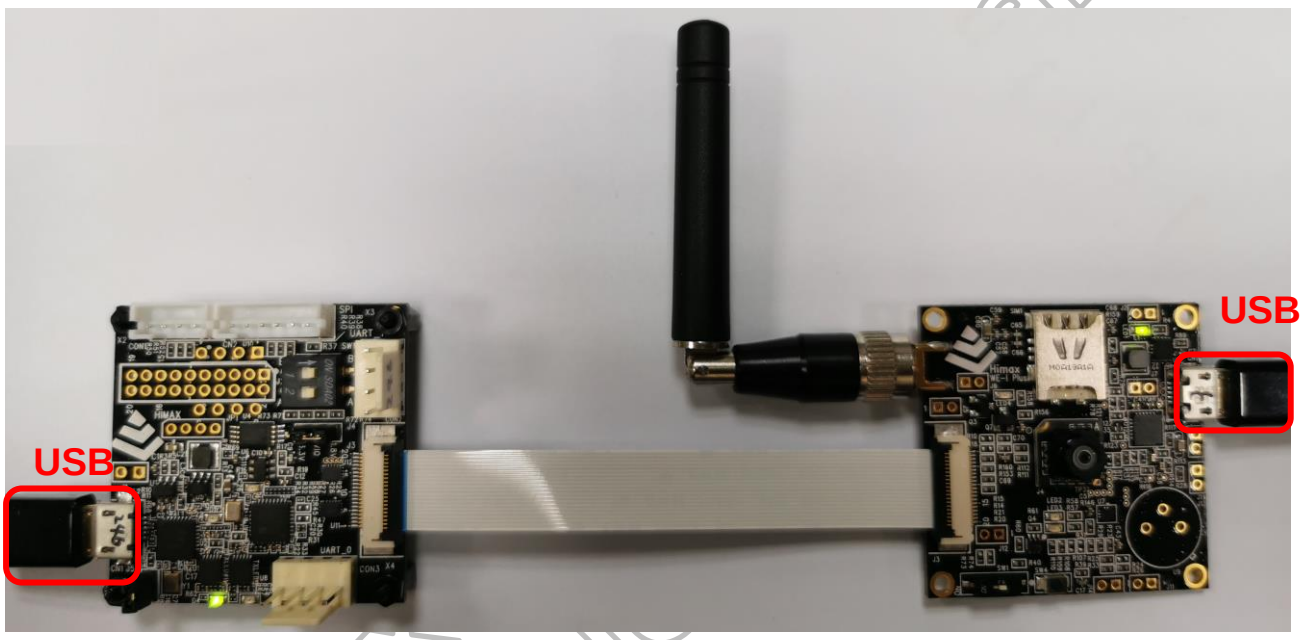
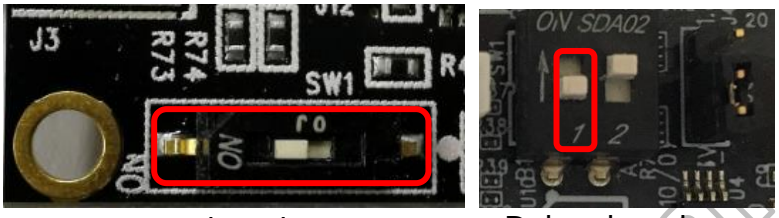


Figure 2.13: Debug board connect to NB-IoT board

B. Flash image download

a. Use HMX-AIOT-NB-G2_GUI Tool: after power on EVB
NB-IoT board SW1 pin switch to “ON”
Debug board SW1 pin 1 switch to “OFF”, pin 2 keep “ON”



NB-IoT board Debug board

Figure 2.14: Switch pin for flash image download

- Use GUI_Tool to download EVB image

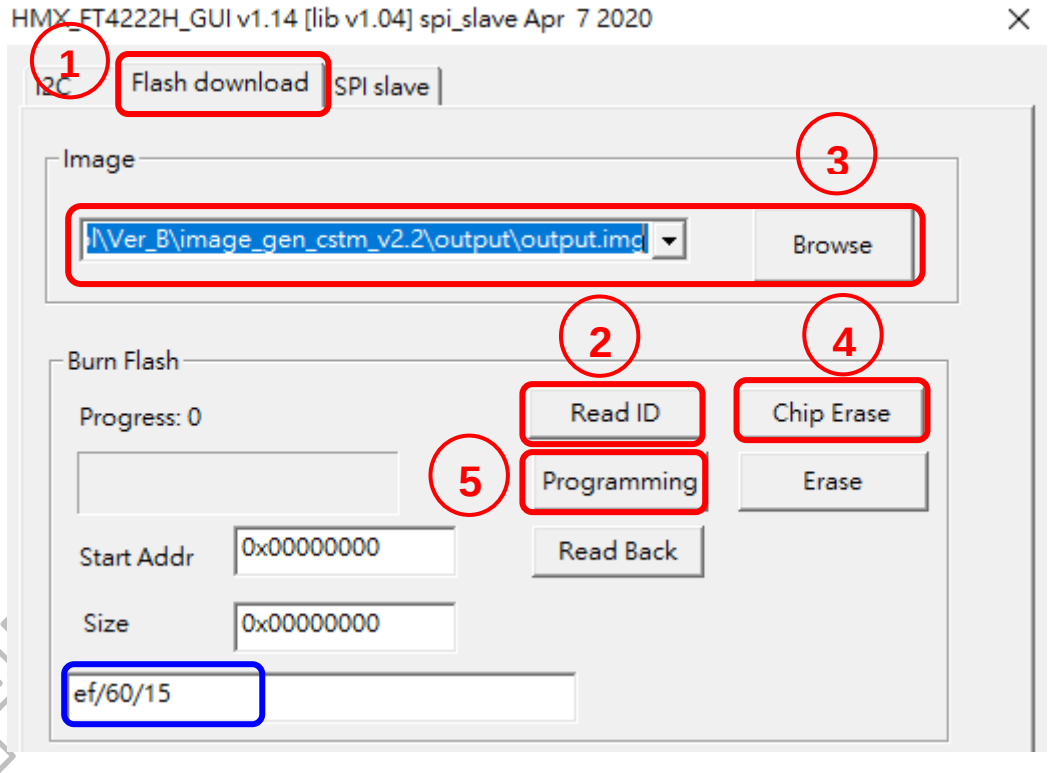
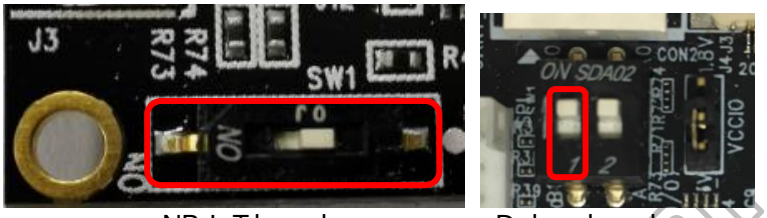


Figure 2.15: Flash image download by GUI

Step 1: Open HMX-AIOT-NB-G2_GUI.exe and change to Flash download page
Step 2: Read ID to check HW ready **(ID info Show in blue box)**
Step 3: Select correct image file
Step 4: Erase flash **(optional)**
Step 5: Programming data

b. Download Firmware use Metaware
NB-IoT board SW1 pin switch to “OFF”
Debug board SW1 pin 1 switch to “ON”



NB-IoT board Debug board

Figure 2.16: Switch pin for Metaware Download firmware

- I²C Setting **(load PLL_Script_24to400MHz_JTAG Script)** before load elf.

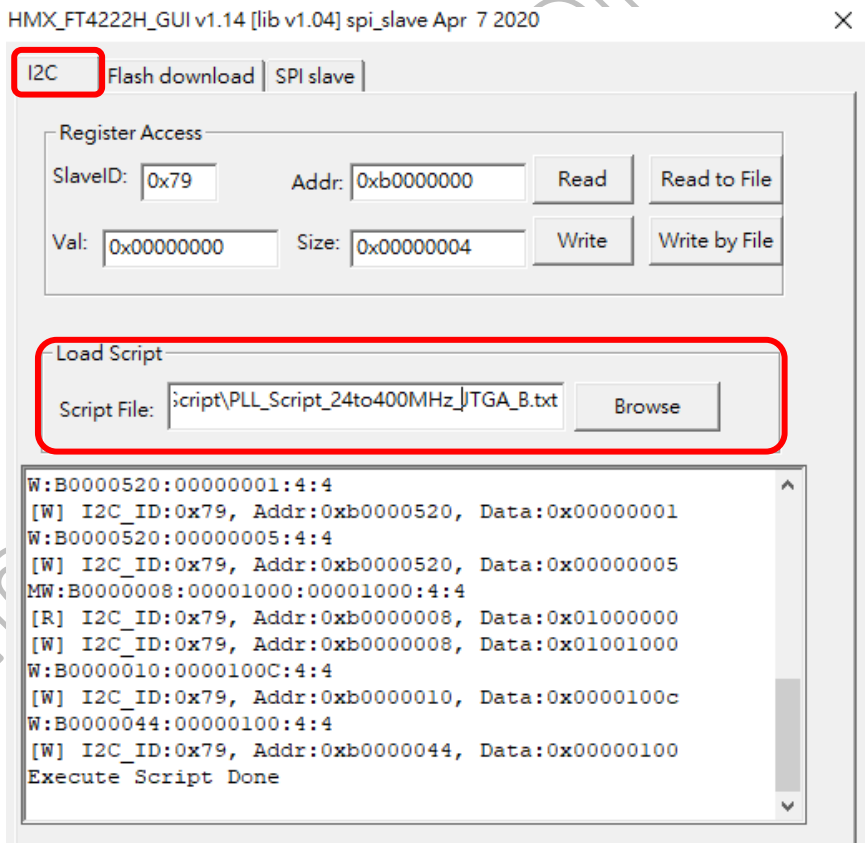


Figure 2.17: I2C load script file by GUI for Metaware load elf

- Open Metaware and Select **Run > Debug Configurations** and Select elf file that you want to download to HX6539-A.

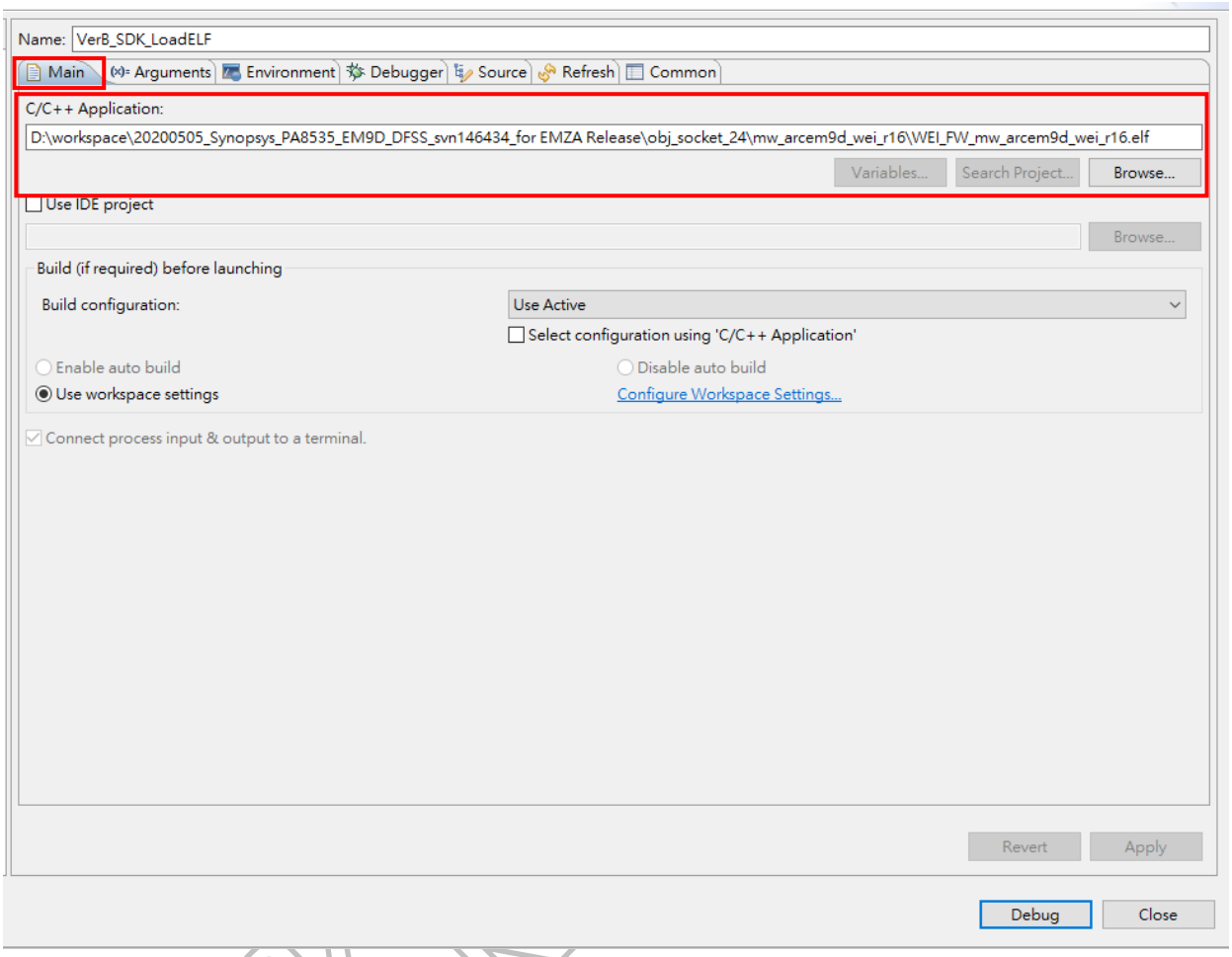


Figure 2.18: Metaware debug configuration I

- Set “Target Selection”

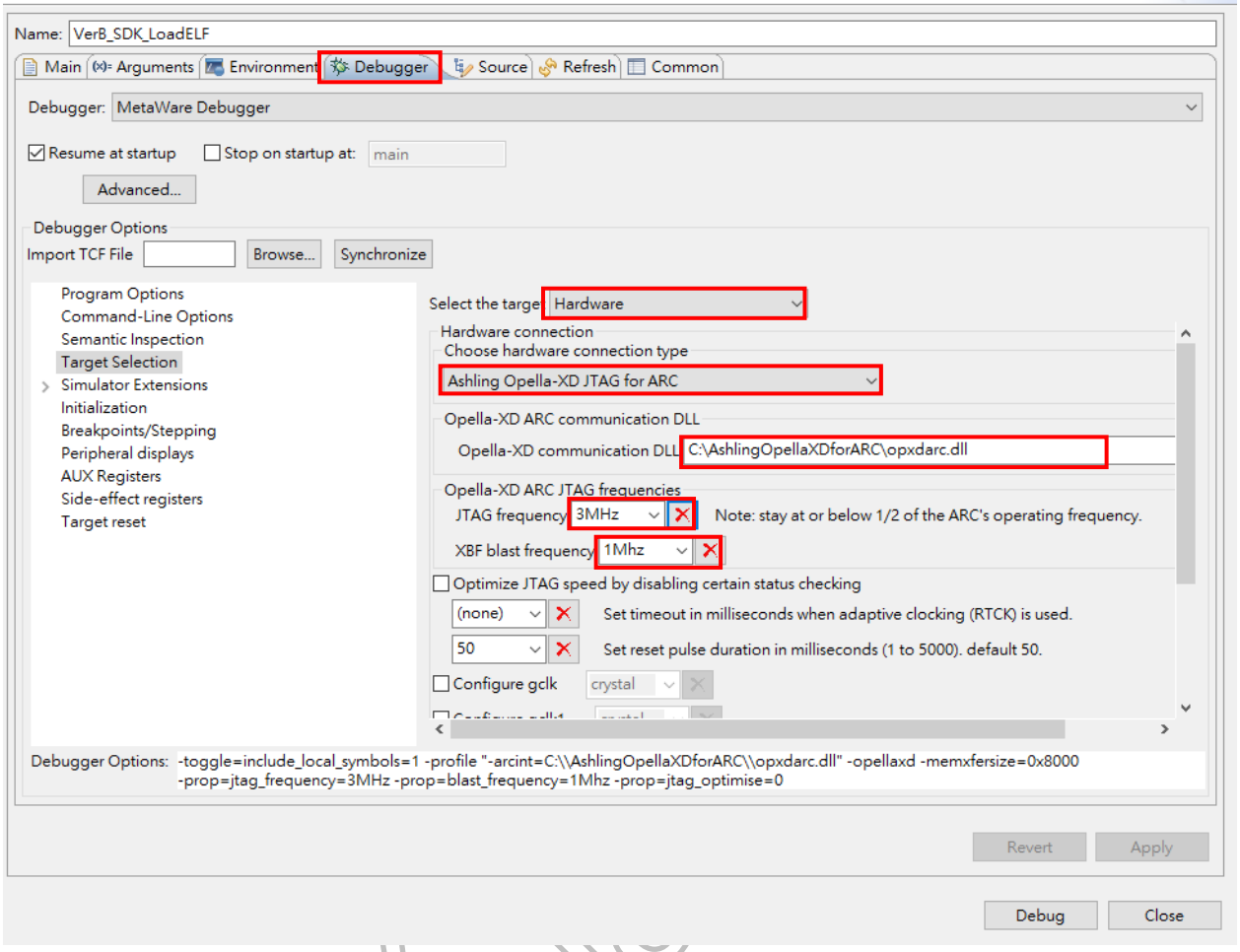


Figure 2.19: Metaware debug configuration II

- Start Debug

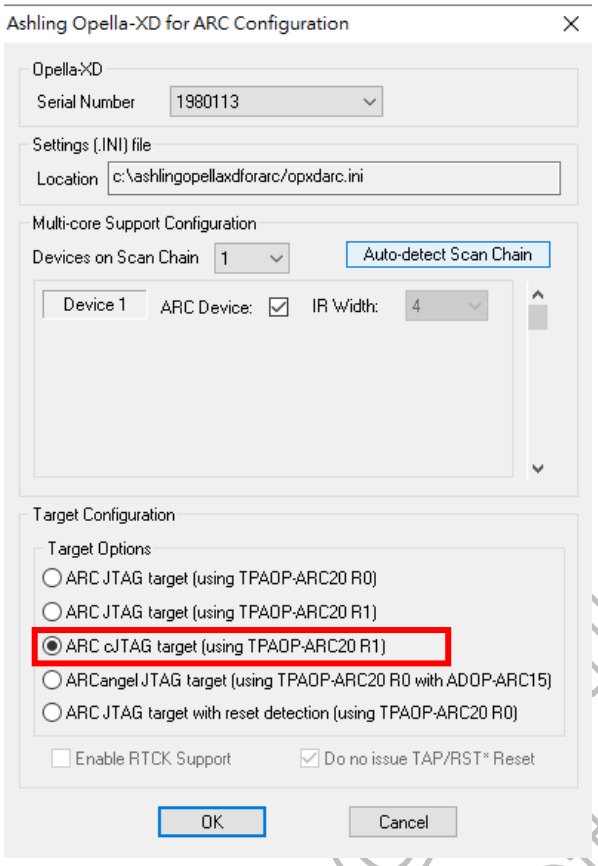


Figure 2.20: Metaware debug configuration III

- Debugger connected to Device, when the MetaWare Debugger connected to Device, UART will output message as the following **(Program still NOT run)**

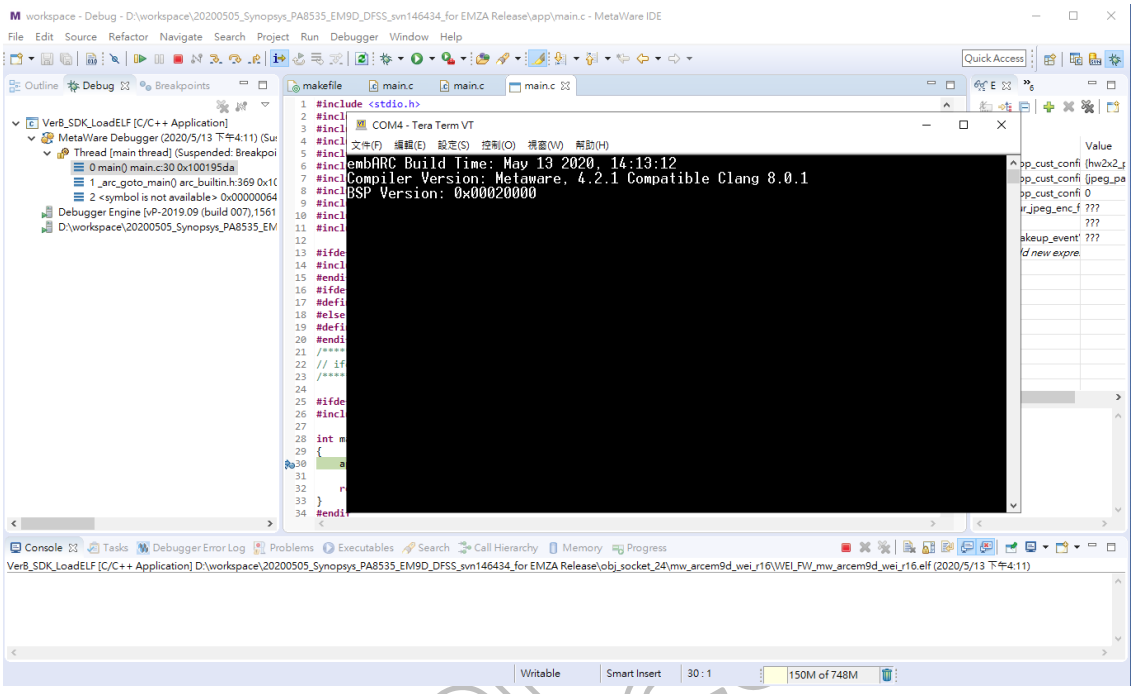


Figure 2.21: UART output message I

- When the MetaWare Debugger Start to "**run**" program, UART will output message as the following

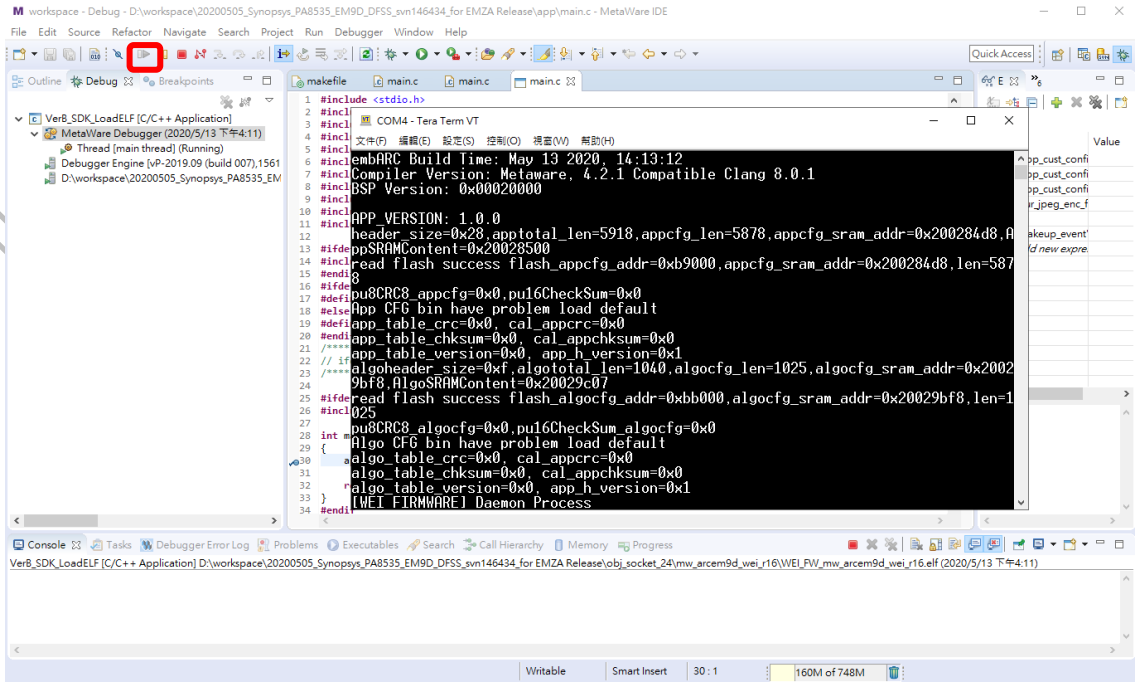


Figure 2.22: UART output message II

- Please note that the UART output log message needs load script **(JTAG switch_to UART1)** by GUI tool, because UART and JTAG is share pin.

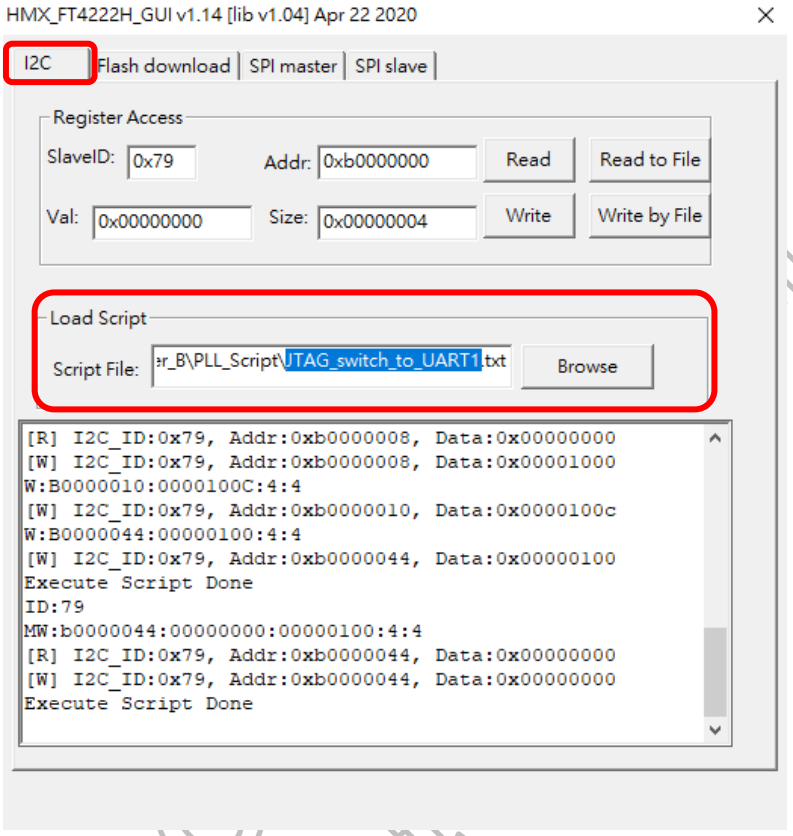


Figure 2.23: UART output message load script by GUI Tool

C. Reset NB-IoT board

The user can press the Reset button **(SW4)** to reset NB-IoT board and restart the application program. Please note that SW1 should be in the "OFF" position.

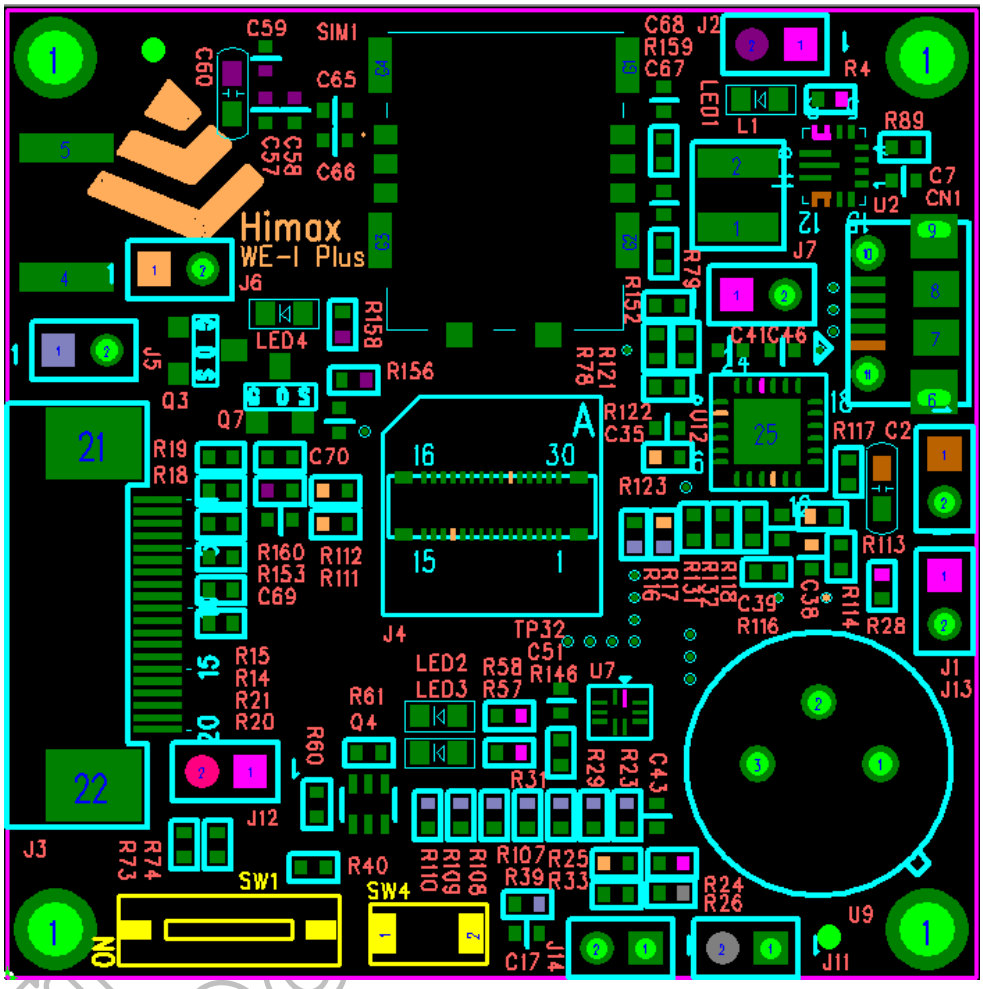


Figure 2.24: NB-IoT board reset

D. Check UART message output

The system will output the following message to the UART console. Please setup UART terminal tool setting as **(115200/8/N/1)**.

(If the boot method is to load the ELF file into SRAM by JTAG, the SRAM data will be cleared after hardware reboot.)