HARDWARE USER GUIDE

(DOC No. HX6539-A-HWUG(AIOT-NB-G3))

HX6539-A(AIOT-NB-G3)

WE-I Plus

Preliminary version 01 September, 2021

Revision History

September,2021

Version	Date	Description of changes
01	2021/09/06	New setup.

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1. Introduction

The HX6539-A AIOT-NB-G3 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 AIOT-NB-G3 hardware kit and procedures to run the applications on the platform.

2. HX6539-A AIOT-NB-G3 Platform

2.1. HX6539-A AIOT-NB-G3 platform system requirement

- AIOT-NB-G3 board x 1pcs
- Debug board x 1pcs
- Connection cable
  - Micro USB cable: Debug Board **(I²C/SPI/Flash Download)** x 1pcs
  - JTAG probe: ASHLING Opella-XD for ARC™ **(optional)** x 1pcs
- Software tools
  - mw_devkit_arc_Q_2019_12_win_install.exe **(MetaWare Toolset)**
  - HMX-AIOT-NB-GX_GUI **(I²C/CLK/SPI/Flash Download)**
  - teraterm-4.76 **(UART terminal)**
  - OPXDARCv1.2.6.EXE **(ASHLING ICE Driver) (optional)**

Note : Connect with Himax-AIoT-NB-G3 and Debug mode simultaneously with USB cable in debug mode and Himax-AIoT-NB-G3 with USB cable in normal operation mode.

2.2. HX6539-A AIOT-NB-G3 hardware

- AIOT-NB-G3 board block diagram
  Please note that debug board is not included in the AIOT-NB-G3 board. Please contact Himax sales staff to support.

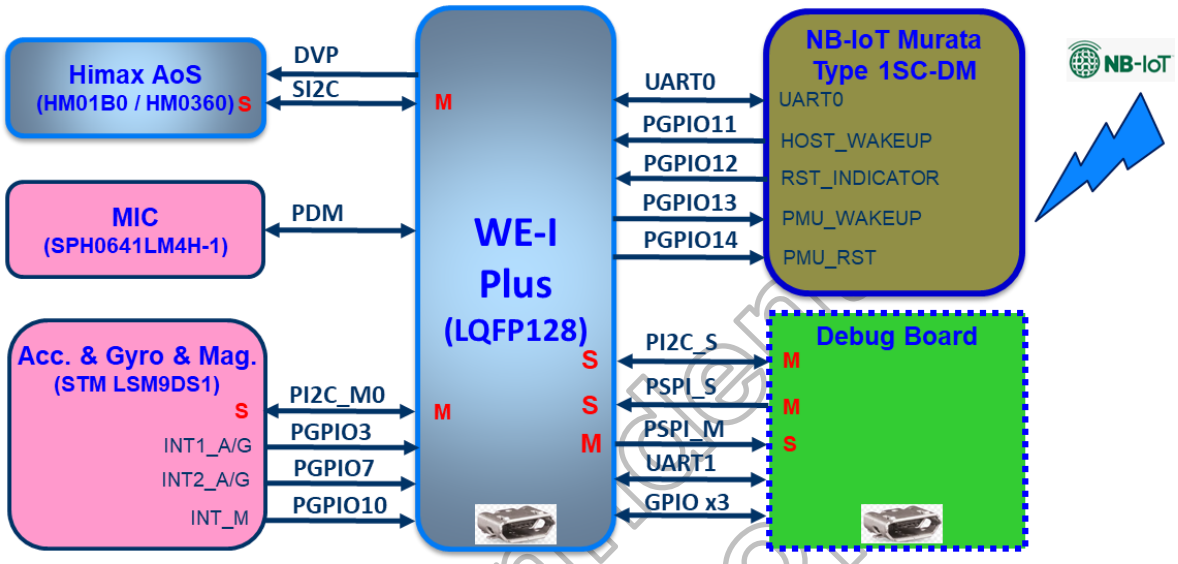


Figure 2.1: AIOT-NB-G3 board block diagram

- PCB mechanical dimension, board size 40 x 40mm

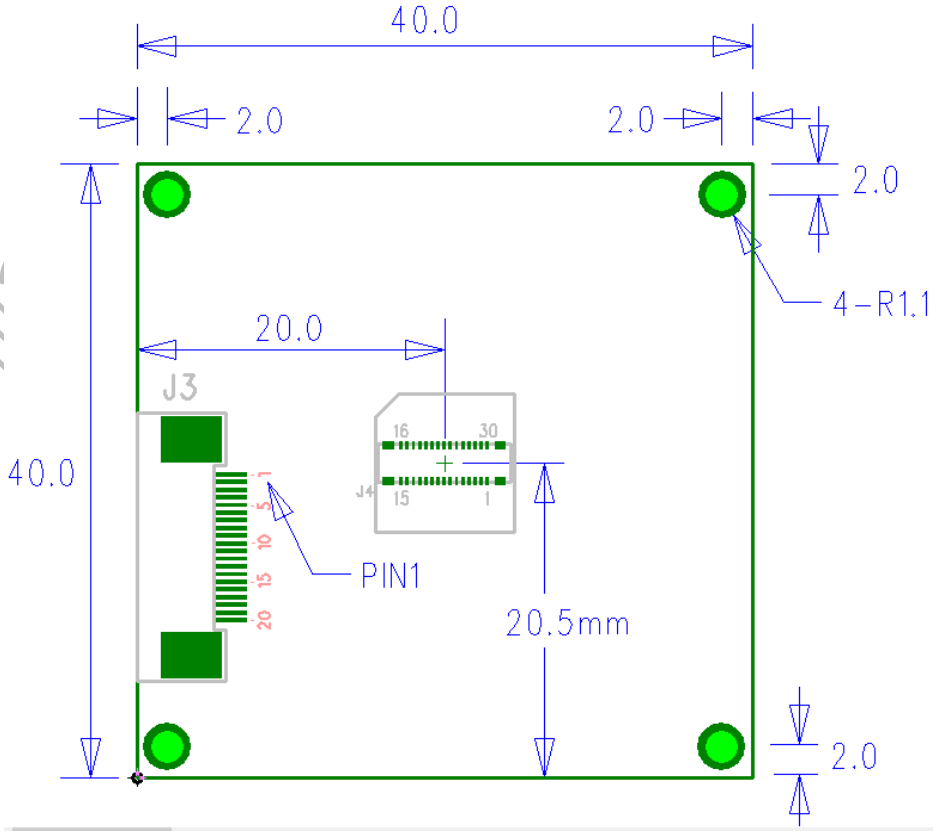


Figure 2.2: AIOT-NB-G3 board PCB dimension

- AIOT-NB-G3 board placement

◆ Top View

◆ Bottom View

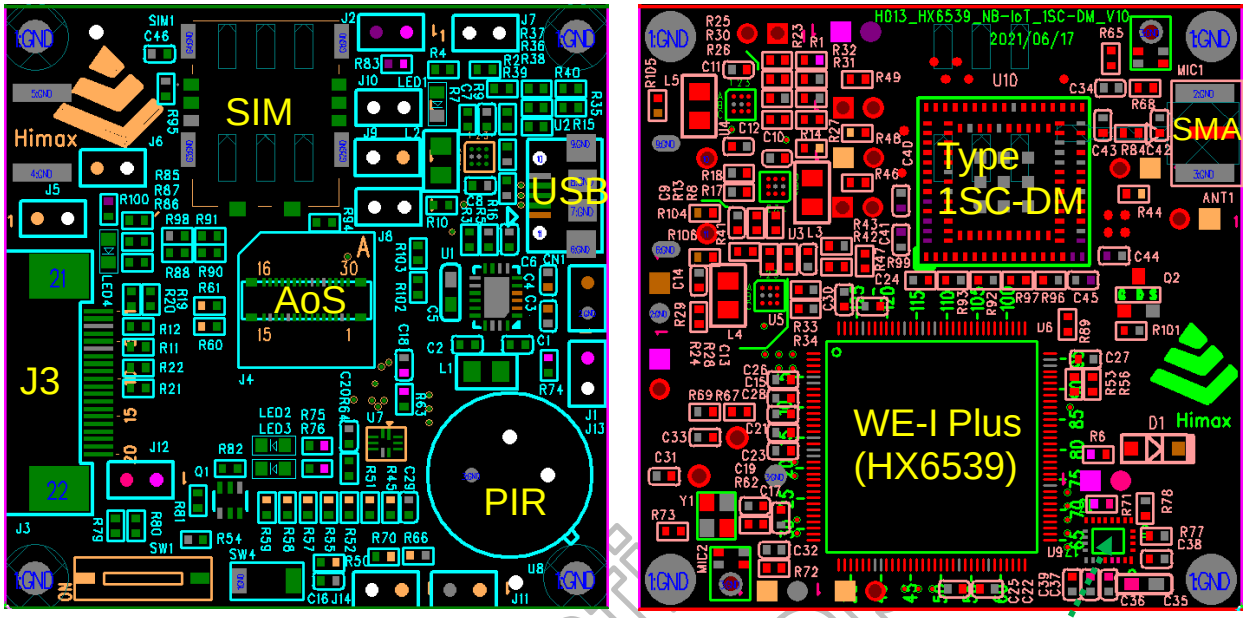


Figure 2.3: AIOT-NB-G3 board placement

- PCB stack-up

4-Layer: Signal **(L1)**, GND **(L2)**, VCC **(L3)**, Signal **(L4)**.

4L T=1.6mm						Single-End Impedance W	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 mil	L2
-	-	P.P	-	3	mils	-	-
-	L2	Cu	1oz	1.4	mils	-	L1/L3
1.3mm 1/1 (including)	-	Core	FR4	50	mils	-	-
-	L3	Cu	1oz	1.4	mils	-	L2/L4
-	-	P.P	-	3	mils	-	-
-	L4	Cu	1/2oz+plating	1.2	mils	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.

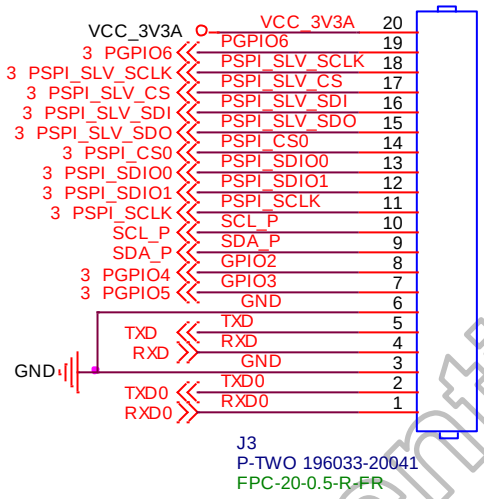


Figure 2.4: AIOT-NB-G3 board FPC20 (J3) connector

- Main Component List

The main components on the AIOT-NB-G3 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	SMA761/1-10.5/1.6	Lihyeu/ PCB edge mounting SMA connector.
CN1	105017-0001	Molex/ Micro USB Type B Connector.
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	LTC3130EUDC#PBF	Linear/ 2.4V to 25V, Buck-Boost Converter
U2, U3, U4	ADP5301ACBZ-2-R7	Analog Device/ 50 mA or 500 mA, Step-Down Regulator
U5	ADP5301ACBZ-3-R7	Analog Device/ 50 mA or 500 mA, Step-Down Regulator
U6	HX6539_LQFP128	Himax/ WE-I plus LQFP128 package.
U7	TS3A5223RSWR	TI/ IC 0.5ohm dual SPDT analog switch.
U8	EKMB1307113K	Panasonic/ PIR motion sensor 6μA.
U9	LSM9DS1	STM/ 3D accelerometer, 3D gyroscope, 3D magnetometer.
U10	Murata 1SC-DM	Murata/ LTE CAT-M1, Type 1SC-DM
Y1	ECS-240-10-36-CKM-TR	ECS/Crystal 24MHz 10ppm 10pF.

Table 2.2: AIOT-NB-G3 board main component list

- GPIO Function

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

GPIO no.	Direction	Description
PGPIO0	In	To Murata Type 1SC-DM UART0_RTS
PGPIO1	In	Digital PIR Sensor.
PGPIO2	Out	To Murata Type 1SC-DM UART0_CTS
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	To Murata Type 1SC-DM HOST_WAKEUP
PGPIO12	In	To Murata Type 1SC-DM RST_INDICATOR
PGPIO13	Out	To Murata Type 1SC-DM PMU_WAKEUP
PGPIO14	Out	To Murata Type 1SC-DM PMU_RST

Table 2.3: AIOT-NB-G3 board GPIO function

- Jumpers

There are twelve jumpers available for measuring current consumption.

Jumper no.	Operation voltage	Description
J1	3.4V ~ 6.5V	The system power is input to the Buck-Boost converter IC. Although the Buck-Boost converter IC can support 2.4V~25V, due to NB-IoT performance requirements, it is recommended to use 3.4V~6.5V.
J2	3.3V	Murata Type 1SC-DM power supply 3.3V input.
J5	1.8V	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. ● Four buck regulator IC ● WE-I Plus IC. ● AoS (Always on Sensor), HM01B0 or HM0360.
J8	2.8V	AoS AVDD28 power supply.
J9	1.8V	AoS IOVDD18 power supply.
J10	1.2V / 1.5V	AoS DVDD power supply. HM0360 DVDD=1.2V, HM01B0 DVDD=1.5V
J11	1.8V	Microphone power supply.
J12	3.3V	Accelerometer & gyroscope & magnetometer power supply.
J13	3.3V	PIR motion sensor power supply.
J14	1.8V	Accelerometer & gyroscope & magnetometer IO power.

Table 2.4: AIOT-NB-G3 board jumper

- Jumper position

The twelve jumper positions are shown below.

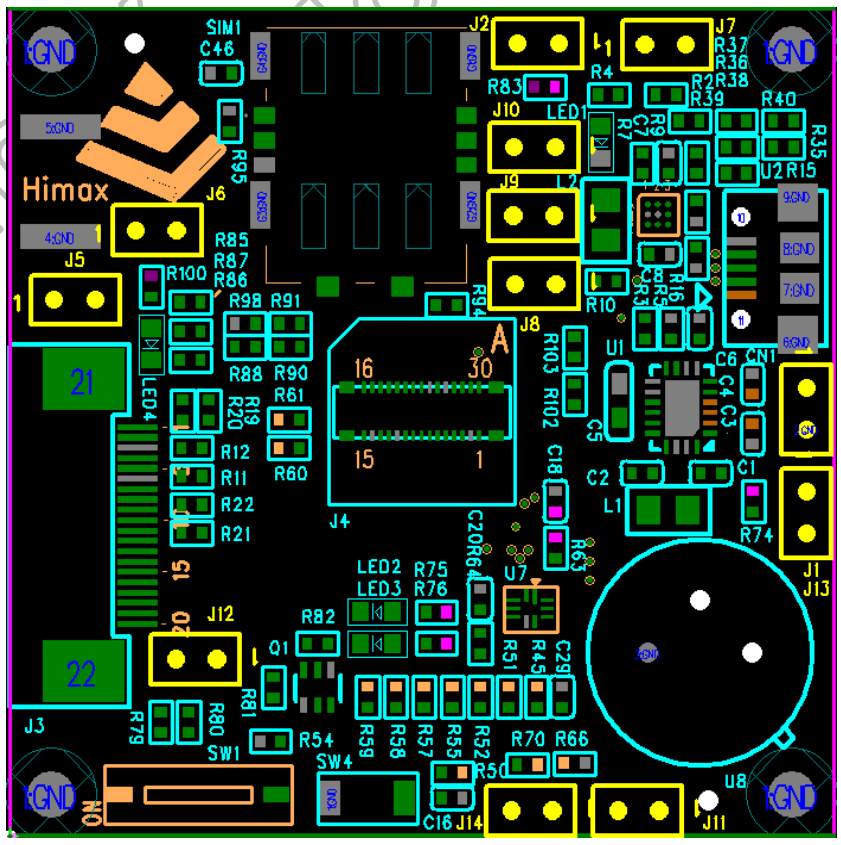


Figure 2.5: AIOT-NB-G3 board jumper positions

- AIOT-NB-G3 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 & R100 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	Murata Type 1SC-DM power save mode status.

Table 2.5: AIOT-NB-G3 board LEDs function

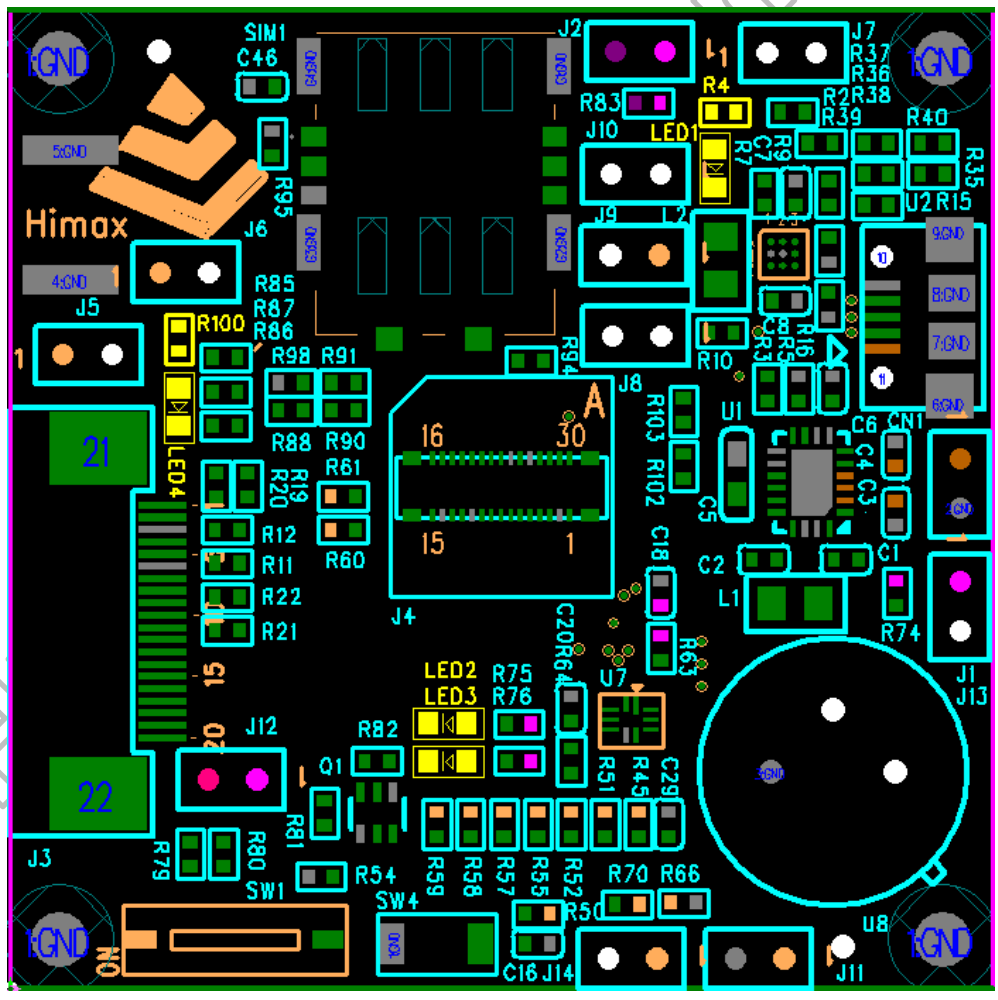
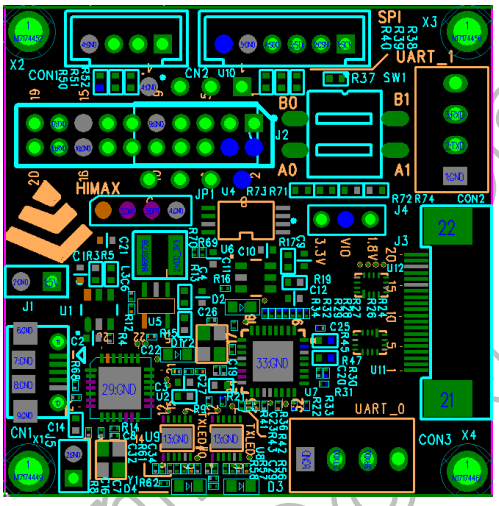


Figure 2.6: AIOT-NB-G3 board LEDs location

- Debug Board

Figure 2.7: Debug board

◆ Top View



◆ Bottom View

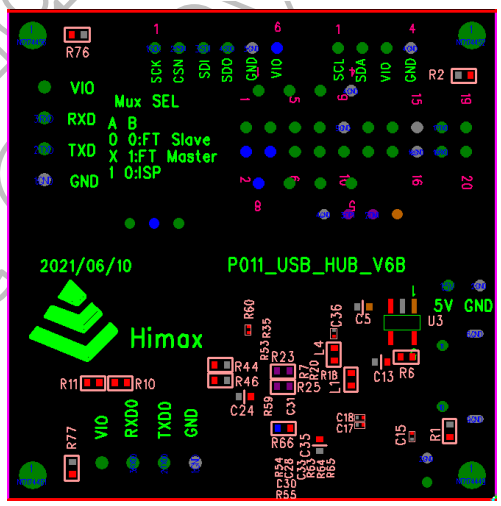


Figure 2.8: Debug board placement

- ASHLING Opella-XD for ARC™

Figure 2.9: ASHLING Opella-XD

2.3. HX6539-A AIOT-NB-G3 platform setup

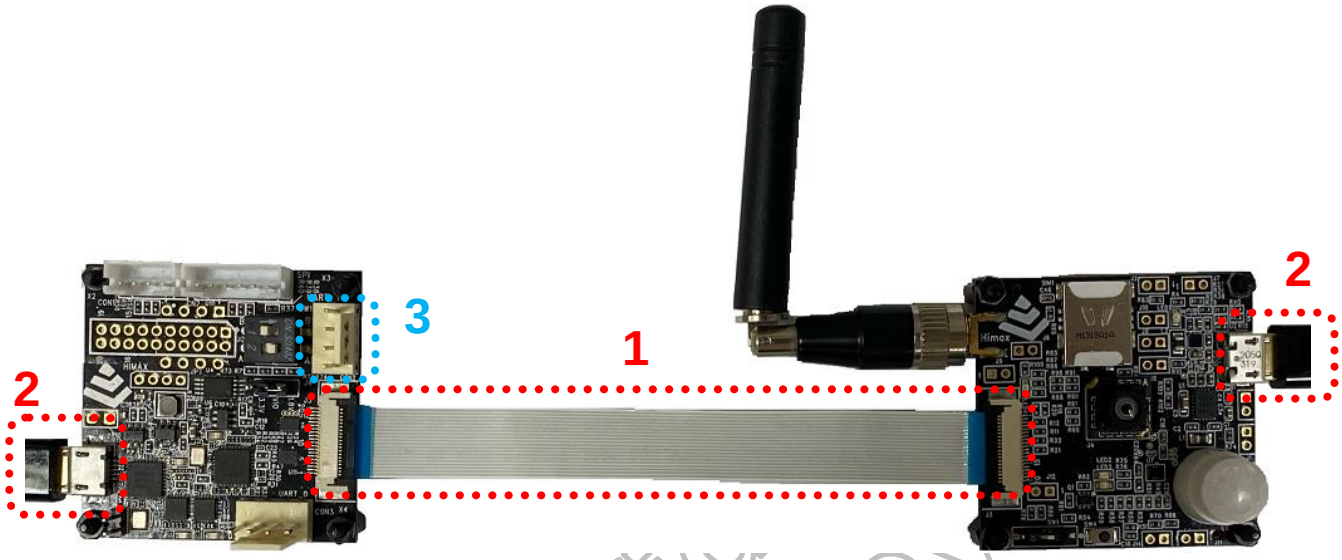


Figure 2.10: HX6539-A AIOT-NB-G3 platform setup

Item 1. Flex Cable **(20 Pin)**
Item 2. USB Cable **(I²C/SPI/Flash Download)**
Item 3. ASHLING JTAG ICE **(refer to Figure 2.11)**

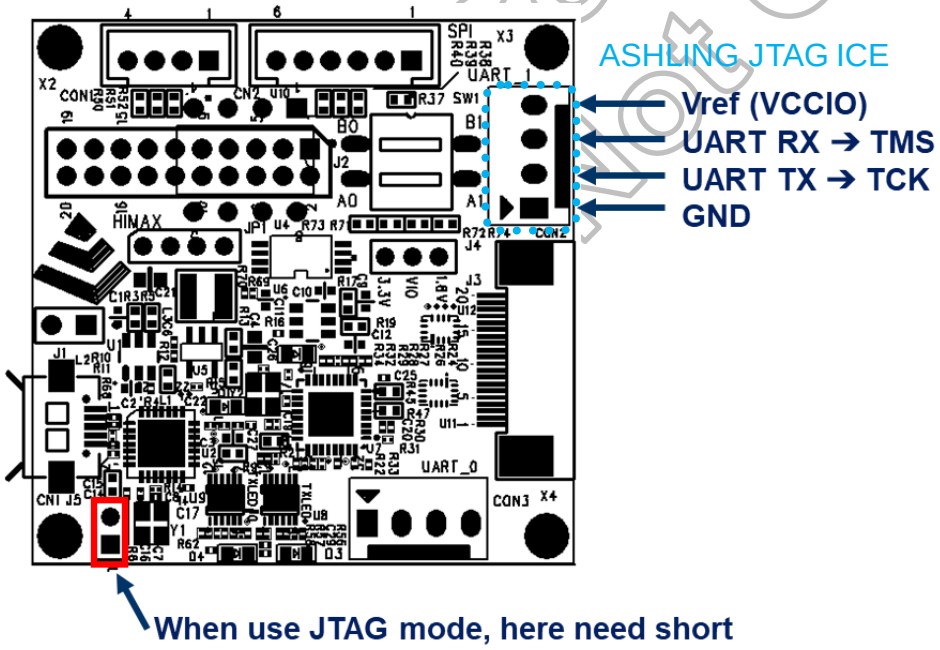


Figure 2.11: ASHLING JTAG ICE

2.4. HX6539-A AIOT-NB-G3 platform startup

Use the following procedure to startup the HX6539-A AIOT-NB-G3 platform.

A. Power on EVB
B. Flash image download
C. Reset AIOT-NB-G3 board
D. Check UART message output

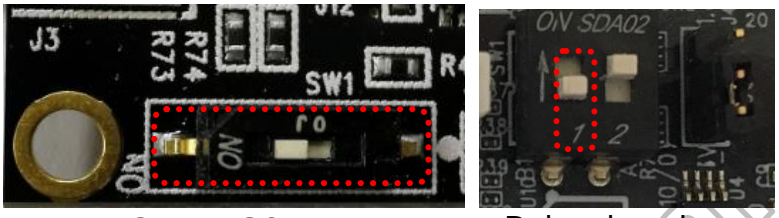
A. Power on EVB

The debug board and AIOT-NB-G3 are connected to the PC through each USB cable.

Figure 2.12: Debug board connect to AIOT-NB-G3 board

B. Flash image download

a. Use HMX-AIOT-NB-GX_GUI Tool: after power on EVB
- AIOT-NB-G3 board SW1 pin switch to “ON”
- Debug board SW1 pin 1 switch to “OFF”, pin 2 keep “ON”



AIOT-NB-G3 Debug board

Figure 2.13: Switch pin for flash image download

- Use HMX-AIOT-NB-GX_GUI to download EVB image

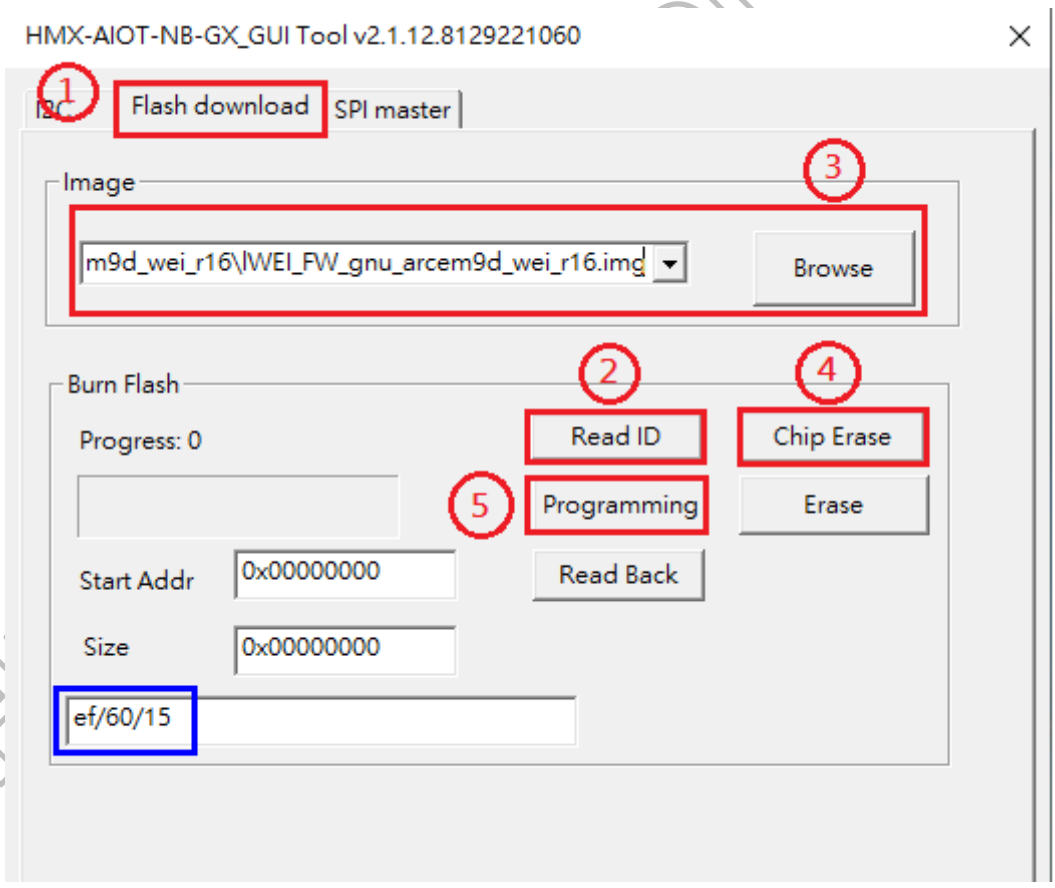
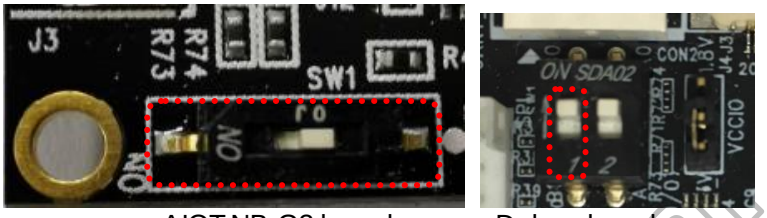


Figure 2.14: Flash image download by HMX-AIOT-NB-GX_GUI

Step 1: Open HMX-AIOT-NB-GX_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 *.img data

b. Download firmware use Metaware
- AIOT-NB-G3 board SW1 pin switch to “OFF”
- Debug board SW1 pin 1 switch to “ON”



AIOT-NB-G3 board Debug board

Figure 2.15: Switch pin for Metaware download firmware

- I2C Setting (load PLL_Script_24to400MHz_JTAG_B Script) before load elf.

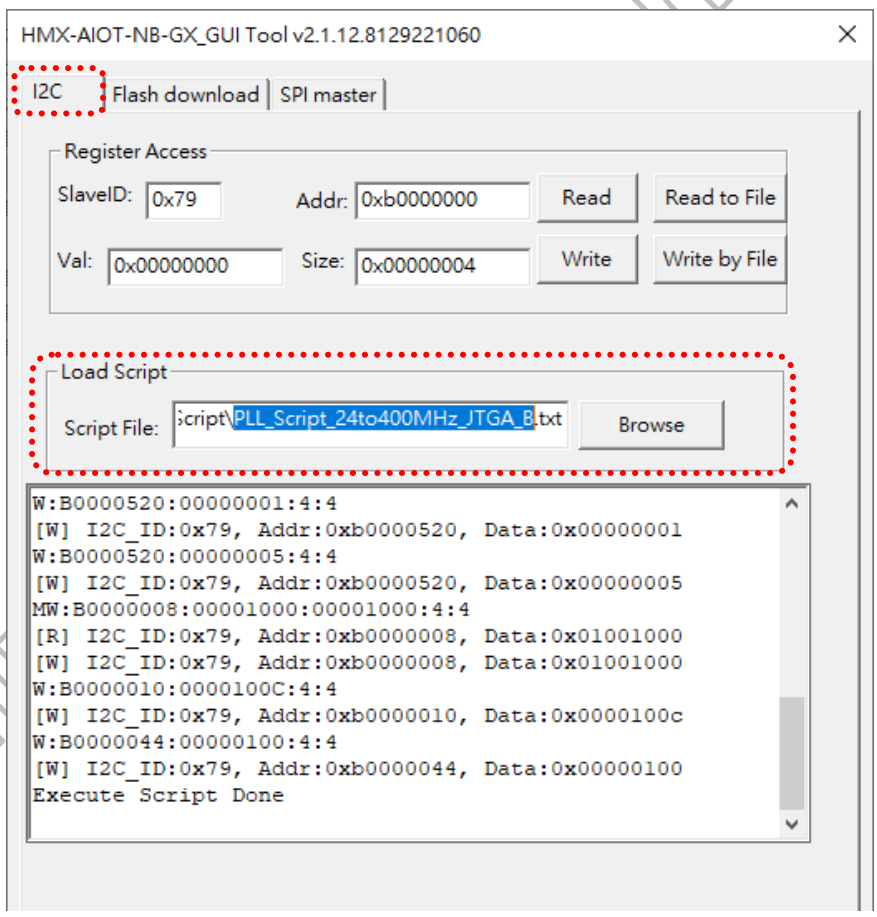


Figure 2.16: I2C load script file by HMX-AIOT-NB-GX_GUI for Metaware load elf

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

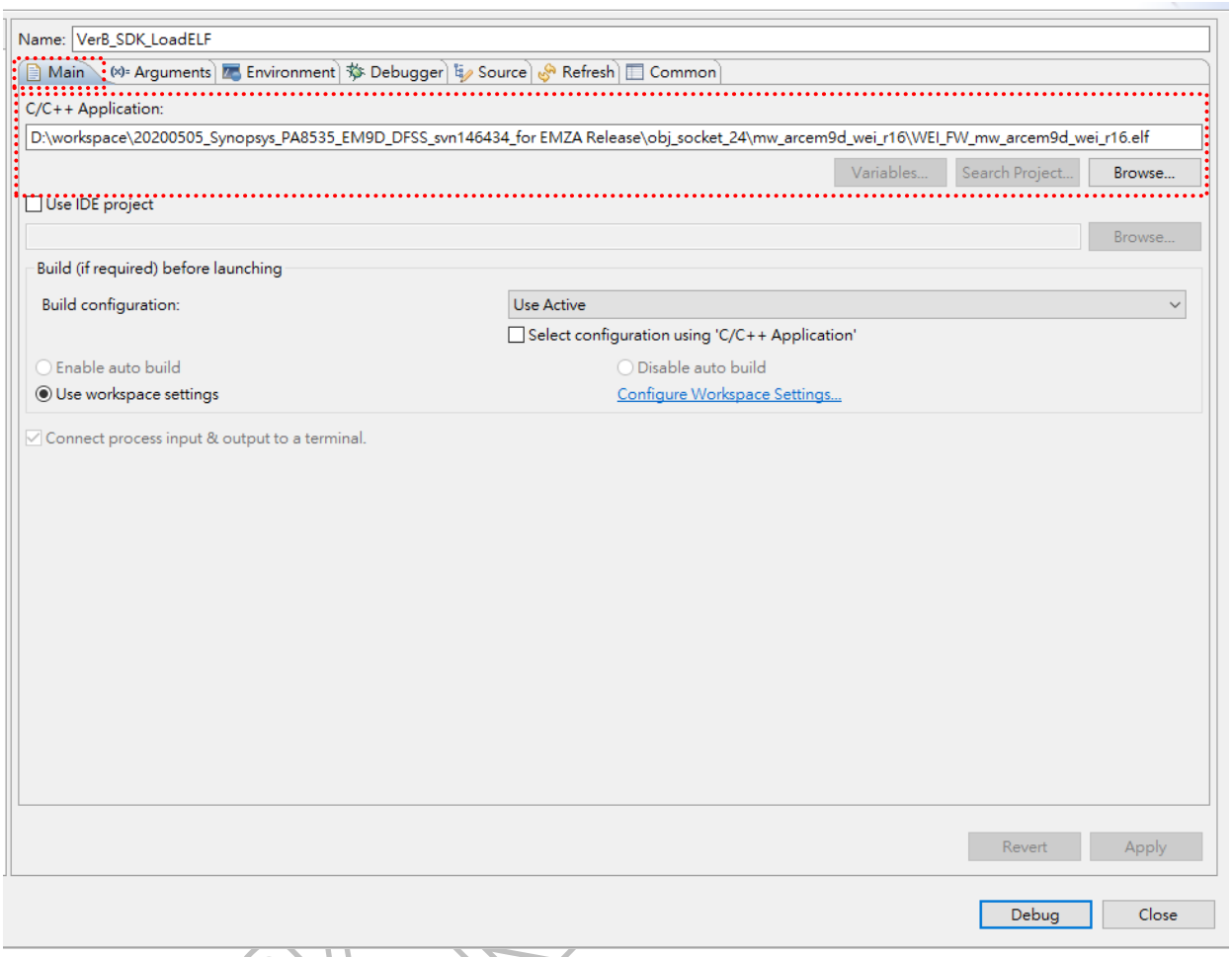


Figure 2.17: Metaware debug configuration I

- Set “Target Selection”

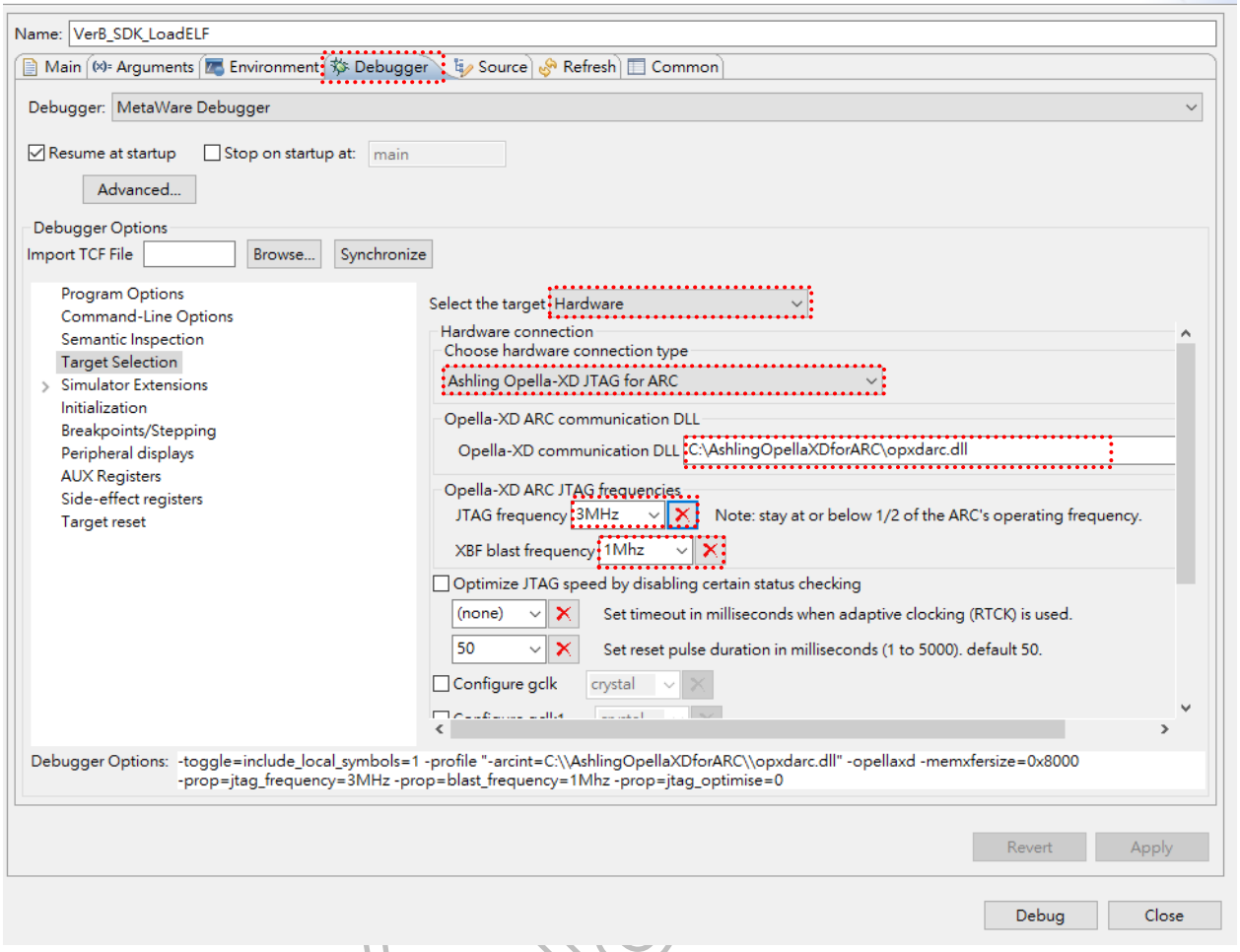


Figure 2.18: Metaware debug configuration II

- Start Debug

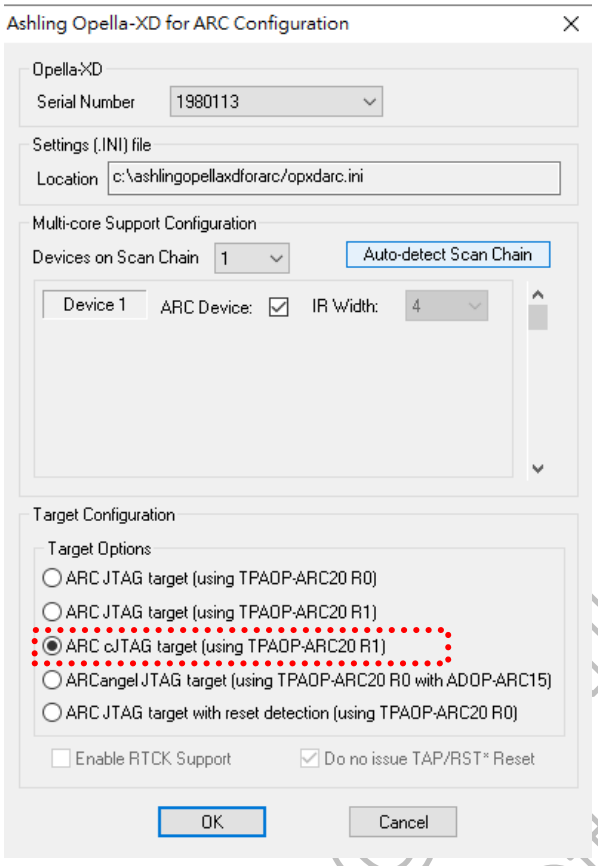


Figure 2.19: Metaware debug configuration III

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

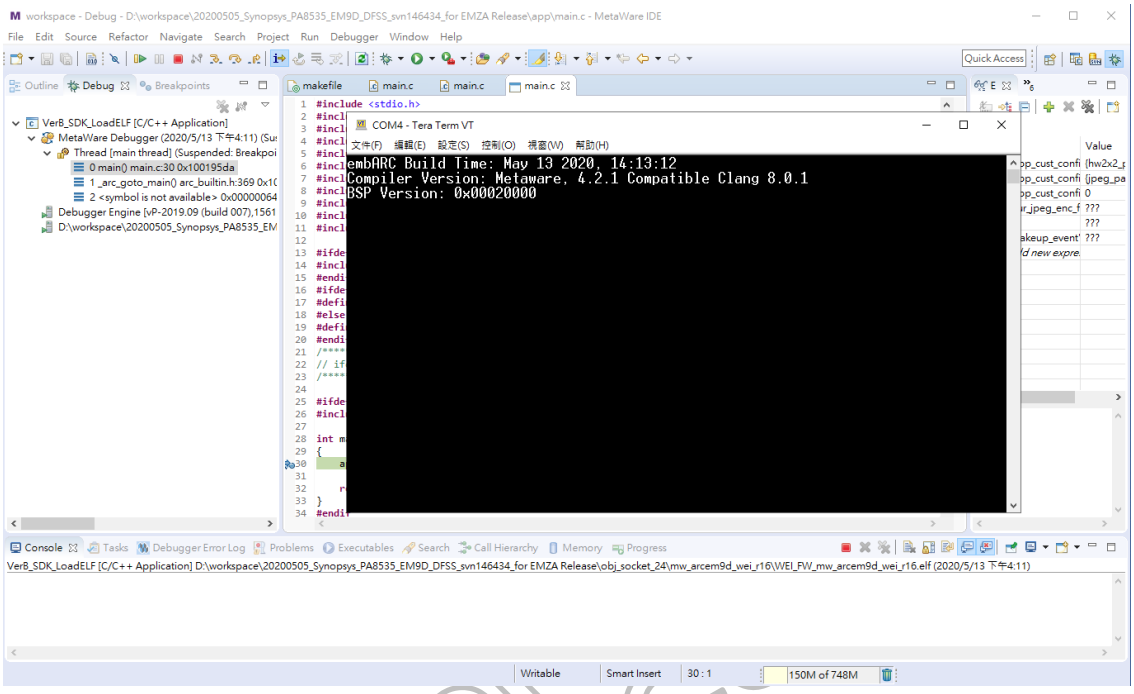


Figure 2.20: UART output message I

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

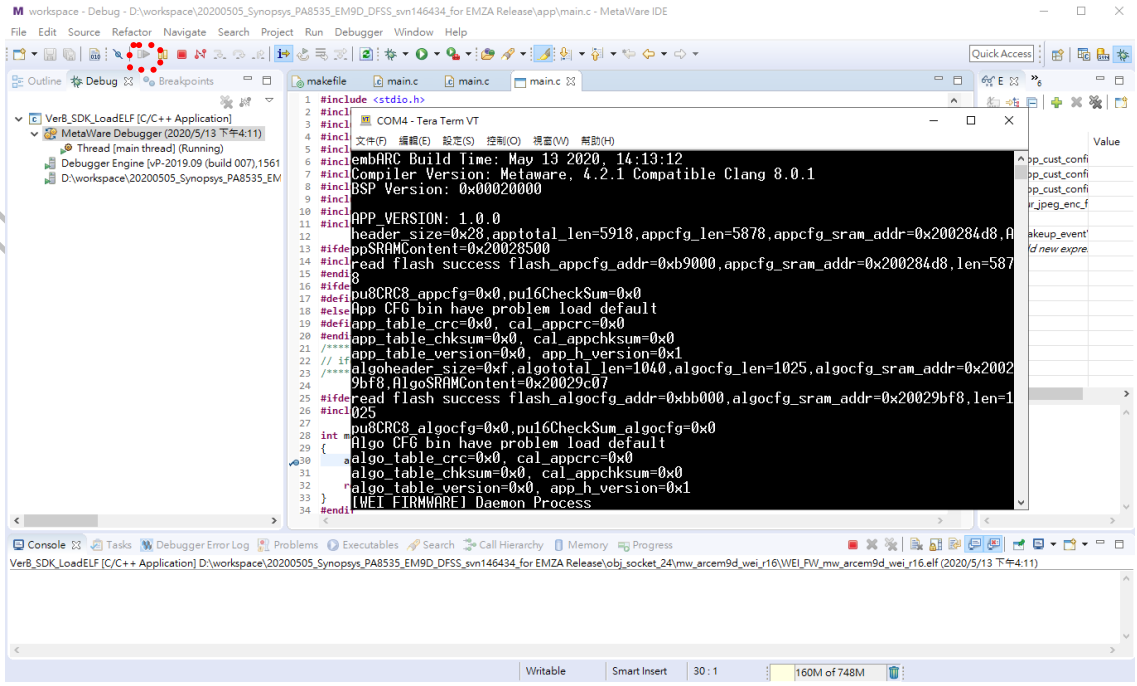


Figure 2.21: UART output message II

- 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.

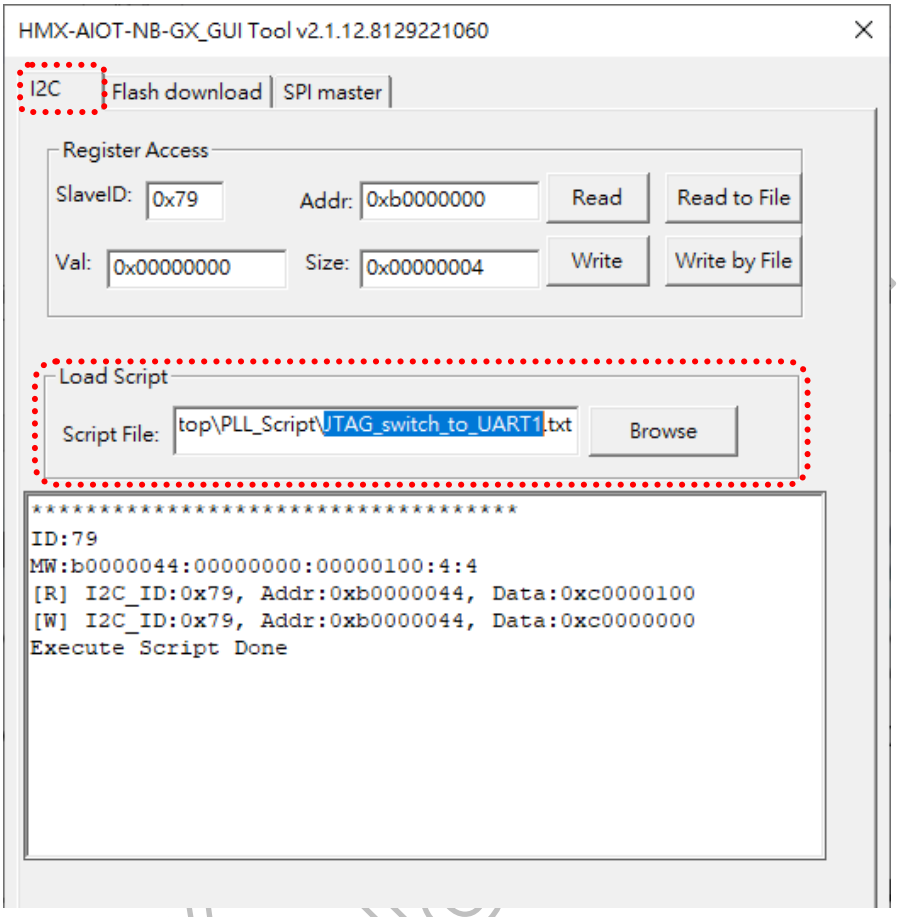


Figure 2.22: UART output message load script by HMX-AIOT-NB-GX_GUI Tool

C. Reset AIOT-NB-G3 board

The user can press the Reset button **(SW4)** to reset AIOT-NB-G3 board and restart the application program. Please note that SW1 should be in the "OFF" position.

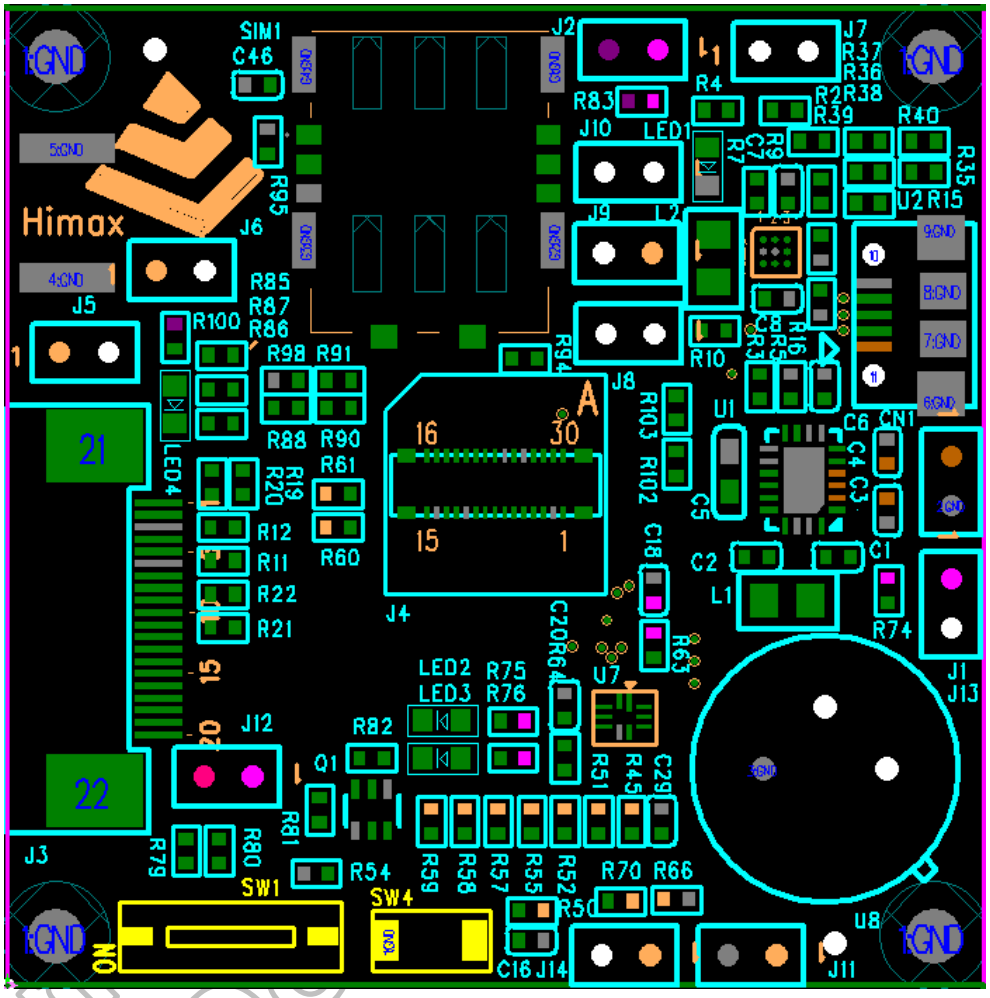


Figure 2.23: AIOT-NB-G3 board reset

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.)