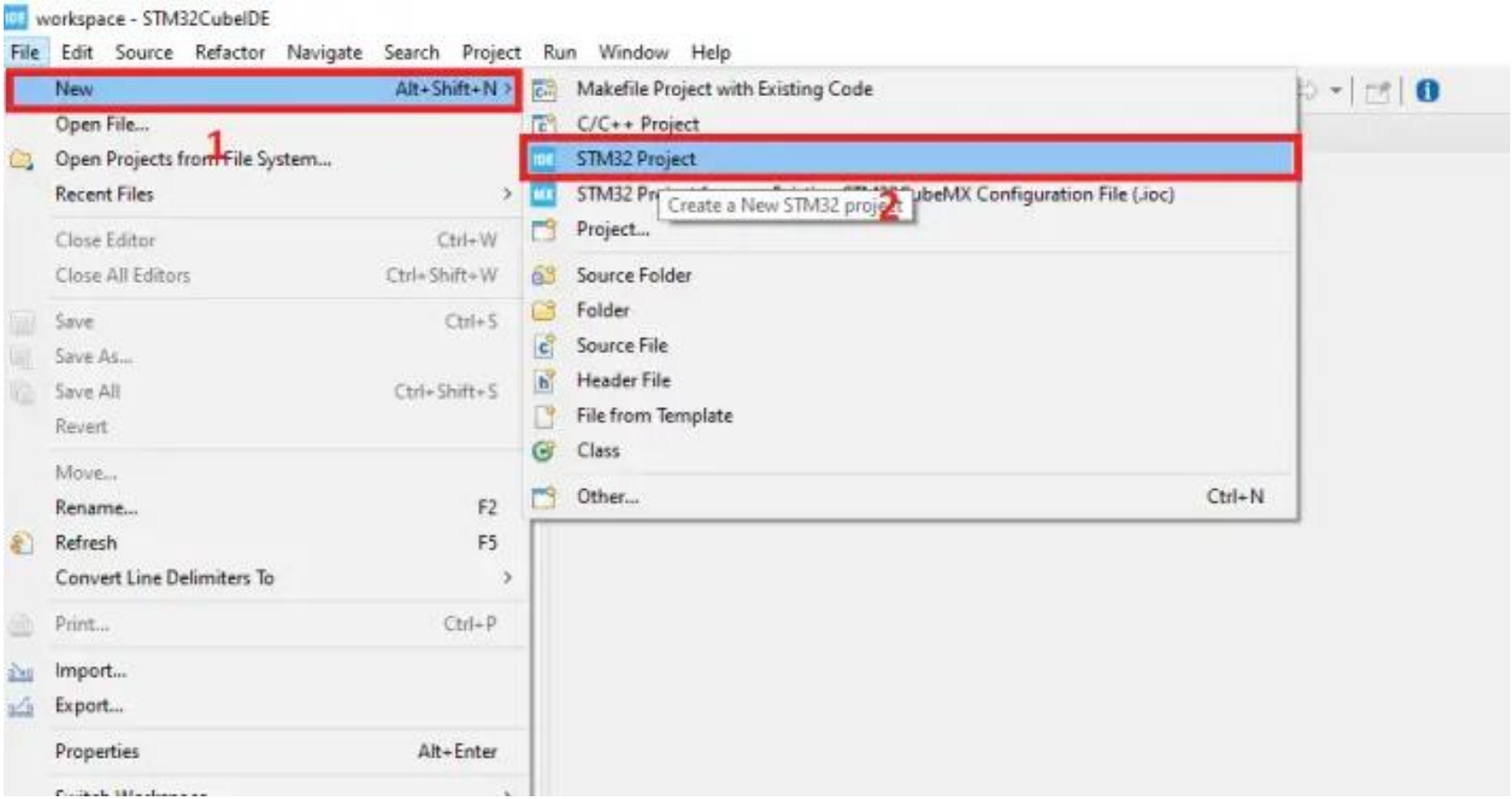
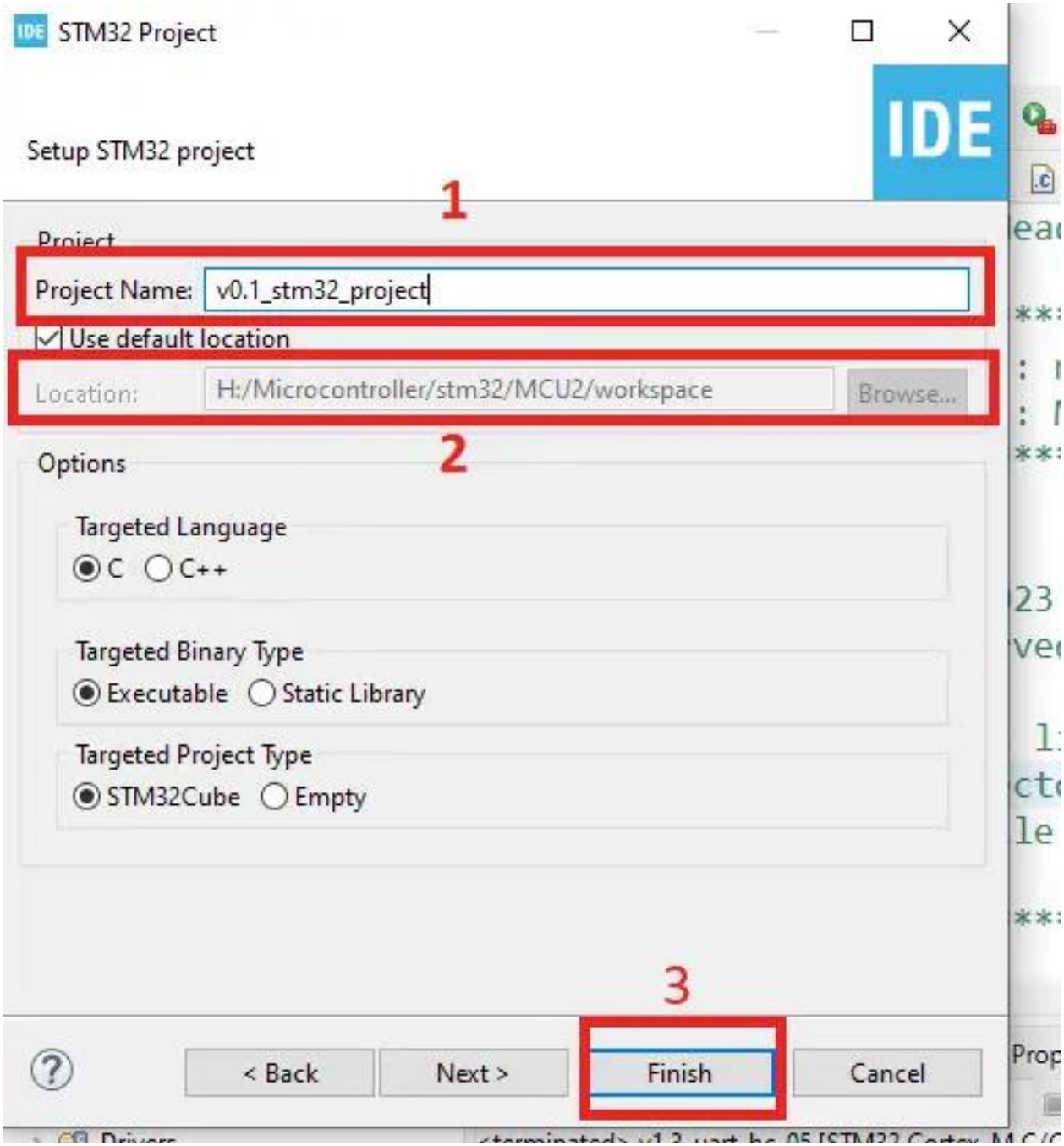
Project creation in Stm32Cube IDE



Select STWINBX1 board



Open MX and clear all Pinouts

SETTING UP LEDS

Find the pins and set them up as GPIO Output

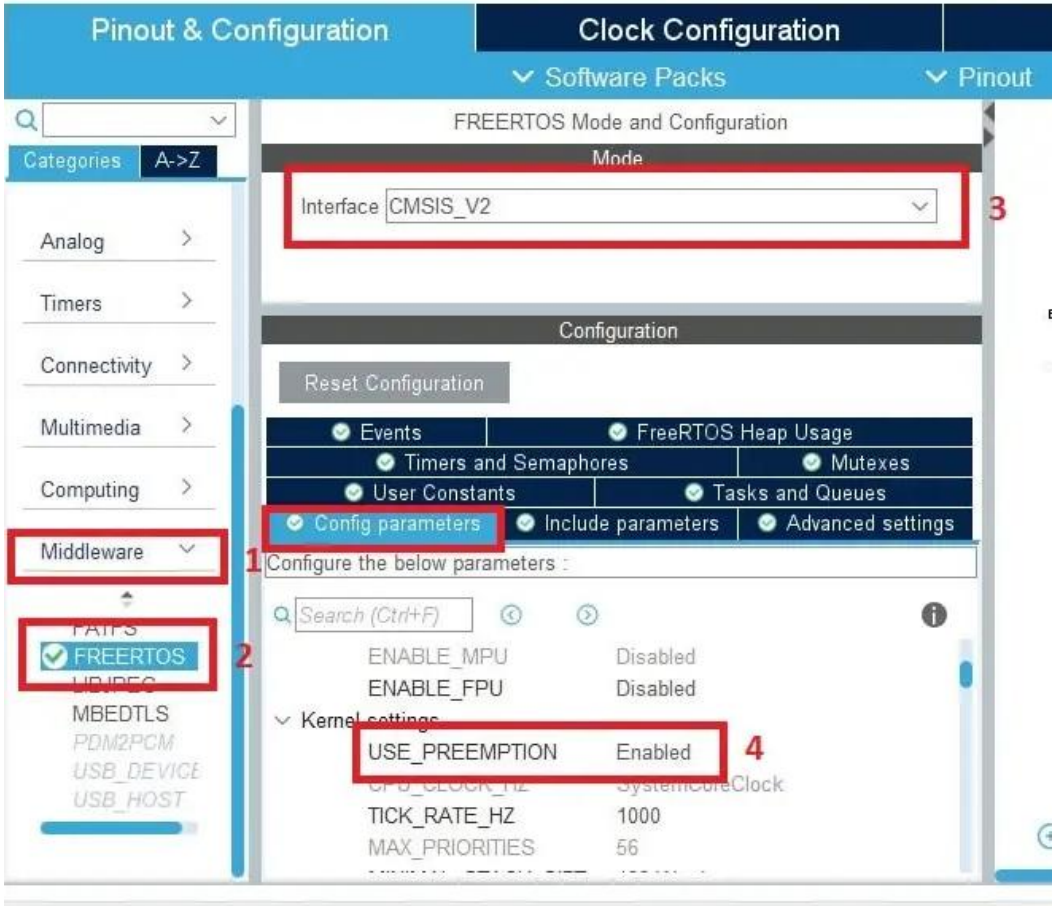
PH10	n/a	n/a	n/a	Low	Output Push Pull	No pull-up and no p...	Medium	n/a	LED2[ORANGE]	☑
PH12	n/a	n/a	n/a	Low	Output Push Pull	No pull-up and no p...	Medium	n/a	LED1[GREEN]	☑

Set up FreeRTOS

Download the middleware X-CUBE-FREERTOS

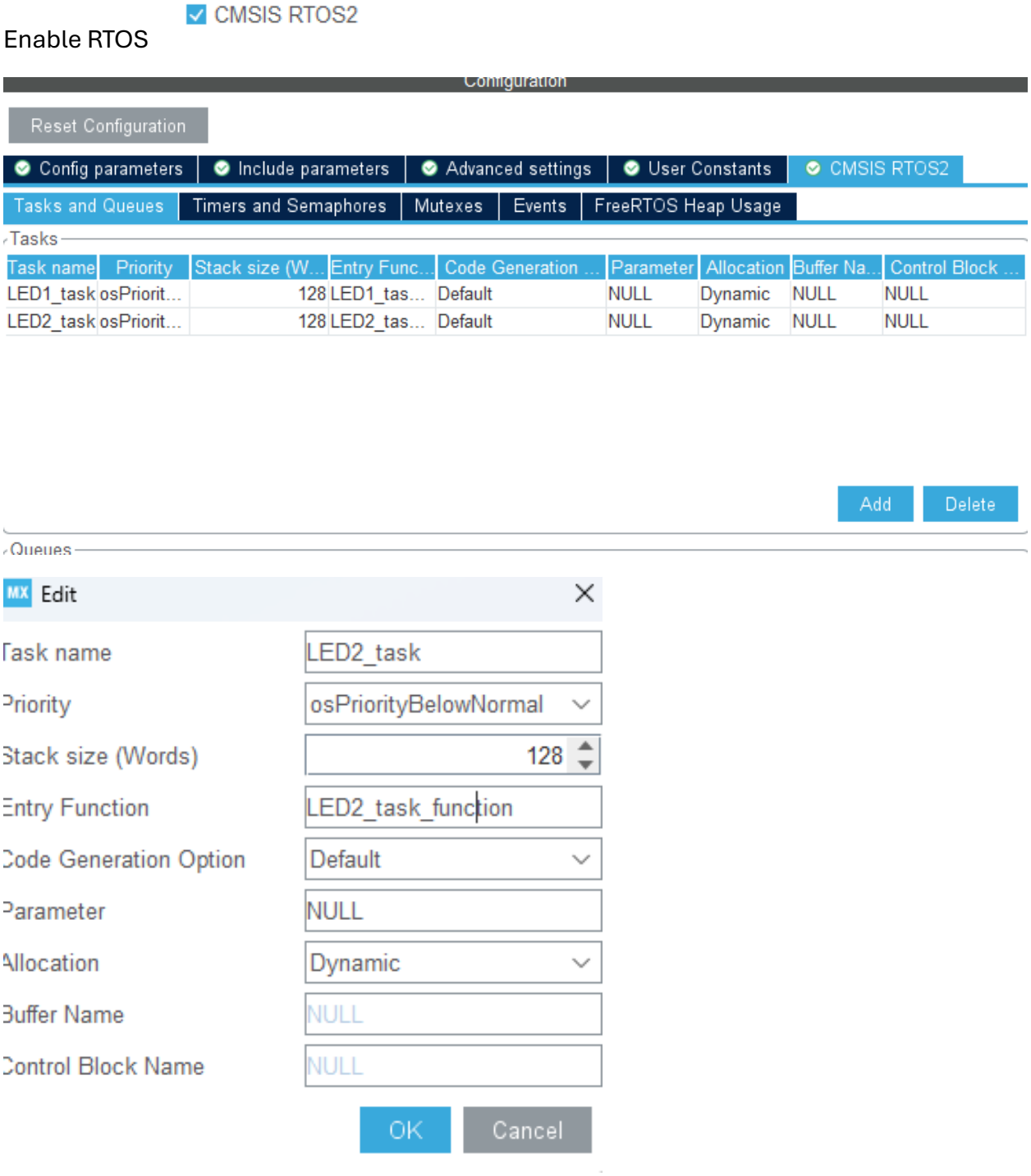
STMicroelectronics.X-CUBE-FREERTOS	✓	1.3.1	
CMSIS RTOS2	✓	10.6.2	
RTOS2	✓		
Core	✓	10.6.2	TZ_Non_Supported
Heap	✓	10.6.2	Heap_4

Then



Create tasks

Enable RTOS



Change timebase for SYS from SysTick to TIM3 (any available TIM)

Multitask toggle LED

```c
void LED1_task_function(void *argument)
{
  /* USER CODE BEGIN LED1_task */
  /* Infinite loop */
  for(;;)
  {
      HAL_GPIO_TogglePin(LED1_GPIO_Port, LED1_Pin);
      osDelay(500);
  }
  /* USER CODE END LED1_task */
}
```

Make sure both tasks toggle different LEDs

SET UP SPI

Set up the spi to mode 0

Mode	Full-Duplex Master
Hardware NSS Signal	Disable
Hardware RDY Signal	Disable

Configuration

Reset Configuration

Parameter Settings | User Constants | NVIC Settings | DMA Settings | GPIO Settings

Configure the below parameters :

Search (Ctrl+F)

Basic Parameters	
Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First
Clock Parameters	
Prescaler (for Baud Rate)	32
Baud Rate	4.0 MBits/s
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge
Autonomous Mode	
State	Disable
CRC Parameters	
CRC Calculation	Disabled
Advanced Parameters	
NSSP Mode	Enabled
NSS Signal Type	Software
Fifo Threshold	Fifo Threshold 01 Data
Nss Polarity	Nss Polarity Low
Master Ss Idleness	00 Cycle
Master Inter Data Idleness	00 Cycle
Master Receiver Auto Susp	Disable
Master Keep Io State	Master Keep Io State Disable
IO Swap	Disabled
Ready Master Management	Internal
Ready Signal Polarity	High

Make sure that the SPI pins MATCHES THE IIS3DWB datasheet

Pin Name	Signal on Pin	Pin Context Assign...	Pin Privilege access	GPIO output level	GPIO mode	GPIO Pull-up/Pull-d...	Maximum output sp...	Fast Mode	User Label	Modified
PD3	SPI2_MISO	n/a	n/a	n/a	Alternate Function ...	No pull-up and no p...	Low	n/a		☐
PI1	SPI2_SCK	n/a	n/a	n/a	Alternate Function ...	No pull-up and no p...	Low	n/a		☐
PI3	SPI2_MOSI	n/a	n/a	n/a	Alternate Function ...	No pull-up and no p...	Low	n/a		☐

Then set up the GPIO

Pin Name	Signal on Pin	Pin Context Assign...	Pin Privilege access	GPIO output level	GPIO mode	GPIO Pull-up/Pull-d...	Maximum output sp...	Fast Mode	User Label	Modified
PF12	n/a	n/a	n/a	Low	Output Push Pull	Pull-up	Medium	n/a	CS_DWB[IIS3DWB]	☑
PF15	n/a	n/a	Non-privileged access	n/a	External Interrupt M...	No pull-up and no p...	n/a	n/a	INT1[IIS3DWB]	☑
PH10	n/a	n/a	n/a	Low	Output Push Pull	No pull-up and no p...	Medium	n/a	LED2[ORANGE]	☑
PH12	n/a	n/a	n/a	Low	Output Push Pull	No pull-up and no p...	Medium	n/a	LED1[GREEN]	☑

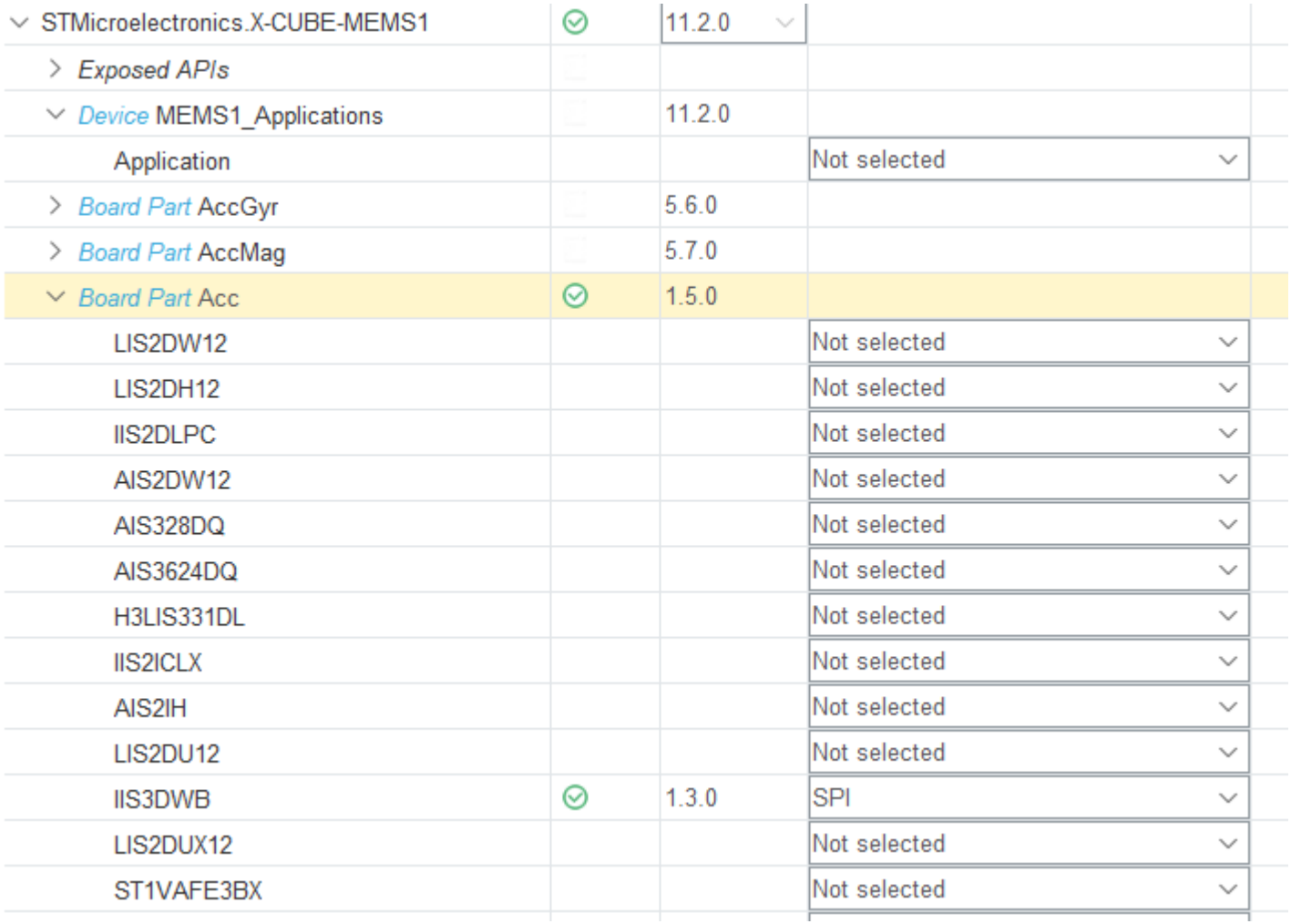
And interrupt

NVIC Interrupt Table	Enabled	Preemption Priority	Sub Priority
EXTI Line15 interrupt	☑	0	0

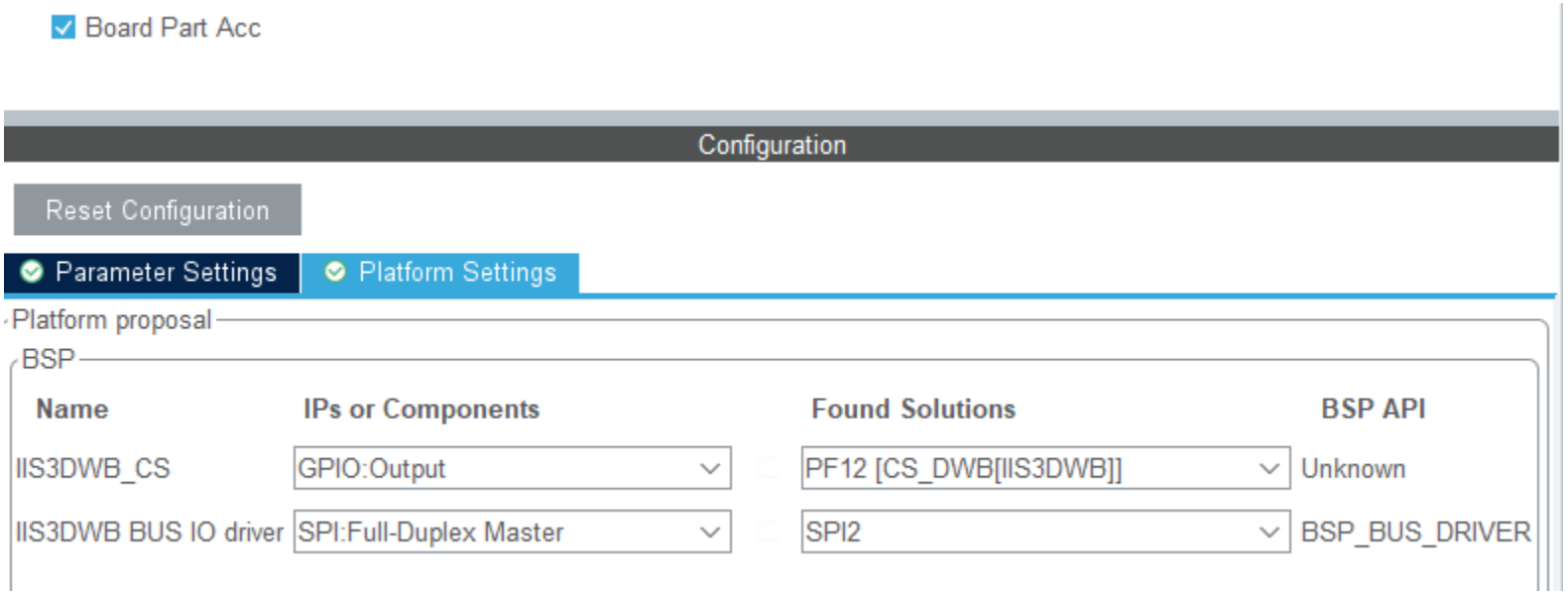
PLEASE MAKE SURE IT MATCHES THE ISS3DWB PINS IN DATASHEET

SETUP IIS3DWB

Download the middleware X-CUBE-MEMS1



Go to the middleware and set up this



CHECK WHO_AM_I REGISTER TO SEE IF SENSOR ON

In a new file vib_io.c

Add the includes needed

```c
#include "vib_io.h"
#include "iis3dwb_reg.h"
#include "steval_stwinbx1_bus.h"
#include "main.h"       // for CS_DWB_GPIO_Port, CS_DWB_Pin

extern SPI_HandleTypeDef hspi2;
static stmdev_ctx_t dev_ctx;
```

SPI Write Wrapper

```c
/*  SPI write wrapper: assert CS, send reg & data, de-assert CS */
static int32_t  drv_write(void *handle, uint8_t reg, uint8_t *bufp, uint16_t len) {
  HAL_GPIO_WritePin(CS_DWB_GPIO_Port, CS_DWB_Pin, GPIO_PIN_RESET);
  BSP_SPI2_Send(&reg, 1);
  BSP_SPI2_Send(bufp, len);
  HAL_GPIO_WritePin(CS_DWB_GPIO_Port, CS_DWB_Pin, GPIO_PIN_SET);
  return 0;
}
```

SPI Read Wrapper

```c
/*  SPI read wrapper: assert CS, send reg|0x80, read data, de-assert CS */
static int32_t  drv_read(void *handle, uint8_t reg, uint8_t *bufp, uint16_t len) {
  reg |= 0x80;
  HAL_GPIO_WritePin(CS_DWB_GPIO_Port, CS_DWB_Pin, GPIO_PIN_RESET);
  BSP_SPI2_Send(&reg, 1);
  BSP_SPI2_Recv(bufp, len);
  HAL_GPIO_WritePin(CS_DWB_GPIO_Port, CS_DWB_Pin, GPIO_PIN_SET);
  return 0;
}
```

Initialize the IIS3DWB

```c
/**
 * @brief  Initialize the IIS3DWB vibration sensor and configure it for data acquisition.
 *
 * This function performs the following:
 *  - Initializes the SPI interface for communication with the IIS3DWB sensor.
 *  - Sets up the STM32 sensor driver context with board-specific read/write functions.
 *  - Verifies the sensor is connected by reading the WHO_AM_I register.
 *  - Resets the IIS3DWB sensor to default configuration.
 *  - Configures the sensor for 3-axis measurement at 26.7 kHz, 2g full scale, with block data update.
 *  - Sets the output data filter path to 6.3 kHz bandwidth.
 *  - Enables the data-ready interrupt on INT1.
 *
 * @retval 0   Initialization and configuration successful.
 * @retval -1  SPI interface initialization failed.
 * @retval -2  IIS3DWB sensor not found (WHO_AM_I mismatch).
 */
```

```c
int32_t vib_io_init(void)
{
  uint8_t whoamI, rst;

  /* 1) bring up the SPI bus */
  if (BSP_SPI2_Init() != BSP_ERROR_NONE)            return -1;


  /* 2) hook our wrappers into the ST driver */
  dev_ctx.write_reg = drv_write;
  dev_ctx.read_reg  = drv_read;
  dev_ctx.handle    = &hspi2;
  dev_ctx.mdelay    = HAL_Delay;

  /* 3) check device ID */
  iis3dwb_device_id_get(&dev_ctx, &whoamI);
```

```
  if (whoamI != IIS3DWB_ID)                          return -2;          // WHO_AM_I_EXPECTED 0x7B


  /* 4) reset sensor */
  iis3dwb_reset_set(&dev_ctx, PROPERTY_ENABLE);
  do {
    iis3dwb_reset_get(&dev_ctx, &rst);
  } while (rst);

  /* 5) basic configuration */
  iis3dwb_block_data_update_set(&dev_ctx, PROPERTY_ENABLE);
  iis3dwb_xl_data_rate_set  (&dev_ctx, IIS3DWB_XL_ODR_26k7Hz);
  iis3dwb_xl_full_scale_set(&dev_ctx, IIS3DWB_2g);
  iis3dwb_xl_filt_path_on_out_set(&dev_ctx, IIS3DWB_LP_6k3Hz);

  /* 6) enable data-ready interrupt on INT1 */
  iis3dwb_int1_ctrl_t int1_ctrl;
  iis3dwb_read_reg(&dev_ctx, IIS3DWB_INT1_CTRL, (uint8_t *)&int1_ctrl, 1);
  int1_ctrl.int1_drdy_xl = 1;
  iis3dwb_write_reg(&dev_ctx, IIS3DWB_INT1_CTRL, (uint8_t *)&int1_ctrl, 1);

  return 0;
}
```

In a new file vib_io.h

Add the header

```
#ifndef VIB_IO_H
#define VIB_IO_H

#include <stdint.h>
#include "iis3dwb_reg.h"
#include "stm32u5xx_hal.h"

/* call once at startup. returns 0 on success */
int32_t  vib_io_init(void);

#endif /* VIB_IO_H */
```

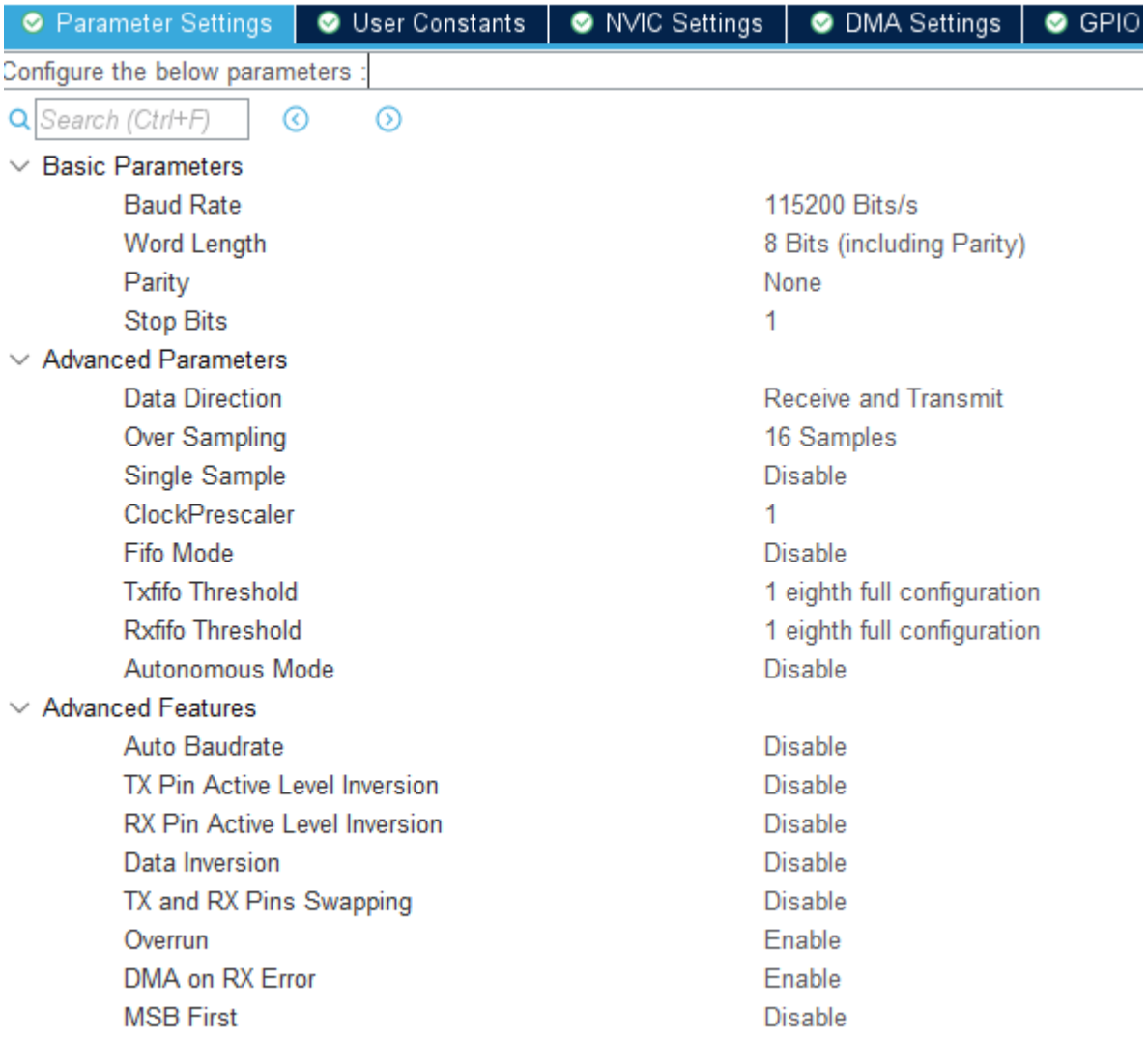
In main.c

Add check code in user code 2

```
/* USER CODE BEGIN 2 */
  if(vib_io_init() != 0)  HAL_GPIO_TogglePin(LED2_GPIO_Port, LED2_Pin); // LED2[ORANGE] ON
  else                                HAL_GPIO_TogglePin(LED1_GPIO_Port, LED1_Pin); // LED1[GREEN] ON
  /* USER CODE END 2 */
```

SETUP USART

Enable usart2 in connectivity, set up its mode to Asynchronous



Pin Name	Signal ...	Pin Cont...	Pin Privi...	GPIO o...	GPIO ...	GPIO P...	Maximu...	Fast M...	User Label	Modified
PA15 (JTDI)	USART...	n/a	n/a	n/a	Alternat...	No pull-...	Low	n/a		☐
PD5	USART...	n/a	n/a	n/a	Alternat...	No pull-...	Low	n/a		☐

Code example

```
static uint8_t tx_buffer[2000];
num = number;
snprintf((char *)tx_buffer, sizeof(tx_buffer), "Text %d \r\n", num);
HAL_UART_Transmit(&huart2, tx_buffer, strlen((char const *)tx_buffer), 1000);
```

SETUP FIFO

In init function, add initialization of fifo

```
iis3dwb_fifo_watermark_set(&dev_ctx, FIFO_WATERMARK); // 1. Set FIFO threshold (samples)
iis3dwb_fifo_mode_set(&dev_ctx, IIS3DWB_STREAM_MODE); // 2. Set FIFO mode to stop collecting data when FIFO is full
```

in interrupt handler

set a flag

```
if(GPIO_Pin == INT1_Pin){
            fifo_int_flag = 1;  // Set the flag

      } else {
            __NOP();
        }
```

now to read the fifo,

you read the watermark flag, then read the entries and reset fifo

```
iis3dwb_fifo_status_get(&dev_ctx, &fifo_status);
```

```
/* read out all FIFO entries in a single read */
            iis3dwb_fifo_out_multi_raw_get(&dev_ctx, fifo_data, num);
            // Reset FIFO
            iis3dwb_fifo_mode_set(&dev_ctx, IIS3DWB_BYPASS_MODE);
            iis3dwb_fifo_mode_set(&dev_ctx, IIS3DWB_STREAM_MODE);
            for (k = 0; k < num; k++) {
                  iis3dwb_fifo_out_raw_t *f_data;

                  /* print out first two and last two FIFO entries only */
                  if (k > 1 && k < num - 2) continue;

                  f_data = &fifo_data[k];

                  /* Read FIFO sensor value */
```

```
                datax = (int16_t *)&f_data->data[0];
                datay = (int16_t *)&f_data->data[2];
                dataz = (int16_t *)&f_data->data[4];
                ts = (int32_t *)&f_data->data[0];

                switch (f_data->tag >> 3) {
                case IIS3DWB_XL_TAG:
                        snprintf((char *)tx_buffer, sizeof(tx_buffer), "%d: ACC [mg]:\t%4.0f\t%4.0f\t%4.0f\r\n",
                                        k,
                                        iis3dwb_from_fs8g_to_mg(*datax),
                                        iis3dwb_from_fs8g_to_mg(*datay),
                                        iis3dwb_from_fs8g_to_mg(*dataz));
                        HAL_UART_Transmit(&huart2, tx_buffer, strlen((char const *)tx_buffer), 1000);
                        break;
                default:
                        break;
                }
        }
```