



## 1. Description

### 1.1. Project

Project Name	BLE_Comm
Board Name	NUCLEO-L496ZG-P
Generated with:	STM32CubeMX 6.9.2
Date	11/27/2023

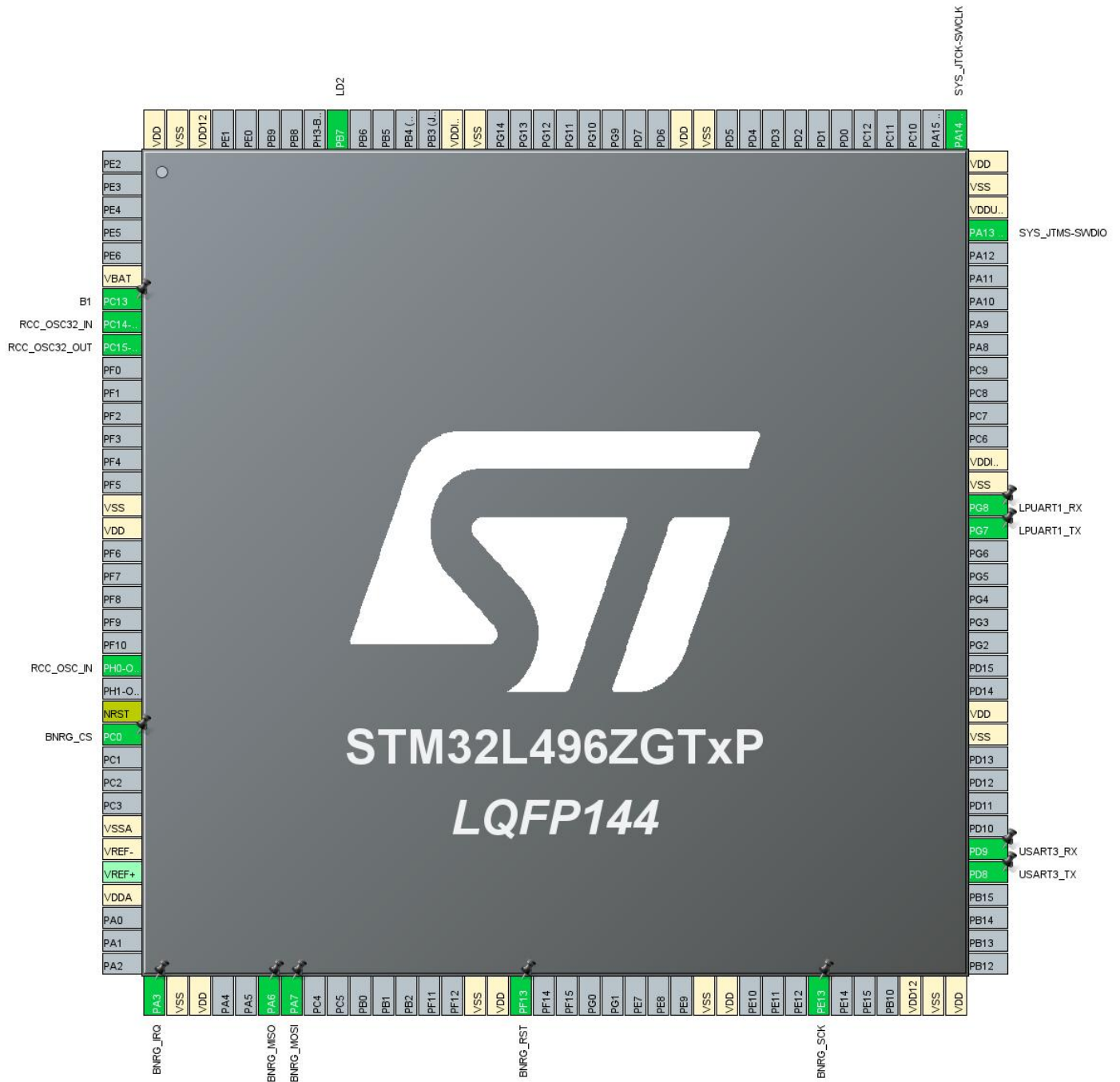
### 1.2. MCU

MCU Series	STM32L4
MCU Line	STM32L4x6
MCU name	STM32L496ZGTxP
MCU Package	LQFP144
MCU Pin number	144

### 1.3. Core(s) information

Core(s)	Arm Cortex-M4
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## 2. Pinout Configuration



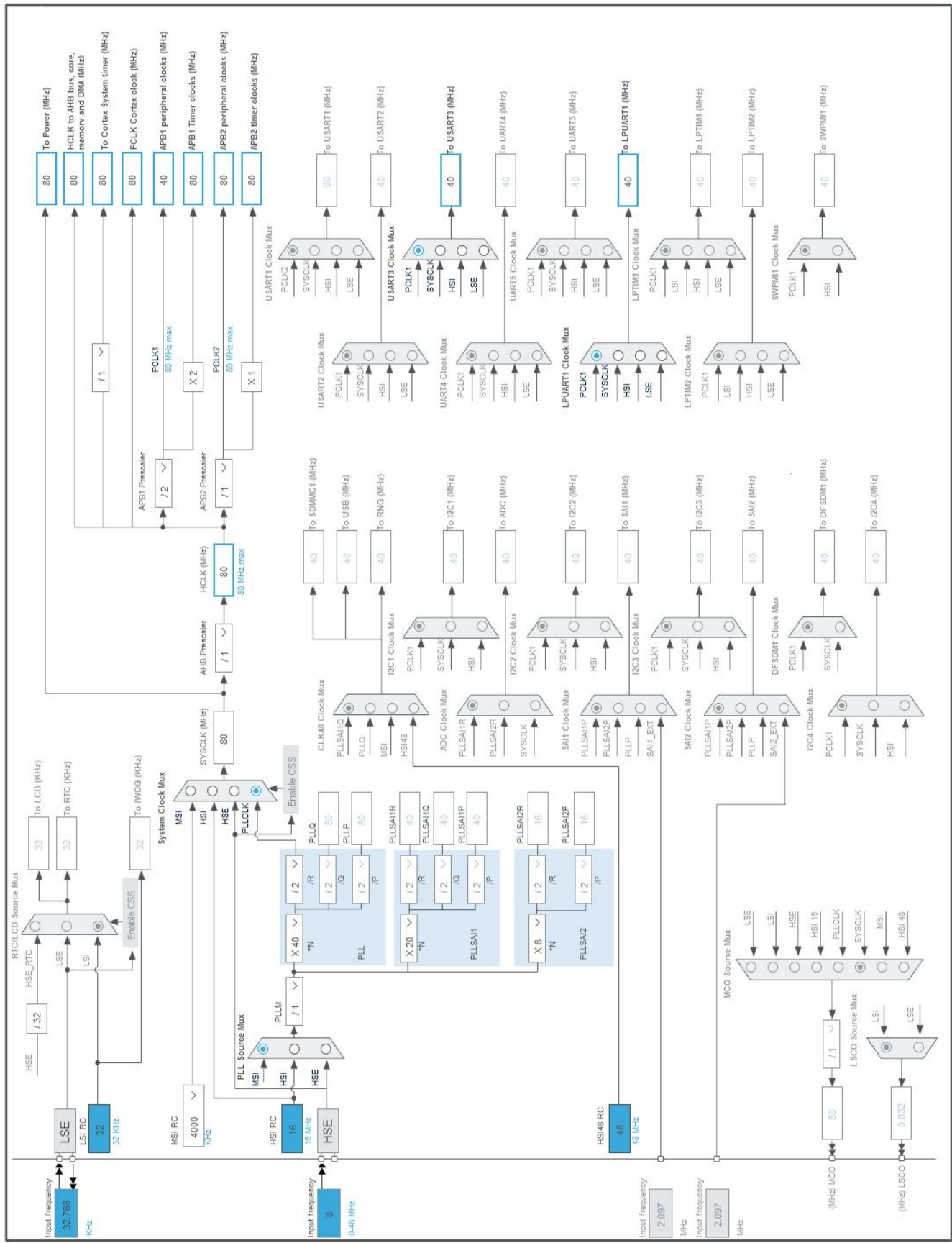
### 3. Pins Configuration

Pin Number LQFP144	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
6	VBAT	Power		
7	PC13	I/O	GPIO_EXTI13	B1
8	PC14-OSC32_IN (PC14)	I/O	RCC_OSC32_IN	
9	PC15-OSC32_OUT (PC15)	I/O	RCC_OSC32_OUT	
16	VSS	Power		
17	VDD	Power		
23	PH0-OSC_IN (PH0)	I/O	RCC_OSC_IN	
25	NRST	Reset		
26	PC0 *	I/O	GPIO_Output	BNRG_CS
30	VSSA	Power		
31	VREF-	Power		
33	VDDA	Power		
37	PA3	I/O	GPIO_EXTI3	BNRG_IRQ
38	VSS	Power		
39	VDD	Power		
42	PA6	I/O	SPI1_MISO	BNRG_MISO
43	PA7	I/O	SPI1_MOSI	BNRG_MOSI
51	VSS	Power		
52	VDD	Power		
53	PF13 *	I/O	GPIO_Output	BNRG_RST
61	VSS	Power		
62	VDD	Power		
66	PE13	I/O	SPI1_SCK	BNRG_SCK
70	VDD12	Power		
71	VSS	Power		
72	VDD	Power		
77	PD8	I/O	USART3_TX	
78	PD9	I/O	USART3_RX	
83	VSS	Power		
84	VDD	Power		
92	PG7	I/O	LPUART1_TX	
93	PG8	I/O	LPUART1_RX	
94	VSS	Power		
95	VDDIO2	Power		
105	PA13 (JTMS/SWDIO)	I/O	SYS_JTMS-SWDIO	
106	VDDUSB	Power		

Pin Number LQFP144	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
107	VSS	Power		
108	VDD	Power		
109	PA14 (JTCK/SWCLK)	I/O	SYS_JTCK-SWCLK	
120	VSS	Power		
121	VDD	Power		
130	VSS	Power		
131	VDDIO2	Power		
136	PB7 *	I/O	GPIO_Output	LD2
142	VDD12	Power		
143	VSS	Power		
144	VDD	Power		

\* The pin is affected with an I/O function

## 4. Clock Tree Configuration



## 5. Software Project

### 5.1. Project Settings

Name	Value
Project Name	BLE_Comm
Project Folder	C:\Users\kaushik\Documents\CubeIDE\BLE_Comm
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_L4 V1.18.0
Application Structure	Advanced
Generate Under Root	Yes
Do not generate the main()	No
Minimum Heap Size	0x200
Minimum Stack Size	0xD00

### 5.2. Code Generation Settings

Name	Value
STM32Cube MCU packages and embedded software	Add necessary library files as reference in the toolchain project configuration file
Generate peripheral initialization as a pair of '.c/.h' files	No
Backup previously generated files when re-generating	No
Keep User Code when re-generating	Yes
Delete previously generated files when not re-generated	Yes
Set all free pins as analog (to optimize the power consumption)	No
Enable Full Assert	No

### 5.3. Advanced Settings - Generated Function Calls

Rank	Function Name	Peripheral Instance Name
1	SystemClock_Config	RCC
2	MX_GPIO_Init	GPIO
3	MX_CRC_Init	CRC
4	MX_LPUART1_UART_Init	LPUART1
5	MX_BlueNRG_2_Init	STMicroelectronics.X-CUBE-BLE2.3.3.0
6	MX_BlueNRG_2_Process	STMicroelectronics.X-CUBE-BLE2.3.3.0

## 1. Power Consumption Calculator report

### 1.1. Microcontroller Selection

Series	STM32L4
Line	STM32L4x6
MCU	STM32L496ZGTxP
Datasheet	DS11585_Rev2

### 1.2. Parameter Selection

Temperature	25
Vdd	3.0

### 1.3. Battery Selection

Battery	Li-SOCL2(A3400)
Capacity	3400.0 mAh
Self Discharge	0.08 %/month
Nominal Voltage	3.6 V
Max Cont Current	100.0 mA
Max Pulse Current	200.0 mA
Cells in series	1
Cells in parallel	1



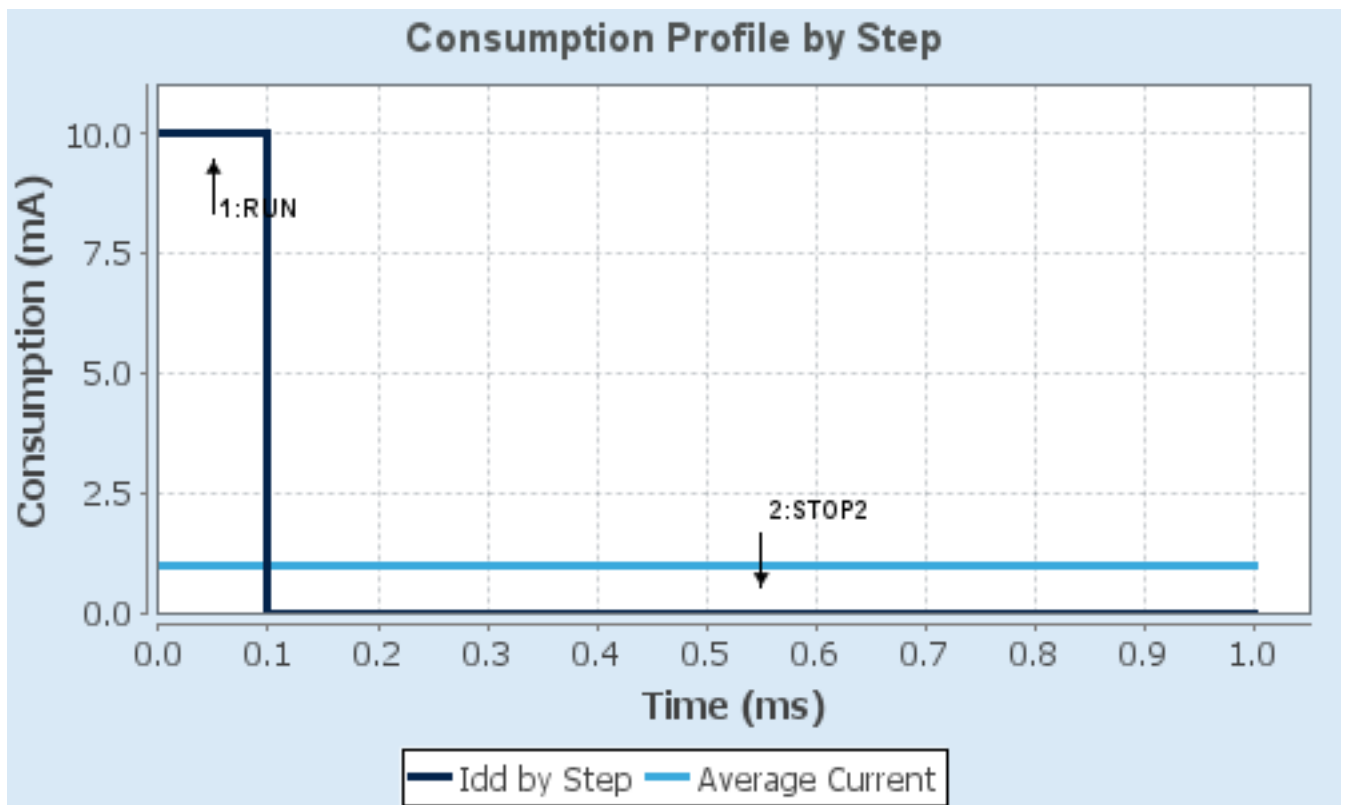
#### 1.4. Sequence

<b>Step</b>	Step1	Step2
<b>Mode</b>	RUN	STOP2
<b>Vdd</b>	3.0	3.0
<b>Voltage Source</b>	Battery	Battery
<b>Range</b>	Range1-High	NoRange
<b>Fetch Type</b>	FLASH	n/a
<b>CPU Frequency</b>	80 MHz	0 Hz
<b>Clock Configuration</b>	HSE BYP PLL Flash-ON	ALL CLOCKS OFF
<b>Clock Source Frequency</b>	4 MHz	0 Hz
<b>Peripherals</b>		
<b>Additional Cons.</b>	0 mA	0 mA
<b>Average Current</b>	10 mA	2.69 $\mu$ A
<b>Duration</b>	0.1 ms	0.9 ms
<b>DMIPS</b>	100.0	0.0
<b>Ta Max</b>	104.04	105
<b>Category</b>	In DS Table	In DS Table

#### 1.5. Results

Sequence Time	1 ms	Average Current	1 mA
Battery Life	4 months, 19 days, 3 hours	Average DMIPS	100.0 DMIPS

#### 1.6. Chart



## 2. Peripherals and Middlewares Configuration

### 2.1. CRC

**mode: Activated**

#### 2.1.1. Parameter Settings:

**Basic Parameters:**

Default Polynomial State	Enable
Default Init Value State	Enable

**Advanced Parameters:**

Input Data Inversion Mode	None
Output Data Inversion Mode	Disable
Input Data Format	Bytes

### 2.2. LPUART1

**Mode: Asynchronous**

#### 2.2.1. Parameter Settings:

**Basic Parameters:**

Baud Rate	115200 *
Word Length	8 Bits (including Parity) *
Parity	None
Stop Bits	1

**Advanced Parameters:**

Data Direction	Receive and Transmit
Single Sample	Disable

**Advanced Features:**

Auto Baudrate Mode	Disable
TX Pin Active Level Inversion	Disable
RX Pin Active Level Inversion	Disable
Data Inversion	Disable
TX and RX pins Swapping	Disable
Overrun	Enable
DMA on RX Error	Enable
MSB First	Disable

## 2.3. RCC

### High Speed Clock (HSE): BYPASS Clock Source

### Low Speed Clock (LSE) : Crystal/Ceramic Resonator

#### 2.3.1. Parameter Settings:

##### System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Disabled
Data Cache	Enabled
Flash Latency(WS)	4 WS (5 CPU cycle)

##### RCC Parameters:

HSI Calibration Value	64
MSI Calibration Value	0
HSE Startup Timeout Value (ms)	100
LSE Startup Timeout Value (ms)	5000

##### Power Parameters:

Power Regulator Voltage Scale	Power Regulator Voltage Scale 1
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## 2.4. SPI1

### Mode: Full-Duplex Master

#### 2.4.1. Parameter Settings:

##### Basic Parameters:

Frame Format	Motorola
Data Size	<b>8 Bits *</b>
First Bit	MSB First

##### Clock Parameters:

Prescaler (for Baud Rate)	<b>64 *</b>
Baud Rate	<b>1.25 MBits/s *</b>
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	<b>2 Edge *</b>

##### Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Software

## 2.5. SYS

**Debug: Serial Wire**

**Timebase Source: SysTick**

## 2.6. USART3

**Mode: Asynchronous**

### 2.6.1. Parameter Settings:

#### **Basic Parameters:**

Baud Rate	115200
Word Length	8 Bits (including Parity)
Parity	None
Stop Bits	1

#### **Advanced Parameters:**

Data Direction	Receive and Transmit
Over Sampling	16 Samples
Single Sample	Disable

#### **Advanced Features:**

Auto Baudrate	Disable
TX Pin Active Level Inversion	Disable
RX Pin Active Level Inversion	Disable
Data Inversion	Disable
TX and RX Pins Swapping	Disable
Overrun	Enable
DMA on RX Error	Enable
MSB First	Disable

## 2.7. STMicroelectronics.X-CUBE-BLE2.3.3.0

**mode: WirelessJjBlueNRGAa2**

**mode: DeviceJjBLE2liApplications**

### 2.7.1. Parameter Settings:

#### **Log & Debug:**

BLE2_DEBUG	0: No debug message
PRINT_CSV_FORMAT	0: .csv format message print disabled
BLUENRG2_DEBUG	0: No debug message

#### **Basic Parameters:**

HCI_READ_PACKET_SIZE	128
HCI_MAX_PAYLOAD_SIZE	128
HCI_READ_PACKET_NUM_MAX	10
<b>Connection Parameters (for expert users):</b>	
Scan Interval (SCAN_P)	16384
Scan Window (SCAN_L)	16384
Supervision Timeout (SUPERV_TIMEOUT)	60
Min Connection Period (CONN_P1)	40
Max Connection Period (CONN_P2)	40
Min Connection Length (CONN_L1)	2000
Max Connection Length (CONN_L2)	2000
Advertising Type (ADV_DATA_TYPE)	Connectable Undirected Advertising (ADV_IND)
Min Advertising Interval (ADV_INTERV_MIN)	2048
Max Advertising Interval (ADV_INTERV_MAX)	4096
Min Connection Event Interval (L2CAP_INTERV_MIN)	9
Max Connection Event Interval (L2CAP_INTERV_MAX)	20
Timeout Multiplier (L2CAP_TIMEOUT_MULTIPLIER)	600

### 2.7.2. Platform Settings:

Exti Line	PA3
BSP BUTTON	PC13
BSP USART	USART3
BUS IO driver	SPI1
CS Line	PC0
Reset Line	PF13
BSP LED	PB7

**\* User modified value**

### 3. System Configuration

#### 3.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
LPUART1	PG7	LPUART1_TX	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High</b> *	
	PG8	LPUART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High</b> *	
RCC	PC14-OSC32_IN (PC14)	RCC_OSC32_IN	n/a	n/a	n/a	
	PC15-OSC32_OUT (PC15)	RCC_OSC32_OUT	n/a	n/a	n/a	
	PH0-OSC_IN (PH0)	RCC_OSC_IN	n/a	n/a	n/a	
SPI1	PA6	SPI1_MISO	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High</b> *	BNRG_MISO
	PA7	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High</b> *	BNRG_MOSI
	PE13	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High</b> *	BNRG_SCK
SYS	PA13 (JTMS/SWDIO)	SYS_JTMS-SWDIO	n/a	n/a	n/a	
	PA14 (JTCK/SWCLK)	SYS_JTCK-SWCLK	n/a	n/a	n/a	
USART3	PD8	USART3_TX	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High</b> *	
	PD9	USART3_RX	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High</b> *	
GPIO	PC13	GPIO_EXTI13	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	B1
	PC0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	BNRG_CS
	PA3	GPIO_EXTI3	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	BNRG_IRQ
	PF13	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	BNRG_RST
	PB7	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LD2

### **3.2. DMA configuration**

nothing configured in DMA service



### 3.3. NVIC configuration

#### 3.3.1. NVIC

Interrupt Table	Enable	Preenmption Priority	SubPriority
Non maskable interrupt	true	0	0
Hard fault interrupt	true	0	0
Memory management fault	true	0	0
Prefetch fault, memory access fault	true	0	0
Undefined instruction or illegal state	true	0	0
System service call via SWI instruction	true	0	0
Debug monitor	true	0	0
Pendable request for system service	true	0	0
System tick timer	true	0	0
EXTI line3 interrupt	true	0	0
USART3 global interrupt	true	0	0
EXTI line[15:10] interrupts	true	0	0
PVD/PVM1/PVM2/PVM3/PVM4 interrupts through EXTI lines 16/35/36/37/38	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
SPI1 global interrupt	unused		
LPUART1 global interrupt	unused		
FPU global interrupt	unused		

#### 3.3.2. NVIC Code generation

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Non maskable interrupt	false	true	false
Hard fault interrupt	false	true	false
Memory management fault	false	true	false
Prefetch fault, memory access fault	false	true	false
Undefined instruction or illegal state	false	true	false
System service call via SWI instruction	false	true	false
Debug monitor	false	true	false
Pendable request for system service	false	true	false
System tick timer	false	true	true
EXTI line3 interrupt	false	true	true
USART3 global interrupt	false	true	true
EXTI line[15:10] interrupts	false	true	true

**\* User modified value**

## 4. System Views

### 4.1. Category view

#### 4.1.1. Current

Middlewares

Additional Software

X-CUBE-BLE2 ✓

System Core	Analog	Timers	Connectivity	Multimedia	Security	Computing
DMA			LPUART1 ✓			CRC ✓
GPIO ✓			SPI1 ✓			
NVIC ✓			USART3 ✓			
RCC ✓						
SYS ✓						

## 5. Software Pack Report

### 5.1. Software Pack selected

Vendor	Name	Version	Component
STMicroelectronics	X-CUBE-BLE2	3.3.0	Class : Wireless Group : BlueNRG-2 SubGroup : Controller Version : 3.3.0 Class : Wireless Group : BlueNRG-2 SubGroup : HCI_TL Variant : Basic Version : 3.3.0 Class : Wireless Group : BlueNRG-2 SubGroup : HCI_TL_INTERFACE Variant : UserBoard Version : 3.3.0 Class : Wireless Group : BlueNRG-2 SubGroup : Utils Version : 3.3.0 Class : Device Group : Application Variant :

			SampleApp Version : 3.3.0
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## 6. Docs & Resources

Type	Link
BSDL files	<a href="https://www.st.com/resource/en/bsdl_model/stm32l4_bsd.zip">https://www.st.com/resource/en/bsdl_model/stm32l4_bsd.zip</a>
IBIS models	<a href="https://www.st.com/resource/en/ibis_model/stm32l4_ibis.zip">https://www.st.com/resource/en/ibis_model/stm32l4_ibis.zip</a>
System View Description	<a href="https://www.st.com/resource/en/svd/stm32l4_svd.zip">https://www.st.com/resource/en/svd/stm32l4_svd.zip</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/stm32-stm8_embedded_software_solutions.pdf">https://www.st.com/resource/en/product_presentation/stm32-stm8_embedded_software_solutions.pdf</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/stm32_eval_tools_portfolio.pdf">https://www.st.com/resource/en/product_presentation/stm32_eval_tools_portfolio.pdf</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/stm32_stm8_functional-safety-packages.pdf">https://www.st.com/resource/en/product_presentation/stm32_stm8_functional-safety-packages.pdf</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/stm32l4_marketing-pres.pdf">https://www.st.com/resource/en/product_presentation/stm32l4_marketing-pres.pdf</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/stm32-stm8_software_development_tools.pdf">https://www.st.com/resource/en/product_presentation/stm32-stm8_software_development_tools.pdf</a>
Brochures	<a href="https://www.st.com/resource/en/brochure/brstm32ulp.pdf">https://www.st.com/resource/en/brochure/brstm32ulp.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flstm32l4.pdf">https://www.st.com/resource/en/flyer/flstm32l4.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flstm32nucleo.pdf">https://www.st.com/resource/en/flyer/flstm32nucleo.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flstmcsuite.pdf">https://www.st.com/resource/en/flyer/flstmcsuite.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flstm32trust.pdf">https://www.st.com/resource/en/flyer/flstm32trust.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flstm32gui.pdf">https://www.st.com/resource/en/flyer/flstm32gui.pdf</a>
Magazine Articles	<a href="https://www.st.com/resource/en/magazine/design-elektronik_august2017.pdf">https://www.st.com/resource/en/magazine/design-elektronik_august2017.pdf</a>
Magazine Articles	<a href="https://www.st.com/resource/en/magazine/design-elektronik_october2016.pdf">https://www.st.com/resource/en/magazine/design-elektronik_october2016.pdf</a>
Product Certifications	<a href="https://www.st.com/resource/en/certification_document/sesip-2000002-01-cert.pdf">https://www.st.com/resource/en/certification_document/sesip-2000002-01-cert.pdf</a>
Product Certifications	<a href="https://www.st.com/resource/en/certification_document/sesip-2000002-01-st2.pdf">https://www.st.com/resource/en/certification_document/sesip-2000002-01-st2.pdf</a>

Product	<a href="https://www.st.com/resource/en/certification_document/psa-certificate_stm32l4.pdf">https://www.st.com/resource/en/certification_document/psa-certificate_stm32l4.pdf</a>
Certifications	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an1181-electrostatic-discharge-sensitivity-measurement-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an1181-electrostatic-discharge-sensitivity-measurement-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an2606-stm32-microcontroller-system-memory-boot-mode-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2606-stm32-microcontroller-system-memory-boot-mode-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an2639-soldering-recommendations-and-package-information-for-leadfree-ecopack-mcus-and-mpus-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2639-soldering-recommendations-and-package-information-for-leadfree-ecopack-mcus-and-mpus-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an2834-how-to-get-the-best-adc-accuracy-in-stm32-microcontrollers-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2834-how-to-get-the-best-adc-accuracy-in-stm32-microcontrollers-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an2867-oscillator-design-guide-for-stm8afals-stm32-mcus-and-mpus-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2867-oscillator-design-guide-for-stm8afals-stm32-mcus-and-mpus-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3126-audio-and-waveform-generation-using-the-dac-in-stm32-products-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3126-audio-and-waveform-generation-using-the-dac-in-stm32-products-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3154-can-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3154-can-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3155-uart-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3155-uart-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3156-usb-dfu-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3156-usb-dfu-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3236-increase-the-number-of-touchkeys-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3236-increase-the-number-of-touchkeys-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3960-esd-considerations-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3960-esd-considerations-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an4013-stm32-crossseries-timer-overview-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an4013-stm32-crossseries-timer-overview-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an4221-i2c-protocol-">https://www.st.com/resource/en/application_note/an4221-i2c-protocol-</a>

used-in-the-stm32-bootloader-stmicroelectronics.pdf

Application Notes [https://www.st.com/resource/en/application\\_note/an4229-how-to-implement-a-vocoder-solution-using-stm32-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4229-how-to-implement-a-vocoder-solution-using-stm32-microcontrollers-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4277-using-stm32-device-pwm-shutdown-features-for-motor-control-and-digital-power-conversion-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4277-using-stm32-device-pwm-shutdown-features-for-motor-control-and-digital-power-conversion-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4286-spi-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4286-spi-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf)

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