

WS2116 MODULE/EVB

FW DEVELOPMENT GUIDE

Version: 2.0.2



Version	Date	Description	Author
WS2116_FW_Guide_1.0.4	2019.2.1	Updated descriptions for	Joshua
		Jorjin SDK v.1.0.0	Guo
WS2116_FW_Guide_2.0.0	2021.7.23	Updated descriptions for	Louis
		Jorjin SDK v2.1.0+	Lee
WS2116_FW_Guide_2.0.1	2021.12.17	Added notation for Sigfox	Jack
		transmissions	Tseng
WS2116_FW_Guide_2.0.2	2022.1.19	Updated descriptions for	Jack
		Jorjin SDK v2.1.7	Tseng

CHANGE HISTORY



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1 INTRODUCE

This document is for Sigfox and BLE dual mode module FW development guide, which is suitable for WS2116 EVB and Module. The WS2116 is designed for Sigfox Monarch which feature makes IoT devices aware of the local radio configuration (RC) to use, WS2116 support RC 1, 2, 3, 4, 5 and 6.

1.1 DEVELOPMENT SDK FROM STMICRO

2 items need to download from STMicro.

 STSW-BNRG-S2LP evaluation software package based on BlueNRG-2 and S2-LP

http://www.st.com/content/st_com/en/products/embedded-software/wirelessconnectivity-software/stsw-bnrg-s2lp.html

2. BlueNRG-1 ST-LINK utility for BlueNRG-1, BlueNRG-2 MCU

http://www.st.com/content/st_com/en/products/embedded-software/wirelessconnectivity-software/stsw-bnrg1stlink.html

NOTE1: Default BlueNRG-1_ST-LINK_CLI.exe in NRG ST-LINK installation directory has issue which is section erase.

Please unzip **BlueNRG-1_ST-LINK_CLI.7z** and copy it inside the folder C:\Program Files (x86)\STMicroelectronics\BlueNRG-1_2 ST-Link Utility V 2.0.0\ST-LINK_Utility to replace the original file.

NOTE2: DON'T erase Page 124 - 128 of flash by STLINK CLI or GUI

More BlueNRG-2 SW package for from ST:

http://www.st.com/en/wireless-connectivity/bluenrg-2.html

More information from Sigfox:

https://resources.sigfox.com/



1.2 DEBUG TOOL - STLINK

Buy it from ST or contact ST distributor.

http://www.st.com/en/development-tools/st-link-v2.html



1.3 SIGFOX SIMULATOR - SDR DONGLE

You must use antenna with correct frequency domain for your development sigfox RC zone.





Sigfox RC zones have different frequency as below:

Zone 1: Europe, Oman, South Africa

Tx Frequency: 868.13MHz

Rx Frequency: 869.525MHz

Zone 2: USA, Mexico, Brazil

Tx Frequency: 902.2MHz

Rx Frequency: 905.2MHz

Zone 3: Japan

Tx Frequency: 923.2MHz

Rx Frequency: 922.2MHz

Zone 4: Australia, New Zealand, Singapore, Taiwan, Hong Kong, Colombia,

Argentina

Tx Frequency: 920.8MHz

Rx Frequency: 922.3MHz

Zone 5: South Korea

Tx Frequency: 923.25MHz

Rx Frequency: 922.25MHz

Zone 6: India

Tx Frequency: 865.2MHz Rx Frequency: 866.3MHz

More information

https://resources.sigfox.com/document/sigfox-sdr-dongle

https://storage.sbg1.cloud.ovh.net/v1/AUTH_669d7dfced0b44518cb186841d7cbd75/ staging_docs/att19630513-1709-SIGFOX-DATASHEET-SDR_dongle.pdf

Where to buy SDR Dongle:

https://www.digikey.tw/product-detail/zh/sigfox/SDR-DONGLE/1895-1000-ND/7930762



1.4 JORJIN SIGFOX AND BLE DUAL MODE EVB

• WS2116 EVB



The WS2116 EVB user guide you can download from Jorjin website or contact with Jorjin Sales.

WS2116 EVB has three SMA connector, left (SMA1) is for BT and the others (SMA2, SMA3) is for Sigfox.



1.5 JORJIN DUAL MODE MODULE





1.6 DEVELOPMENT TOOL

- IAR embedded workbench 8.32+ (*Note: 8.50.9 is required since SDK v2.1.7)
- Jorjin SDK version 2.1.0+
- Standard AT command FW developed by Jorjin



2 FLASH MAPPING IN BLUENRG-2

2.1 FLASH ADDRESS MAPPING

NOTE: DON'T modify **page 124-128**, there have module information and calibration parameter and SIGFOX sequence number.

2.1.1 Enable OTA service manager

+ 	+ 0x10080000		
Jorjin Reserved(6K)	+ 0x1007E800	(Page.	125)
 Sigfox Reserved(2K) +	 + 0x1007E000 	(Page.	124)
 User app (248K) 	 		
 +	 + 0x10040000		

2.1.2 Disable OTA service manager

+ I	+ 0x10080000		
 Jorjin Reserved(6K) +	+ 0x1007E800	(Page.	125)
 Sigfox Reserved(2K) +	 + 0x1007E000	(Page.	124)
 User app (178K) 	 		
 + OTA Service Manager (70K)	 + 0x10051800 		
+	+ 0x10040000		



2.2 FLASH CONTROL

1. Reading Flash memory

To read one single word of the flash, just read it as if RAM memory: read the desired flash address and get read data on the bus.

2. Erasing Flash

The Flash controller allows erasing one page or the full main Flash.

3. Write function

The Flash Controller allows writing one word (4 bytes), up to 4 words or the full main Flash memory (with a single fixed word).

4. Basic Flash operations:

Erase a page

Write a page word by word

Verify write operation word by word

You have to erase flash (page) first then program flash. Otherwise you can't program data successfully.

2.2.1 Flash functions

Erase page (BlueNRG1_flash.c)

Void FLASH_ErasePage(uint16_t PagNumbere;)

Erase all flash (BlueNRG1_flash.c)

> void FLASH_EraseAllFlash(void);

Read flash (vint32) (BlueNRG1_flash.c)

uint32_t FLASH_ReadWord(uint32_t Address);

Read flash (uint8) (BlueNRG1_flash.c)

uint8_t FLASH_ReadByte(uint32_t Address);



3 EEPROM MAPPING IN WS2116 EVB



DON'T modify 0x0000~ 0x0032 and 0x0500 ~ 0x0540, there have Sigfox information and calibration parameter.

If module flash has been erased, please read EVB information to develop. Reference <u>4.2.3</u> to switch setting.



4 JORJIN SDK

4.1 SDK INFORMATION

Jorjin SDK is customized based on ST official released, which include latest Sigfox library and PIN configuration base on WS2116 PIN definition.

4.2 IAR EMBEDDED WORKBENCH IDE

4.2.1 Open project file

EWARM				-		×
🕀 New 🗸 🔥		Sort \cdot \equiv View \cdot				
$\leftarrow \rightarrow \cdot \cdot \uparrow$	≪ Bl → E → ✓ Ő 🖉 Se	earch EWARM				
v 🔶 Quick secore	Name	Date modified	Туре	Size		
Quick access	📁 settings	11/15/2021 6:07 PM	File folder			
Desktop *	BlueNRG2.icf	3/12/2019 1:49 PM	ICF File		14 KE	8
	Jorjin_WS2116_DK.dep	12/14/2021 10:51 AM	DEP File		133 KE	в
Documents *	Jorjin_WS2116_DK.ewd	11/23/2021 3:10 AM	EWD File		106 KE	в
Pictures 🖈	Jorjin_WS2116_DK.ewp	11/23/2021 3:10 AM	EWP File		88 KE	в
🚞 Downloads 🖈	Jorjin_WS2116_DK.ewt	11/23/2021 3:10 AM	EWT File		214 KE	в
🚞 Exe	Jorjin_WS2116_DK.eww	3/14/2019 10:42 AM	IAR IDE Workspace		1 KE	
늘 src	Jorjin_WS2116_DKewp	11/19/2021 10:37 AM	EWP File		156 KB	3
늘 WS211x_DK_6.0						
늘 WS2116_SDK_1.						
8 items 1 item selected	771 bytes					<u>ا</u>

4.2.2 Defined symbols

 $Project {\rightarrow} option {\rightarrow} C/C{++} compiler {\rightarrow} preprocessor$





1. Memory type

There have two types of memories, internal FLASH and external EEPROM. To use FLASH for data storing, the "USE_FLASH" symbol must be defined in the "Defined symbols" in IAR's preprocessor settings (as shown in the following picture). If the "USE_FLASH" symbol is not defined, EEPROM will be used during the initialization.

Options for node "Jorjin_WS	2116_DK"				×
Category:				Facto	ory Settings
General Options	Multi-file Com	pilation			
Static Analysis Runtime Checking	🗌 Discard L	Jnused Publics			
C/C++ Compiler	MISRA-C:	1998	Encodings	Extra C	Options
Assembler	Language 1	Language 2	Code	Optimizations	Output
Output Converter	List	Preprocessor	Diagnos	tics MISR	A-C:2004
Custom Build Build Actions Linker Debugger Simulator CADI CMSIS DAP GDB Server I-jet J-Link/J-Trace TI Stellaris Nu-Link PE micro ST-LINK Third-Party Driver TI MSP-FET TI XDS	☐ Ignore stan Additional inclu \$PROJ_DIR\$ \$PROJ_DIR\$ \$PROJ_DIR\$ \$PROJ_DIR\$ \$PROJ_DIR\$ \$PROJ_DIR\$ Preinclude file: ☐ DEBUGU DEBUGU USE_FLASH HANDCODEA	dard include directories: (or 	ctories ne per line) ers\MCU\HAL ers\MCU\CMSi ers\MCU\Bluet ers\BSP\SDK_	BLUENRG\inc [S\BlueNRG1\inc VRG1_Periph_Driv Eval_BlueNRG\in processor output t Preserve comment Generate #line dim	o file ts ectives

The "HARDCODE" symbol controls the active ID, PAC, key and rcz at "ST_Sigfox_Init.c". If it's not defined, the Sigfox information stored in the memory will

be used for the Sigfox operations.

If "HARDCODE" is defined, the hardcoded Sigfox information in "ST_Sigfox_Init.c" will be used, and the original information in the memory will also be overwritten by the hardcoded ones.





Sigfox sequence number store located will change depend on "USE FLASH" define.





Use in main.c, ST_Sigfox_Init.c, nvm_api.c and S2LP_MON_REF_DES.h



2. Debug mode

Set "DEBUG=1" to open debug mode, will show PRINTF(""). Defined symbols "DEBUG=0" to disable debug mode. If use printf("") debug message always show context(PRINTF \neq printf).

					Factory	y Setting:
General Options	🗌 🗌 Multi-file Con	npilation				
Static Analysis	🗌 Discard	Unused Publics				
Runtime Checking	MICRAC	1000	F b		F . 0	
C/C++ Compiler	MISRA-C	:1998	Encodings		Extra Op	tions
Assembler	Language 1	Language 2	Code	Optimiz	zations	Output
Output Converter	List	Preprocessor	Diagnos	stics	MISRA	-C:2004
Linker Debugger Simulator CADI CMSIS DAP GDB Server I-jet J-Link/J-Trace	Additional incl \$PROJ_DIR: \$PROJ_DIR: \$PROJ_DIR: \$PROJ_DIR: \$PROJ_DIR:	lude directories: (c \$\\\inc \$\\\\\Driv \$\\\\\Driv \$\\\\\Driv \$\\\\\Driv	one per line) rers\MCU\HAL rers\MCU\CMS rers\MCU\Blue rers\BSP\SDK	_BLUENF IS\BlueN NRG1_Pe _Eval_Blue	\G\inc RG1\inc riph_Driv∉ eNRG\inc	
GDB Server I-jet J-Link/J-Trace	P <u>r</u> einclude file	ə:				

It is used in chat.h, gatt.c, rf_api.c and mcu_api_bluewnrg1.c.





```
main.c ST_Sigfox_Init.c chat.c rf_api.c bluenrg1_api.h ble_status.h nvm_api.c chat.h x

# #ifndef _CHAT_H_
# define _CHAT_H_
# define CHAT_H_
# tifdef DEBUG
# include <stdio.h>
# define PRINTF(...) printf(_VA_ARGS_)
# define BLE_CHAT_VERSION_STRING "1.0.0"
# else
# define PRINTF(...)
# # endif
```

main.c ST_Sigfox_Init.c chat.c rf_api.c bluenrg1_api.h ble_status.h nvm_api.c mcu_api_bluenrg1.c 🗙

```
fifdef DEBUG
// #include <stdio.h>
// void ST_dbg_CB(const char *vectcStr,...);
// #define PRINTF(...) { ST_dbg_CB(_VA_ARGS_);}
//#elif DEBUG_BLE
    #include <stdio.h>
    #include "SDK_EVAL_Com.h"
    #define PRINTF(...) printf(_VA_ARGS_)
#else
    #define PRINTF(...)
#endif
```

main.c ST_Sigfox_Init.c chat.c **rf_api.c x** bluenrg1_api.h ble_status.h nvm_api.c mcu_api_bluenrg1.c

```
/* The DEBUG symbol is used to print the names of the invoked functions */
//#define DEBUG
#ifdef DEBUG
//void ST_dbg_CB(const char *vectcStr,...);
//#define PRINTF(...) { ST_dbg_CB(_VA_ARGS__);}
//#elif DEBUG_BLE
#include "SDK_EVAL_Com.h"
#define PRINTF(...) printf(_VA_ARGS__)
#else
#define PRINTF(...)
#endif
```



3. GPIO mapping

It is used in S2LP_MON_REF_DES.h.

Jorjin_WS2116_DK - IAR Embedded Workbench IDE - Arm 8.5	50.9	
File Edit View Project ST-Link Tools Window Hel	p	
1 D C 🖸 🗳 🖌 🚔 🗳 C		• = • • • • • • • • • • • • • • • • • •
Workspace 💌 🕈 🗙	main.c ST_Sigfox_Init.c chat.c rf_api.c bluenrg1_api.h	ble_status.h nvm_api.c S2LP_MON_REF_DES.h 🗙
WS2116_Module ~		
Files 🌼 🔹	/*******	*****
	/* S2-LP - SP	I CONFIG */
	/**************************************	**************
	A Abrief SPI definitions	
	A and connections to S2-LP and EEPROM	
	/* Defines for chip select pin */	
BlueNPC1 edch	#define S2LP SPI CS PIN	GPIO Pin 20
BlueNRG1_confh	#define S2LP_SPI_CS_HIGH_POWER ENABLE	
BlueNPG1_cont.n	#define S2LP_SPI_CS_PUPD	ENABLE
B BlueNPC1 fleek k	<pre>#define S2LP_SPI_CS_MODE</pre>	GPI0_Output
BlueNPC1_main h		
BlueNPG1_gpi0.ii	<pre>#define S2LP_SPI_MOSI_PIN</pre>	GPIO_Pin_2
BlueNPC1_zc.n	#define S2LP_SPI_MOSI_HIGH_POWER	ENABLE
	<pre>#define S2LP_SPI_MOSI_PUPD</pre>	ENABLE
	#define S2LP_SPI_MOSI_MODE	Serial0_Mode
BlueNPC1 aveCtd b	Idefine COLD CDT MICO DIN	CRTO Die 0
	#define S2LP_SPI_MISO_PIN	SPIO_PIN_3
BlueNPC1_uartii	#define S2LP_SPI_MISO_NIGN_FOWER	ENADLE
	tdefine S2LP_SPI_MISO_FOFD	Sarial0 Mode
		berraro_node
Dimension compiler h	#define S2LP SPI CLK PIN	GPIO Pin 0
	#define S2LP SPI CLK HIGH POWER ENABLE	
crisis_iccaint.in	#define S2LP SPI CLK PUPD	ENABLE
	#define S2LP SPI CLK MODE	Serial0 Mode
Dispresion on the		
Dib Config Normalh	/*********	**********
DLib_Conlig_Nonnal.in	/* S2-LP - EE	PROM */
DLib_Deraducth	/**********	*******
Diccorm builtin b	/** The EEPROM is an optional component,	normally not required in customer's application.
	* When using a custom board, normally	this define should be set to EEPROM_NO.
Deletform Configuration	- * SINCE SIEVAL KITS USE EEPROM, SET IT	CD LEPROM_IES */
	#define FEDROM SPI_CS_FIN	GFIO_FII_0
	#define FEDDOM SDI CS DUDD	ENABLE
	idefine EEPROM_SPI_CS_MODE	GPIO Output
		0110_040540
	#define EEPROM SPI MOSI PIN	GPIO Pin 2
	#define EEPROM SPI MOSI HIGH POWER	ENABLE
S2LP_CONL_SFIII	#define EEPROM SPI MOSI PUPD	ENABLE
	#define EEPROM_SPI_MOSI_MODE	Serial0_Mode
		-
	<pre>#define EEPROM_SPI_MISO_PIN</pre>	GPIO_Pin_3
	Adefine FFPROM SPT MISO HIGH POWER	FNARLF

Jorjin_WS2116_DK



- 4. OTA mode
 - i. Enable OTA service manager

Define "ST_USE_OTA_SERVICE_MANAGER_APPLICATION=1" at Linker \rightarrow config \rightarrow configuration file symbol definitions and C/C++ compiler \rightarrow preprocessor \rightarrow defined symbol to enable OTA mode will change application FW start address to 0x10051800.

Category: Factory Settings General Options Static Analysis Runtime Checking ////////////////////////////////////	Options for node "Jorjin_WS2	116_DK"					×
11 AD3	Options for node "Jorjin_WS2 Category: General Options Static Analysis Runtime Checking C/C++ Compiler Assembler Output Converter Custom Build Puild Actions Unker Debugger Simulator CADI CMSIS DAP GDB Server I-jet J-Link/J-Trace TI Stellaris Nu-Link PE micro ST-LINK Third-Party Driver TI MSP-FET TI VDS	116_DK" #define Config Linker (♀ Qve SF Configura ST_USE	Diagnostics Library Input configuration file ende default PROJ_DIR\$\Blue! Edit tion file symbol de E_OTA_SERVICE	Checksum Optimizations NRG2.icf finitions: (one per _MANAGER_API	Encodings Advanced	Factory S Extra C Output	× Settings



ategory:			Factory Settings
General Options Static Analysis Suntime Checking	Multi-file Compilation Discard Unused	n d Publics	
C/C++ Compiler	MISRA-C:1998	Encodings	Extra Options
Assembler	Language 1 La	anguage 2 Code	Optimizations Output
Output Converter	List Prep	processor Diagnos	stics MISRA-C:2004
CADI CMSIS DAP GDB Server I-jet J-Link/J-Trace TI Stellaris Nud ink	SPROJ_DIRS\\.\ SPROJ_DIRS\\.\ SPROJ_DIRS\\.\ Preinclude file: Defined symbols: (on	Drivers\MCU\CMS \Drivers\MCU\Blue \Drivers\BSP\SDK_	IS\BlueNRG1\inc NRG1_Periph_Drive _Eval_BlueNRG\inc
Nu-Link	HARDCODEX	FF	processor output to file Preserve <u>c</u> omments
PE micro ST-LINK Third-Party Driver TI MSP-FET	ST_USE_OTA_SEP		<u>G</u> enerate #line directives



ii. Disable OTA service manager

Remove define "ST_USE_OTA_SERVICE_MANAGER_APPLICATION=1" at Linker \rightarrow config \rightarrow configuration file symbol definitions and C/C++ compiler \rightarrow preprocessor \rightarrow defined symbol to disable OTA mode will change application FW start address to 0x10040000.

Options for node "Jorjin_WS2	2116_DK"						×
Category: General Options Static Analysis Runtime Checking C/C++ Compiler Assembler Output Converter Custom Build Build Actions	#define Config Linker	Diag Library configura renide de	Inostics Input stion file fault	Checksum Optimizations	Encodings Advanced	Factory S Extra (Output	Settings Options List
Linker Debugger Simulator CADI CMSIS DAP GDB Server I-jet J-Link/J-Trace TI Stellaris Nu-Link PE micro ST-LINK Third-Party Driver TI MSP-FET TI XDS	S Configur	Edit	R\$\Bluef	finitions: (one per	rline)		
					ОК		ancel



Lategory:					Facto	ry Settings			
General Options	Multi-file Compilation								
Static Analysis	Discard Unused Put	Discard Unused Publics							
Runtime Checking	MISRAC-1998	MISPA C-1998 Encodings							
Assembler		ane 2	Code	Ontim	izations	Output			
Output Converter	List Preproce	ssor	Diagno	stics	MISR	A-C:2004			
Build Actions Linker	Ignore standard includ	e directo	ories						
Debugger Simulator	Additional include director \$PROJ_DIR\$\\.vinc \$PROJ_DIR\$\\.vinc			BLUEN	RG\inc				
Debugger Simulator CADI CMSIS DAP GDB Server	Additional include director \$PROJ_DIR\$\\\vinc \$PROJ_DIR\$\\\\ \$PROJ_DIR\$\\\\ \$PROJ_DIR\$\\\\\	.\Drivers .\Drivers .\Drivers .\Drivers .\Drivers	MCU\HAL MCU\CMS MCU\CMS MCU\Blue BSP\SDK	_BLUEN SIS\BlueN NRG1_P _Eval_Blu	RG\inc NRG1\inc 'eriph_Driv ueNRG\inc	 (
Debugger Simulator CADI CMSIS DAP GDB Server I-jet	Additional include director \$PROJ_DIR\$\\\inc \$PROJ_DIR\$\\\. \$PROJ_DIR\$\\\. \$PROJ_DIR\$\\\. \$PROJ_DIR\$\\\.	.\Drivers .\Drivers .\Drivers .\Drivers	MCU\HAL MCU\CMS MCU\Blue MCU\Blue	_BLUEN SIS\BlueN NRG1_P _Eval_Blu	RG\inc NRG1\inc 'eriph_Driv ueNRG\inc				
Debugger Simulator CADI CMSIS DAP GDB Server I-jet J-Link/J-Trace TI Stellaris	Additional include director \$PROJ_DIR\$\\\inc \$PROJ_DIR\$\\\.\.\ \$PROJ_DIR\$\\\.\ \$PROJ_DIR\$\\\.\ Preinclude file:	.\Drivers .\Drivers .\Drivers .\Drivers	MCU\HAL MCU\CMS MCU\Blue BSP\SDK	_BLUEN 31S\BlueN NRG1_P _Eval_Blu	RG\inc NRG1\inc leriph_Driv ueNRG\inc	е с			
Debugger Simulator CADI CMSIS DAP GDB Server I-jet J-Link/J-Trace TI Stellaris Nu-Link	Additional include director \$PROJ_DIR\$\\.\inc \$PROJ_DIR\$\\.\.\. \$PROJ_DIR\$\\.\.\. \$PROJ_DIR\$\\\. \$PROJ_DIR\$\\\. Preinclude file: Defined symbols: (one per	.\Drivers .\Drivers .\Drivers .\Drivers	MCU\HAL MCU\CMS MCU\CMS MCU\Blue	_BLUEN SIS\BlueN NRG1_P _Eval_Blu	RG\inc NRG1\inc 'eriph_Driv ueNRG\ind	•			
Debugger Simulator CADI CMSIS DAP GDB Server I-jet J-Link/J-Trace TI Stellaris Nu-Link PE micro ST-LINK	Additional include director \$PROJ_DIR\$\\\vinc \$PROJ_DIR\$\\\.\ \$PROJ_DIR\$\\\.\ \$PROJ_DIR\$\\\.\ \$PROJ_DIR\$\\\.\ Preinclude file: 	.\Drivers .\Drivers .\Drivers .\Drivers .\Drivers		_BLUEN IS\BlueM NRG1_P _Eval_Blue eprocesso Preserve	RG\inc NRG1\inc eriph_Driv ueNRG\ind or output to e_comment	e			



4.2.3 Switch your module/EVB type

Select edit configurations to switch type. Each configuration has different defined symbol.



Configurations for "Jorjin_WS2116_D	к" ×
Configurations:	ОК
WS2116_EVB WS2116_Module	<u>N</u> ew
	<u>R</u> emove
(Drag to order)	

Quick switch configuration





4.2.4 Sigfox/BLE functions

• Sigfox functions

Initialize flow (Read EEPROM/flash data)

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6		
							
Init Sigfox ID, pac, key, rcz							
	•			•	4		
Sigfox open							
		+					
	Set Sigfox standard config						

Initialize flow (Hard code)





Sigfox Tx. (12 bytes limit) (main.c) Must initialize Sigfox

SIGFOX_API_send_frame(sfx_u8 *customer_data,

sfx_u8 customer_data_length,

sfx_u8 *customer_response,

sfx_u8 tx_repeat,

sfx_bool initiate_downlink_flag);

Set Sigfox private key (main.c) (Must register ID, key from Sigfox)

- static uint8_t key[16]=\
 { 0x00,0x11,0x22,0x33,0x44,0x55,0x66,0x77,0x88,0x99,0xAA,0xBB,0xCC,0xDD,0xEE,0xFF};
- > enc_utils_set_key(key);

Set Sigfox reduction power (main.c)

ST_RF_API_reduce_output_power(sfx_s16 reduction);

Set Sigfox private id (main.c)

- static uint32_t id=0xfedcba98;
- enc_utils_set_id(id);

Switch the private (0)/public (1) key.

> enc_utils_set_public_key(1);

Set PA. Set 1 if a PA, 0 if not. (st_rf_api.h)

ST_RF_API_set_pa (1);

Set RSSI offset. (st_rf_api.h)

ST_RF_API_set_rssi_offset(sfx_s8 rssi_off);

Sigfox monarch scan mode. (sigfox_monarch_api.h)

 SIGFOX_MONARCH_API_execute_rc_scan (sfx_u8 rc_capabilities_bit_mask, sfx_u16 timer, sfx_timer_unit_enum_t unit, sfx_u8 (* app_callback_handler) (sfx_u8 rc_bit_mask, sfx_s16 rssi));



NOTE: In **WS2116 SDK 2.1.6 or earlier**, the following operations are needed for Sigfox compliant transmissions.

 In main.c & ST_Sigfox_Init.c, adjust the reduction parameters passed to the ST_RF_API_reduce_output_power() function to limit the Sigfox Tx power within the spec at the selected RC.



In main() at main.c (for RC5 only)

Suggested reduction values for RC1-6 are listed as follows:

ТХ	RC1	RC2	RC3	RC4	RC5	RC6
(Uplink)	868.13MHz	902.2MHz	923.2MHz	902.8MHz	923.3MHz	865.2MHz
Reduction	2	6	2	6	2	2



 In main.c & ST_Sigfox_Init.c, set the offset parameters passed to the ST_RF_API_set_Ibt_thr_offset() function to 0.



 In rf_api.c, change the local variable fifo_buff [] in the priv_ST_MANUF_SpiRaw_Ramp() function to a static one to avoid system RAM glitch.

main.c ST_Sigfox_Init.c chat.c ff_api.c x bluenrg1_api.h ble_status.h nvm_api.c S2LP_MON_REF_DES.h
priv_ST_MANUF_SpiRaw_Ramp[uint8_t, uint8_t*, uint8_t*, uint8_t]
/* SPI functions - these functions are implemented using the priv_ST_MANUF_SpiRa
static void priv_ST_MANUF_SpiRaw_Ramp(int8_t n_bytes, uint8_t* buff_in, uint8_t*
{
 if (st_manuf_context->power_reduction!=0 && buff_in!=zeroes)
 {
 uint32 t i;
 static uint8_t fifo_buff[82];
 IIIO_BUIT[0]=BUIT_In[0];
 fifo_buff[1]=buff_in[1];



BLE functions

Initialize flow

(Read EEPROM/flash data)

(Hard code)





BT MAC (chat.c)

static uint8_t bdaddr[6]={0x00, 0x19, 0x94, 0xFF, 0xFF, 0xFF};

BLE name (8 bytes limit) (chat.c)

static uint8_t name[8]={'W', 'S', '2', '1', '1', '6',0x00,0x00};

BLE local_ name (chat.c)

vint8_t local_name[] =
{AD_TYPE_COMPLETE_LOCAL_NAME,'J','o','r','j','i','n','_','W','S','2','1','1','6'};

(Example in 4.2.7.2)

BLE Tx power seting(chat.c)

> aci_hal_set_tx_power_level(1, 4);

(Example in 4.2.7.3)

BLE Tx. (chat.c)

SendRczData(uint8_t rczValue, uint8_t keyValue);

UART Tx via BT. (chat.c)

SdkEvalComIOConfig(Process_InputData);

UART Rx via BT. (gatt_db.c)

Attribute_Modified_CB(uint16_t handle, uint16_t data_length, uint8_t *att_data)

(Example in 4.2.7.1)



4.2.5 Switch SMA connector

WS2116 has two Sigfox antenna connector, default antenna is SMA2.

If want to use SMA3, please use code below.

GPIO_WriteBit(SMA2_GPIO_PIN, Bit_RESET);

GPIO_WriteBit(SMA3_GPIO_PIN, Bit_SET);;



4.2.6 Build code and file location

1. Change output file name. "Option → Output Converter → Output file"

	Jorjin_WS2116_DK - IAR Embedd	ded Workbench IDE - Arm 8.50.9	
	File Edit View Project ST-Li	ink Tools Window Help	
	1 1 🕒 🔛 🗗 🔚 🕹 🖍		
	Workspace	▼ ₽ × main.c ST_Sigfox_Init.c chat.c	
	WS2116_Module	<pre>priv_ST_MANUF_SpiRaw_F</pre>	
	Files	 ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	
	□ ● Jorjin_WS2116_DK	Options	
	⊢⊞ ■ Drivers ⊢⊞ ■ OTA	****	
		Make	
		Rebuild All f	
		Clean f	
	L-⊞ S2LP_CORE	e	
	He Source	C-STAT Static Analysis >	
	H → ⊕ mcu_api_bluenrg	Stop Build	
	rf_api.c	Add > [
	└──⊞ ■ Output	Remove P	
		Rename	
		Version Control System	
		Open Containing Folder	
		File Properties	
		Set as Active	
	J		
Category:		ſ	Faster Cattings
Ceneral Options		l	Factory Settings
Static Analysis			
Runtime Checking			
C/C++ Compiler	Output		
Assembler	Generate add	ditional output	
Output Converter		ational output	
Build Actions	Output <u>f</u> orma	at:	
Linker	Intel Extend	led hex 🗸	
Debugger	-Output file		
Simulator		e default	
CADI	14/021		
CMSIS DAP	W521	116_DK_2.1.6.nex	
I-iet			
J-Link/J-Trace			
TI Stellaris			
Nu-Link			
PE micro			
ST-LINK Third-Party Driver			
TI MSP-FET			
TI XDS			
		OK	Cancel



2. Build code



3. File location

EWARM				– 🗆 X
🕂 New 🗸	□ □ □ □ ∞ □ ↑ Sort	• View · …		
\leftrightarrow \rightarrow \checkmark \uparrow	<pre>« Projects_Cube > S2-LP_SigFox_DK > Jorjin_WS21</pre>	~ C	,○ Search EWARM	
🗙 🔶 Quick access	Name	Date modified	Туре	Size
	🚞 settings	11/15/2021 6:07 PM	File folder	
- Downloads	늘 WS2116_EVB	12/14/2021 2:23 PM	File folder	
Downloads 🖈	늘 WS2116_Module	12/14/2021 1:35 PM	File folder	
	BlueNRG2.icf	3/12/2019 1:49 PM	ICF File	14 KB
Pictures 📌	Dorjin_WS2116_DK.dep	12/14/2021 2:23 PM	DEP File	133 KB
Downloads 🖈	Jorjin_WS2116_DK.ewd	11/23/2021 3:10 AM	EWD File	106 KB
Exe	Jorjin_WS2116_DK.ewp	11/23/2021 3:10 AM	EWP File	88 KB
src	Jorjin_WS2116_DK.ewt	11/23/2021 3:10 AM	EWT File	214 KB
WS211x_DK_6.0	9 Jorjin_WS2116_DK.eww	3/14/2019 10:42 AM	IAR IDE Workspace	1 KB
늘 WS2116_SDK_1.	Dorjin_WS2116_DKewp	11/19/2021 10:37 AM	EWP File	156 KB
10 items 2 items selected	d			



늘 Exe					- 0	×
🕂 New - 岁	0 0 0 0	\Uparrow Sort ${\scriptscriptstyle \curlyvee}$ \equiv View ${\scriptscriptstyle \curlyvee}$				
← → ∽ ↑ 🖿	~ C					
🛓 Downloads 🖈	Name	Date modified	Туре	Size		
📑 Documents 🖈	WS2116 DK 2.1.4.out	12/14/2021 2:23 PM	Wireshark capture	713 KB		
🔀 Pictures 🔹 🖈	BWS2116_DK_2.1.6.bin	12/14/2021 2:23 PM	BIN File	85 KB		
늘 Downloads 🖈	BWS2116_DK_2.1.6.hex	12/14/2021 2:23 PM	HEX File	239 KB		
늘 Exe						
늘 src						
늘 WS211x_DK_6.0						
늘 WS2116_SDK_1.						
> 🌰 OneDrive - Perso						
> 📮 This PC						
3 items 2 items selected	323 KB					



4.2.7 Function Testing

1. Written value via BLE to module.

Please set new-line both transmit and receive to CR+LF.





Application \rightarrow module.

●●>>>> 中華電信 本 13:13 ● 孝 60% ■	💆 COM8 - Tera Term VT
OxD973F2E2-B19E-11E2 UTF-8	<u>File E</u> dit <u>S</u> etup C <u>o</u> ntrol <u>W</u> indow <u>H</u> elp
WS211x OXD973F2E2-B19E-11E2 UUID: D973F2E2-B19E-11E2-9E96-0800200C9A86 Connected WRITTEN VALUES	Jorjin WS211x application ** May 25 2018 12:01:29 ** BLE Stack Initialized set_public_key Initialization done test
Writew value	
"test"	
DESCRIPTORS	
PROPERTIES	
Write Without Response	
Write	
1o 🤤 Los	

Module \rightarrow application.

Push button or enable timer (Implement in while loop)

COM8 - Tera Term VT	・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・
Jorjin WS211x application ** May 25 2018 12:01:29 **	W5211x 0xD973E2E1-B19E-11E2
BLE Stack Initialized	UUID: D973F2E1-B19E-11E2-9E98-0800200C9A68
set_public_key	Connected
TEST2	NOTIFIED VALUES Stop listening
	Cloud Connect TEST2
	DESCRIPTORS
	Cleat Characteralic Cloritguistion
	Natify
	L.o 👩 Log

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2. BLE name (device name) and local name (advertised name)





NOTE: The local name could only be changed by modifying the **local_name** variable in **Make_Connection()** at **chat.c** in the SDK. But, in the new AT command FW, it can also be changed through the **AT+NAME** command.

3. BLE Tx power parameter (bluenrg1_api.h)





5 FW OTA

5.1 ST-LINK

WS2116 setup, connect power and ST-link then open BlueNRG-1 ST-LINK Utility.



(EVB demo, module has to connect correct pin yourself)





- 1. Connect to the target
- 2. Program verify (WS2116_OTA_ServiceManager_2.0.1.hex)

BlueNRG-1 ST-LINK Utility			_	Х
Eile Edit View Target ST-IJNK Help				
Memory display	Device	BlueNRG-2		
	Version ID	Ver 1		
Address: 0x1007E800 V Size: 0x1000 Data Width: 8 bits V	Revision ID	Rev 2		
	Flash size	256KBytes		
Device Memory @ 0x1007E800 : File : W0001_01B194F8.hex				veUpdate

- 3. Browse and select file
- 4. Setting filter "*.hex" files
- 5. Select "WS2116_OTA_ServiceManager_2.0.1.hex"
- 6. Open file.

📕 BlueNRG-1 ST-LINK Utili	ty		_	
File Edit View Target	ST-LINK Help			
🖴 🖥 🖕 🤹 🥔 🌐	Download [W0001_01B194F8.hex]		×	
Memory display	Start address : 0x1007E800		_	
Address: 0x1007E800 ~	File path : D:\Downloads\Sigfox_ID&KEY_AES_[Decrypt/rebuilt/W0001_0 ⁻ Bro	owse	
	Verification		_	
5 Open				×
\leftarrow \rightarrow \checkmark \uparrow		~ c ³ ∧	Search WS2116_A	T_CMD_E_2
Organize New fold	ler		≣ •	
🛓 Downloads 🖈	Name	Date modified	Туре	Size
Documents *	WS2116_AT_CMD_E_2.1.7_App.hex	8/19/2020 5:45 PM	HEX File	292
Pictures 🖈	5 WS2116_AT_CMD_E_2.1.7_with_OTA.hex	8/20/2020 2:19 PM	HEX File	598
Exe	BWS2116_OTA_ServiceManager_2.0.1.hex	8/18/2020 4:16 PM	HEX File	197
rebuilt				
WS211x_DK_6.0.				
WS2116_SDK_1.(
> 🔷 OneDrive - Person				
🗦 💻 This PC				
		4		
File na	me: WS2116_OTA_ServiceManager_2.0.1.hex	∼ Inte	el Hex Files (*.hex)	
		6	Open	Cancel
				12



7. Check file $\$ start address and start programming



- 8. Check success message
- 9. Program verify (WS2116 firmware)

In OTA_ServiceManager FW also can use cell phone to program FW.

r																				
5 BlueNRG-1	ST-LI	NK U	tility														-			\times
<u>F</u> ile <u>E</u> dit <u>V</u> i	ew	<u>T</u> arge	et S	<u>T-LI</u> N	к <u>н</u>	elp														
🖴 🖥 🖕	Ç,	Ø	Í	5 🙎	2															
Memory display			_	- :	9									()evice		BlueNRG-2			
Address: 0x1	00400	00 .	Sin Sin		0v1	1753		Data V	Vidth	8 hits		,		1	/ersion	ID	Ver 1			
nuoress. one			- 34				_	butu v	viori.	0 010				F	Revisio	n ID	Rev 2			
Device Memory	© 0x1(004000	00: 0	File : \	NS211	6 OT	A Sen	viceMa	nager	2.0.1	hex				nasn s	ze	ZOONDYLES			velindate
Target memory,	Addres	s rand	je: [0x	10040	000 0:	x1005	1753]			_								-	00	reopuut
Address	0	1	2	3	4	5	6	7	8	9	Α	В	С	D	E	F	ASCII			
0x10040000	00	60	00	20	D5	16	05	10	79	F8	04	10	8F	F8	04	10	.`. ?y ???			_
0x10040010	DD	CC	BB	AA	45	55	4C	42	00	00	00	00	00	00	00	00	????E U L B			
0x10040020	00	00	00	00	00	00	00	00	00	00	00	00	A5	F8	04	10	??			
0x10040030	00	00	00	00	00	00	00	00	BB	F8	04	10	D1	F8	04	10				
0x10040040	EB	F8	04	10	01	F9	04	10	00	00	00	00	00	00	00	00	???			
0x10040050	17	F9	04	10	2D	F9	04	10	43	F9	04	10	5D	F9	04	10	. ? ? C ?] ?			
0x10040060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00				
0x10040070	00	00	00	00	73	F9	04	10	89	F9	04	10	9F	F9	04	10	s?????			
0x10040080	00	00	00	00	B5	F9	04	10	CB	F9	04	10	E1	F9	04	10				
0x10040090	F7	F9	04	10	0D	FA	04	10	67	1E	04	10	23	FA	04	10	???g#?			
	-	-	-	-	-	-	-													
15:47:34 : SWD 15:47:34 : Conne	ection	mode	: Conr	nz. nect wi	ith Pre	-Rese	t.													
15:47:34 : Debug	j in Lo	w Pow	er mo	de en	abled.															
15:47:34 : Device	e : Blu e famil	eNRG-	2 NRC-	2																- H
15:47:34 : Device	e flash	Size :	256K	∠ Bytes																- 1
15:47:39 : [WS2	116_0	TA_Se	ervice	lanag	er_2.0	.1.hex] oper	ed su	ccessf	ully.	_									- 1
15:47:53 : Memo	ry pro	drame	ned in	10s a	or 2.0 nd 187	7 hey 7ms.	chec	KSUM	: 0x00	012EA	8									- 1
15:47:53 · Verific	ration	OK	inca in	100 0	10/		0													



- 10. Browse and select file
- 11. Setting filter "*.hex" files
- 12. Select "(WS2116 firmware).hex" (Must be *.hex file)
- 13. Open file.

🔜 BlueNRG-1 ST-LINK Utility		_	
File Edit View Target ST-LINK Help		×	
Memory display Start address : 0x10051800 Address: 0x10051800 File path : D:\works\WS2116_SDK\Projects, Verification Verification Verification	_Cube\S2-LP_SigFox_DK\Jor	rowse	
Gpen $\leftarrow \rightarrow \checkmark \uparrow$ \frown EWARM > WS2116_EVB > Exe	~ C ×) Search Exe	×
Organize - New folder		≣ •	?
 Downloads Documents Pictures Downloads Exe src WS2111_DK_6.0. WS2116_DK_1.(OneDrive - Person 	Date modified 12/14/2021 2:23 PM	Type HEX File	Size 240
File name:	11 Int	tel Hex Files (*.hex) 3 Open	 Cancel



14. Check file $\$ start address and start programming

Download WS	2116_DK_2.1.6	5.hex]			×
Start address :	0x10051800				
File path :	D:\works\WS	S2116_SDK\Proje	ects_Cube\S2	LP_SigFox_DK\Jor	Browse
Verification	Verify while pro	gramming	⊖ Verify a	fter programming	
Click "Start" to p	orogram target.				
Reset after	programming				
	14	Start	Cancel		

15. Check success message

👼 BlueNRG-1	ST-LI	NK U	tility														_		×
<u>F</u> ile <u>E</u> dit <u>V</u>	iew	<u>T</u> arge	t S	T-LIN	к <u>н</u>	elp													
🖴 🖬 🗳	Œ (/	0 🗐	\$ 🖉)														
Memory display														D	evice	1	BlueNRG-2		
Addrace: 0v10051800 v Size: 0v15475 Data Widths R bite v																			
nuuress. ona			514		-		_		viori.	0 bits				R	evisior	1 ID	Rev 2		
Flash size 256KBytes Device Memory @ 0x10051800 : File : WS2116_DK_2.1.6.hex											eUpdate								
Target memory,	Addres	s rang	je: [0x	10051	800 0	(10066	5C7F]												
Address	0	1	2	3	4	5	6	7	8	9	Α	В	С	D	Е	F	ASCII		
0x10051800	00	60	00	20	B9	69	06	10	01	58	06	10	03	58	06	10	.`. ?iXX		- 1
0x10051810	AA	55	55	AA	45	55	4C	42	00	00	00	00	00	00	00	00	?U U ?E U L B		
0x10051820	00	00	00	00	00	00	00	00	00	00	00	00	05	58	06	10	X		
0x10051830	00	00	00	00	00	00	00	00	83	30	05	10	CD	3C	05	10			
0x10051840	07	58	06	10	D3	30	05	10	00	00	00	00	00	00	00	00	. X ?0		
0x10051850	4B	58	06	10	AF	32	05	10	43	58	06	10	03	4B	05	10	K X ?2 C X K		
0x10051860	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00			
0x10051870	00	00	00	00	07	4B	05	10	3B	56	05	10	93	56	05	10	K;V?V		
0x10051880	00	00	00	00	C3	33	05	10	7B	2C	05	10	33	3D	05	10	?3{,3=		
0-10051000	cn.	40	05	10	40	20	05	10	67	<i>c</i> c	05	10	50	50	00	10	HI L AA CV		
16:23:49 : 51-L1 16:23:49 : Conn 16:23:49 : SWD 16:23:49 : Devio 16:23:49 : Devio 16:23:49 : Devio 16:23:49 : Devio 16:23:49 : Devio	ected v Freque ection i g in Lor e : Blue e famil o flach ory pro	nware ria SW ency = mode w Pow eNRG- y :Blue Size : gramm	256Kl ned in	Hz. Hz. de ena 2 26s a	th Preabled.	-Resel	.												



5.2 OTA

 Press SW1 to return OTA service manager. Please ensure SW1 is setting "OTA_Jump_To_Service_Manager_Application".









2. Prepare another WS2116 EVB to the USB connectors on a PC.



3. Program the second WS2116 EVB with the "DTM_UART.hex" to be used with the BlueNRG GUI

늘 DTM					-	×
🕂 New 🗸	0 6 9 0	\Uparrow Sort ${\scriptscriptstyle \curlyvee}$ \equiv View ${\scriptscriptstyle \curlyvee}$				
\leftarrow \rightarrow \checkmark \uparrow	ST > BlueNRG GUI 4.2.0 > Firmwa	re > BlueNRG2 > DTM	~ C			
> 🕖 Music	Name	Date modified	Туре	Size		
> 🔀 Pictures	DTM_SPI.hex	10/13/2021 12:12 PM	HEX File	389 KB		
> 🛂 Videos	DTM_SPI_NOUPDATER.bin	10/13/2021 12:12 PM	BIN File	146 KB		
> 💾 Windows-SSD (DTM_UART.hex	10/13/2021 12:12 PM	HEX File	389 KB		
> _ DATA (D:)	DTM_UART_NOUPDATER.bin	10/13/2021 12:12 PM	BIN File	146 KB		
> IDB007VX (E:)	DTM_UART_Sleep.hex	10/13/2021 12:12 PM	HEX File	389 KB		
> = IDB007VX (F:)	DTM_UART_Throughput.hex	10/13/2021 12:12 PM	HEX File	389 KB		
> 📻 IDB007VX (E:)						
> = IDB007VX (F:)						
> 🋬 Network						_
6 items 1 item selected	388 KB					≣□



4. Open the BlueNRG GUI on the PC and select the COM port related to the second WS2116 EVB configured on step 9, through the drop down "Port" and press 'Open'. And make sure the baudrate is set to 115200.



File	lueNRG GUI v4.2.0				- (
Port:	COM6 (ST DK) V Open HW Reset I Commands ACI Utilities Scripts Beacon RF '	Test Th	roughtput			
	Init	Device				
	Service I	Managemen	t			
. [Security	Configuratio	on			
	Security	Information	ı			
	<u>Central Role</u>			<u>Peripheral Role</u>		
	Scanning			Advertising		
	Connections					
	Update Connections			Update Advertising Data		
	Security	Managemer	.t			
	Service	e Discovery.				
	Terminat	e Connection	15			
Cle	ear List 🔽 Update 🔽 Autoscroll	.1				Send
Sent/F	Time Type Packet	ails meter	Value	Literal		Info
	Time Type Para		value	Literai		
Baudr	ate: 115200 (Only BlueNRG/BlueNRG-MS/BlueNRG-	1/BlueNR	G-2)		2	2021-12-22



5. On BlueNRG GUI select 'Tools' -'OTA bootloader' to open up the dialog containing OTA FW upgrade actions and press 'Search for devices'.

ST BI	ueNRG GUI v4.2.0			- 0	×				
File	Tools Settings Help								
Port:	Stack Updater IFR/Device Configuration Flash Motherboard FW OTA Bootloader	HW Reset	Throughtput	BlueNRG-2 H₩ v1.2 BlueNRG-2 F₩ v2.1e - DTM UA Motherboard F₩ v1.8	ART v3.3.0				
	Get Version Get Prod Data Init Device								
		Service Mar	agement						
		Security Con	figuration						
		Security Inf	ormation						
-	<u>Central Ro</u>	<u>le</u>		Peripheral Role					
	Scanning			Advertising					
	Connections								
	Update Connections Update Advertising Data								
	Security Management								
	Service Discovery Terminate Connections								

57 Bootloading Actions		×					
Search for devices							
Connect							
New image base address (set at compile time linker options):						
New image file path:							
		Browse					
	0%	Update					
Force Disconnection							



- 6. After 'Search for devices', the GUI starts the discovery process and gets back with some information about the address and application names of the devices running OTA FW upgrade service within the radio range.
- 7. Once the previous process ends, the device list can be opened up through the combo box arrow below the 'Search for devices' button and the user can find the device running the OTA "Service Manager" and press 'Connect'.

Bootloading Actions	×					
Search for devices						
0xcda4cb1f113OTAServiceMgr ~						
Connect						
New image base address (set at compile time linker options):						
New image file path:						
	Browse					
0%	Update					
Force Disconnection						



 If user realizes he has connected the wrong device, he can just press the 'Force Disconnection' button and get back to the device selection within the combo box.

✓ Bootloading Actions ×							
Search for devices							
0xcda4cb1f113OTAServiceMgr ~							
Connect							
Device : 0XCDA4CB1F113; Image to be uploaded: (USE_OTA_SERVICEMANAGER)							
New image base address (set at compile time linker options):							
0x10051800							
New image file path:							
Browse							
0% Update							
Force Disconnection							



9. After the device selection, connection through 'Connect' button and reading of the related free memory range. Then press 'Browse' to select image.

Sootloading Actions	×						
Search for devices							
0xcda4cb1f1130TAServiceMar							
Connect							
Device : 0XCDA4CB1F113; Image to be uploaded: (USE_OTA_SERVICEMANAGER)							
New image base address (set at compile time linker options):							
0x10051800							
New image file path:							
	Browse						
0%	Update						
Force Disconnection							

10. Choose *.bin and select what you want to program. Make sure the image file and press "update".

Open Image									×
\leftarrow \rightarrow \checkmark \uparrow	늘 « WS2116_AT_CM	D_2.1.7_20200818 > W	S2116_AT_CMD_M_2.1.7_202008	18	~ C	Q	Search WS211	6_AT_CMD	_M
Organize 🔹 New fo	older							•	?
> 📑 Documents	Name	^	Date modified	Туре	Size				
> 🛓 Downloads	WS2116_AT_	CMD_M_2.1.7.bin	8/19/2020 5:45 PM	BIN File		112 KB			
> 🕑 Music									
> Videos									
> 🛏 Windows-SSD ((
> 💳 DATA (D:)									
> 📻 IDB007VX (E:)									
> 📻 IDB007VX (F:)									
> 📻 IDB007VX (E:)									
> 💼 IDB007VX (F:)									
> 🛬 Network									
-									
File	name: WS2116_AI_CM	D_M_2.1.7.bin			~	Image	e Files (*.bin)		<u> </u>
						<u>(</u>	<u>pen</u>	Cancel	



🖅 Bootloading Actions	×
Search for devices	
0xcda4cb1f113OTAServiceMgr	~
Connect	
Device : 0XCDA4CB1F113; Image to be uploaded: (USE_OTA_SERVI New image base address (set at compile time linker options):	CEMANAGER)
0x10051800	
New image file path:	
116_AT_CMD_M_2.1.7_20200818/WS2116_AT_CMD_M_2.1.7.bin	Browse
0%	Update
Force Disconnection	

Search for devices 0xcda4cb1f1130TAServiceMgr Connect	
Oxcda4cb1f113OTAServiceMgr Connect	
Connect	
Device : UACDA4CBIFIID; Image to be uploaded: (USE_UIA_SERVICEMAN	AGE.
New image base address (set at compile time linker options):	
······································	
0x10051800	
0x10051800 New image file path:	
0x10051800 New image file path: 116_AT_CMD_M_2.1.7_20200818/WS2116_AT_CMD_M_2.1.7.bin Brow	JSE



Image: Approximate Actions → Sector Actions → Sector Actions → Sector Actions → Sector Action → Sector → S					
Search for devices					
Connect					
Device : 0XCDA4CB1F113; Image to be uploaded: (USE_OTA_SERVICEMANAGER) New image base address (set at compile time linker options):					
0x10051800					
New image file path:					
116_AT_CMD_M_2.1.7_20200818/WS2116_AT_CMD_M_2.1.7.bin Browse					
100% Update					
Force Disconnection					

11. OTA success will show firmware booting log.





6 How to Evaluate with Sigfox funciotn

6.1 Use PUBLIC KEY (Use SDR DONGLE)

- 1. Hold SW1
- 2. Press and release SW2
- 3. Release SW1
- 4. Check the log as below



5. Set TRIGGER_TIMER as a trigger unit to send frame to sigfox backend.





sigfox	001	FIGURATION	MESSAGES ABOUT Authentication enabled		
Device ID	Time	Sequence	Data / Decoding	LQI	Gallbacks
FEDCBA98	2018年12月12日 16:26:42	162	1300	at	0
FEDCBA90	2018年12月12日 16:25:42	161	1200	att	0
FEDCBA98	2018年12月12日 16:24:42	160	1100	at	0
FEDCBA98	2018年12月12日 16:23:42	159	1000	att	0
FEDCBA98	2018年12月12日 16:22:42	158	000	att	0
FEDCBA98	2018年12月12日 16:21:42	157	DeCD	at	0
FEDCBA98	2018年12月12日 16:20:42	156	0000	at	0
FEDCEA98	2018年12月12日 16:19:42	155	0c00	at	0
FEDCBA38	2018年12月12日 16:18:42	154	0600	att	0

6.2 USE PRIVATE KEY

Options for node "Jorjin_WS2116_DK"

Both EEPROM/flash have stored SIGFOX information (id, pac and key etc.), depend on module or EVB you use to define symbol to read SIGFOX information (id, pac and key etc.) which Jorjin provide to simulate sigfox function.

_ategory:	—				Fac	tory Settings
General Options Static Analysis Runtime Checking	Discard Uni	stion used Publics				
C/C++ Compiler	MISRA-C:	1998	Encodings		Extra O	ptions
Assembler	Language 1	Language 2	Code	Optimiz	ations	Output
Output Converter	List	Preprocessor	Diagno	ostics	MISRA	A-C:2004
Debugger Simulator CADI CMSIS DAP GDB Server I-jet/JTAGjet J-Link/J-Trace TI Stelaris	Additional inc SPROJ_DIRS SPROJ_DIRS SPROJ_DIRS SPROJ_DIRS SPROJ_DIRS Preinclude file	lude directories: (o ,\\inc ,\\\\Drivers\N ,\\\Drivers\N ,-\\\Drivers\B ,-\\\Drivers\B	ne per line) ACU\HAL_B ACU\CMSIS ACU\BlueNF ISP\SDK_Eva	LUENRG\in \BlueNRG1 RG1_Periph al_BlueNRG	c \inc _Driver\ii \inc	^
PE micro ST-LINK Third-Party Driver TI MSP-FET TI XDS	Defined symb DEBUGX xMONARCH USE_FLASH HARDCODEX	ols: (one per line) FEATURE_ENABL	*	eprocessor]Preserve <u>c</u>] <u>G</u> enerate	output tr omment #line dire	o file s ectives

×



Ele Edit Setup Control Window Help Jorjin WS2116 application ** Jan 30 2019 16:56:46 ** BLE Stack Initialized ID = 00B965EF PAC = 0000000051A4A31B RC4 open Sigfox send 1 Sigfox send 2 Sigfox send 3 Sigfox send 4 Sigfox send 5 Sigfox send 6 Sigfox send 7 Sigfox send 9 Sigfox send 10 Sigfox send 12 Sigfox send 13 Sigfox send 13 Sigfox send 14	COM39 - Tera Term VT	-	×
Jorjin WS2116 application ** Jan 30 2019 16:56:46 ** BLE Stack Initialized ID = 00B965EF PAC = 0000000051A4A31B RC4 open Sigfox send 1 Sigfox send 2 Sigfox send 3 Sigfox send 4 Sigfox send 4 Sigfox send 6 Sigfox send 7 Sigfox send 7 Sigfox send 10 Sigfox send 10 Sigfox send 12 Sigfox send 12 Sigfox send 13 Sigfox send 13 Sigfox send 14 Sigfox send 15	<u>Eile E</u> dit <u>S</u> etup C <u>o</u> ntrol <u>W</u> indow <u>H</u> elp		
BLE Stack Initialized ID = 00B965EF PAC = 0000000051A4A31B RC4 open Sigfox send 1 Sigfox send 2 Sigfox send 3 Sigfox send 4 Sigfox send 5 Sigfox send 6 Sigfox send 7 Sigfox send 8 Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Jorjin WS2116 application ** Jan 30 2019 16:56:46 **		^
ID = 00B965EF PAC = 0000000051A4A31B RC4 open Sigfox send 1 Sigfox send 2 Sigfox send 3 Sigfox send 4 Sigfox send 5 Sigfox send 6 Sigfox send 7 Sigfox send 8 Sigfox send 8 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	BLE Stack Initialized		
PAC = 000000051A4A31B RC4 open Sigfox send 1 Sigfox send 2 Sigfox send 3 Sigfox send 4 Sigfox send 5 Sigfox send 6 Sigfox send 7 Sigfox send 8 Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	ID = 00B965EF		
RC4 open Sigfox send 1 Sigfox send 2 Sigfox send 3 Sigfox send 4 Sigfox send 5 Sigfox send 6 Sigfox send 7 Sigfox send 8 Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	PAC = 000000051A4A31B		
Sigfox send 1 Sigfox send 2 Sigfox send 3 Sigfox send 4 Sigfox send 5 Sigfox send 6 Sigfox send 7 Sigfox send 7 Sigfox send 8 Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	RC4 open		
Sigfox send 2 Sigfox send 3 Sigfox send 4 Sigfox send 5 Sigfox send 6 Sigfox send 7 Sigfox send 8 Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 1		
Sigfox send 3 Sigfox send 4 Sigfox send 5 Sigfox send 6 Sigfox send 7 Sigfox send 8 Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 2		
Sigfox send 4 Sigfox send 5 Sigfox send 6 Sigfox send 7 Sigfox send 8 Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 3		
Sigfox send 5 Sigfox send 6 Sigfox send 7 Sigfox send 8 Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 4		
Sigfox send 6 Sigfox send 7 Sigfox send 8 Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 5		
Sigfox send 7 Sigfox send 8 Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 6		
Sigfox send 8 Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 7		
Sigfox send 9 Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 8		
Sigfox send 10 Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 9		
Sigfox send 11 Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 10		
Sigfox send 12 Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 11		
Sigfox send 13 Sigfox send 14 Sigfox send 15	Sigfox send 12		
Sigfox send 14 Sigfox send 15	Sigfox send 13		
Sigfox send 15	Sigfox send 14		
	Sigfox send 15		

Y sigfox	DEVICE	DEVICE TYPE US	ER GROUP	•		4
INFORMATION	Device B	965EF - Messages	5			
LOCATION		Time	Data / Decoding	Link quality	Callbacks	Location
EVENTS		2010-12-14 15:42:02	0c00	att	0	0
EVENT CONFIGURATION		2010-12-14 15:41:22	0500	att	0	0
		2018-12-14 15:40:42	0a00	att	0	0
		2018-12-14 15:40:02	0900	atl	0	0
		2018-12-14 15:39:23	0800	atl	0	0
		2018-12-14 15:38:42	0700	att	0	0
		2018-12-14 15:36:02	0600	att	0	0
		2018-12-14 15:37:22	0500	att	0	0
		2018-12-14 15:36:43	0400	atl	0	0
		2018-12-14 15:36:03	0300	att	0	0



- 1 - C

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If show information below, please click "Disengage sequence number" on Sigfox backend. Then the sequence number will match.

Y sigfox	DEVICE DEVICE TYPE USER GROUP -	≜∆ 0 ⊮
INFORMATION	Device B965F2 - Information Suspend Disengage sequence number	Edit Transfer
LOCATION		
MESSAGES	Name: Jorjin_DevKit_2-device	
EVENTS	Protocol: V1	
	Activable state: 🗹 🕢	
STATISTICS	Sequence number: 11 (2018-07-23 17:00:51)	
EVENT CONFIGURATION	Trash sequence number: N/A (N/A)	
	Last seen: 2018-07-23 17:00:51	
	PAC: 42DADED11AF80406	
	Product certificates P_00EA_4054_01	
	Latitude: 0.000 (degrees)	
	Longitude: 0.000 (degrees)	
	Device type: Jorjin_DevKit_2	
	Average SNR (): 19.16 dB	
	Average RSSI @: : 94.26 dBm	
	State: OK	
	Communication status:	
	Contract: jorjin_t_3e21_5d69	
	Activation date: 2010-07-20 10:51:12	
	Token validity: 2019-07-20	
	Subscription automatic renewal status: Not allowed	
	Subscription automatic renewal: 🕑 0	

6.3 READ SIGFOX ID AND PAC

This section is based on SDK 3.32+ version. If you are using old SDK. Please upgrade.

Don't define "HARDCODE" to read module data SIGFOX information, UART will show ID and PAC.





6.4 SCAN MODE

WS2116 supply a function which scan of the air to detect a Sigfox Beacon to use in different zone. To enable function please define "MONARCH_SCAN".

This SDK is designed that device always in sleep mode when specific timer / unit time wakeup to scan where zone is it.

Wakeup source have IO-11 (UART), IO-12 (Button) and timer. Timer interval setting "WAKEUP_TIMEOUT".

#define WAKEUP_TIMEOUT 30000 //30 sec, MAX = 5242879(5242 sec)

<u>.</u>						
Category: General Options Static Analysis Runtime Checking	Multi-file Compila	tion sed Publics			Fac	ctory Settings
C/C++ Compiler	MISRA-C:1	998	Encoding	5	Extra O	ptions
Assembler	Language 1	Language 2	Code	Optim	nizations	Output
Output Converter	List	Preprocessor	Diag	gnostics	MISRA	A-C:2004
Build Actions Linker Debugger Simulator CADI CMSIS DAP GDB Server I-jet/JTAGjet J-Link/J-Trace TI Stellaris Nu-Link PE micro ST-LINK Third-Party Driver TI MSP-FET TI MSP-FET TI XDS	☐ Ignore stand Additional incl \$PROJ_DIR\$ \$PROJ_DIR\$ \$PROJ_DIR\$ \$PROJ_DIR\$ \$PROJ_DIR\$ Preinclude file: Defined symbol DEBUGx MONARCH_F USE_FLASH HARDCODEx	dard include di ude directories .\\inc .\\\\Driver .\\\\Driver .\\\\Driver .\\\\Driver ols: (one per line EATURE_ENAB	ectories (one per lin s\MCU\HAL s\MCU\CMS s\MCU\Blue s\BSP\SDK_1 e)	e) _BLUENRG' SIS\BlueNR NRG1_Perij Eval_BlueNF Preprocess Preserve <u>G</u> enerat	\inc G1\inc ph_Driver\i RG\inc or output t e <u>c</u> omment te #line dire	n v o file s ectives
				OK	Cancel	



<pre>if(callbackFlag) callbackFlag = 0; sleep_timer();</pre>	
lf(wakeupFlag==1) wakeupFlag=0;	
<pre>SIGFOX_API_close(); resetRcz=1;</pre>	_
<pre>//Begin Monarch Scan session SIGFOX_MONARCH_API_execute_rc_scan (63, 5, SFX_TIME_M, callback_for_found);</pre>	;

printf("waitting for SIGFOX beacon...\r\n");

}

VT	COM39 - Tera Term VT			_	×
<u>F</u> ile	<u>E</u> dit <u>S</u> etup C <u>o</u> ntrol <u>W</u> indow <u>H</u> elp				
Jor BLE ID PAC RC4	ijin WS2116 application ** 3 Stack Initialized = 00B965EF 2 = 0000000051A4A31B open	Jan 30 2019 17:15:5	6 **		^
Ent WAK wai ret ret	er to Sleep - SLEEPMODE_WA (EUP Reason = SLEEP TIMER2 (tting for SIGFOX beacon (urn rc_bit_mask 0 (urn rssi 0	KETIMER			
Ent WAK wai ret ret	er to Sleep - SLEEPMODE_WAW (EUP Reason = SLEEP TIMER2 (tting for SIGFOX beacon (urn rc_bit_mask 0 (urn rssi 0	KETIMER			
Ent WAK wai	er to Sleep - SLEEPMODE_WAH EUP Reason = SLEEP TIMER2 Itting for SIGFOX beacon	KETIMER			