



# **NRC7292 Evaluation Kit**

## **User Guide**

### **(Standalone SDK API)**

#### **Ultra-low power & Long-range Wi-Fi**

**Ver 3.3**  
**Oct. 15, 2021**

**NEWRACOM, Inc.**

## **NRC7292 Evaluation Kit User Guide (Standalone SDK API)**

### **Ultra-low power & Long-range Wi-Fi**

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# Contents

<b>1</b>	<b>Overview.....</b>	<b>13</b>
<b>2</b>	<b>General .....</b>	<b>14</b>
	2.1.1 Error Type.....	14
<b>3</b>	<b>Wi-Fi .....</b>	<b>15</b>
	3.1 Data Type .....	15
	3.1.1 API Status Return Value .....	15
	3.1.2 Device Mode .....	15
	3.1.3 Wifi State.....	16
	3.1.4 Country Code .....	16
	3.1.5 Security Mode .....	17
	3.1.6 Bandwidth .....	17
	3.1.7 IP Mode .....	17
	3.1.8 SCAN_RESULT.....	18
	3.1.9 SCAN_RESULTS.....	18
	3.2 Function Call.....	19
	3.2.1 nrc_wifi_get_ip_mode.....	19
	3.2.2 nrc_wifi_set_ip_mode .....	19
	3.2.3 nrc_wifi_set_ip_address .....	19
	3.2.4 nrc_wifi_add_network.....	20
	3.2.5 nrc_wifi_remove_network .....	20
	3.2.6 nrc_wifi_get_country.....	20
	3.2.7 nrc_wifi_set_country .....	21
	3.2.8 nrc_wifi_set_ssid.....	21
	3.2.9 nrc_wifi_set_bssid .....	22
	3.2.10 nrc_wifi_set_scan_freq.....	22
	3.2.11 nrc_wifi_get_bssid .....	23
	3.2.12 nrc_wifi_set_security.....	23
	3.2.13 nrc_wifi_get_enable_key.....	23
	3.2.14 nrc_wifi_scan .....	24
	3.2.15 nrc_wifi_scan_results .....	24
	3.2.16 nrc_wifi_abort_scan .....	24
	3.2.17 nrc_wifi_disassociate .....	25
	3.2.18 nrc_wifi_connect .....	25
	3.2.19 nrc_wifi_disconnect.....	25

3.2.20 nrc_wifi_get_ip_address.....	26
3.2.21 nrc_wifi_set_state .....	26
3.2.22 nrc_wifi_get_state .....	26
3.2.23 nrc_wifi_set_tx_power .....	27
3.2.24 nrc_wifi_get_tx_power .....	27
3.2.25 nrc_wifi_register_event_handler .....	28
3.2.26 nrc_wifi_get_rssi.....	28
3.2.27 nrc_wifi_get_snr .....	28
3.2.28 nrc_wifi_get_mac_address .....	29
3.2.29 nrc_wifi_get_device_mode .....	29
3.2.30 nrc_wifi_set_rate_control .....	29
3.2.31 nrc_wifi_get_rate_control .....	30
3.2.32 nrc_wifi_get_aid .....	30
3.2.33 nrc_wifi_get_network_index.....	30
3.2.34 nrc_wifi_country_from_string.....	31
3.2.35 nrc_wifi_country_to_string .....	31
3.2.36 register_vendor_ie_handler .....	32
3.2.37 unregister_vendor_ie_handler .....	32
3.2.38 nrc_wifi_set_s1g_config .....	32
3.2.39 nrc_wifi_wps_pbc .....	33
3.2.40 nrc_wifi_set_channel.....	33
3.2.41 nrc_wifi_get_channel .....	33
3.2.42 nrc_wifi_get_ch_bw.....	34
3.2.43 nrc_wifi_softap_set_ip .....	34
3.2.44 nrc_wifi_softap_set_conf .....	34
3.2.45 nrc_wifi_softap_start.....	35
3.2.46 nrc_wifi_softap_start_dhcp_server.....	35
3.3 Callback Functions & Events .....	37
<b>4 System .....</b>	<b>38</b>
4.1 Data Type .....	38
4.1.1 Trace Level .....	38
4.1.2 Trace Types .....	38
4.2 Function Call.....	40
4.2.1 nrc_wifi_set_bdf_use.....	40
4.2.2 nrc_wifi_get_bdf_use .....	40
4.2.3 nrc_wifi_set_cal_use .....	40
4.2.4 nrc_wifi_get_cal_use .....	41
4.2.5 nrc_wifi_set_log_level .....	41

4.2.6 nrc_wifi_get_log_level .....	42
<b>5 Timer.....</b>	<b>43</b>
5.1 Data Type .....	43
5.1.1 Timer Information Type .....	43
5.1.2 Timer Struct.....	43
5.2 Function Call.....	43
5.2.1 nrc_hw_timer_init .....	43
5.2.2 nrc_hw_timer_deinit .....	44
5.2.3 nrc_hw_timer_start .....	44
5.2.4 nrc_hw_timer_stop.....	45
5.2.5 nrc_hw_timer_clear_irq .....	45
5.3 Callback Functions & Events .....	45
<b>6 UART .....</b>	<b>46</b>
6.1 Data Type .....	46
6.1.1 Channel .....	46
6.1.2 UART Data Bit.....	46
6.1.3 UART Stop Bit .....	46
6.1.4 UART Parity Bit .....	47
6.1.5 UART Hardware Flow Control .....	47
6.1.6 UART FIFO .....	47
6.1.7 UART Configuration .....	47
6.1.8 UART Interrupt Type .....	48
6.2 Function Call.....	48
6.2.1 nrc_uart_set_config.....	48
6.2.2 nrc_hw_set_channel.....	48
6.2.3 nrc_uart_get_interrupt_type.....	49
6.2.4 nrc_uart_set_interrupt .....	49
6.2.5 nrc_uart_clear_interrupt .....	50
6.2.6 nrc_uart_put .....	50
6.2.7 nrc_uart_get .....	51
6.2.8 nrc_uart_register_interrupt_handler .....	51
6.2.9 nrc_uart_console_enable .....	51
6.2.10 nrc_uart_printf.....	52
6.3 Callback Functions & Events .....	52
<b>7 GPIO.....</b>	<b>53</b>
7.1 Data Type .....	53
7.1.1 GPIO Pin .....	53
7.1.2 GPIO Direction.....	53

7.1.3 GPIO Mode .....	54
7.1.4 GPIO Level .....	54
7.1.5 GPIO Alternative Function .....	54
7.1.6 GPIO Configurations.....	54
7.2 Function Call.....	55
7.2.1 nrc_gpio_config.....	55
7.2.2 nrc_gpio_output .....	55
7.2.3 nrc_gpio_outputb .....	55
7.2.4 nrc_gpio_input.....	56
7.2.5 nrc_gpio_inputb.....	56
7.2.6 nrc_gpio_register_interrupt_handler.....	57
7.3 Callback Functions & Events .....	57
<b>8 I2C.....</b>	<b>58</b>
8.1 Data Type .....	58
8.2 Function Call.....	58
8.2.1 nrc_i2c_init.....	58
8.2.2 nrc_i2c_enable.....	58
8.2.3 nrc_i2c_reset.....	59
8.2.4 nrc_i2c_start .....	59
8.2.5 nrc_i2c_stop.....	59
8.2.6 nrc_i2c_waitack .....	60
8.2.7 nrc_i2c_writebyte .....	60
8.2.8 nrc_i2c_readbyte .....	60
<b>9 ADC.....</b>	<b>62</b>
9.1 Data Type .....	62
9.1.1 ADC Channel.....	62
9.2 Function Call.....	62
9.2.1 nrc_adc_init .....	62
9.2.2 nrc_adc_deinit .....	62
9.2.3 nrc_adc_get_data .....	63
<b>10 PWM.....</b>	<b>64</b>
10.1 Data Type .....	64
10.1.1 PWM Channel .....	64
10.2 Function Call.....	64
10.2.1 nrc_pwm_hw_init .....	64
10.2.2 nrc_pwm_set_config .....	65
10.2.3 nrc_pwm_set_enable .....	65

<b>11</b>	<b>SPI.....</b>	<b>67</b>
11.1	Data Type .....	67
11.1.1	SPI Mode .....	67
11.1.2	SPI Frame Bits.....	67
11.2	Function Call.....	68
11.2.1	nrc_spi_init.....	68
11.2.2	nrc_spi_enable.....	68
11.2.3	nrc_spi_start_xfer .....	69
11.2.4	nrc_spi_stop_xfer .....	69
11.2.5	nrc_spi_xfer.....	69
11.2.6	nrc_spi_writebyte_value .....	70
11.2.7	nrc_spi_readbyte_value .....	70
11.2.8	nrc_spi_write_values .....	70
11.2.9	nrc_spi_read_values .....	71
<b>12</b>	<b>HTTP Client.....</b>	<b>72</b>
12.1	Data Type .....	72
12.1.1	HTTP Client Return Types .....	72
12.1.2	Define values.....	72
12.1.3	HTTP Client Connection Handle .....	73
12.1.4	SSL Certificate Structure .....	73
12.1.5	HTTP Client Data Type.....	73
12.2	Function Call.....	73
12.2.1	nrc_httpc_get.....	73
12.2.2	nrc_httpc_post.....	74
12.2.3	nrc_httpc_put .....	75
12.2.4	nrc_httpc_delete.....	75
12.2.5	nrc_httpc_delete.....	76
12.2.6	nrc_httpc_recv_response .....	77
12.2.7	nrc_httpc_close.....	77
<b>13</b>	<b>FOTA .....</b>	<b>78</b>
13.1	Data Type .....	78
13.1.1	FOTA Information.....	78
13.2	Function Call.....	78
13.2.1	nrc_fota_is_support.....	78
13.2.2	nrc_fota_write .....	79
13.2.3	nrc_fota_erase .....	79
13.2.4	nrc_fota_set_info.....	79
13.2.5	nrc_fota_update_done .....	80

13.2.6 nrc_fota_update_done_bootloader .....	80
13.2.7 nrc_fota_cal_crc.....	81
<b>14 Power save.....</b>	<b>82</b>
14.1 Data Type .....	82
14.1.1 Power Save Sleep Mode .....	82
14.1.2 Power Save TIM Mode .....	82
14.1.3 Power Save Wakeup Source .....	82
14.2 Function Call.....	83
14.2.1 nrc_ps_set_sleep .....	83
14.2.2 nrc_ps_set_modemsleep_stop.....	83
14.2.3 nrc_ps_set_gpio_wakeup_pin .....	83
14.2.4 nrc_ps_set_gpio_wakeup_source .....	84
<b>15 PBC (Push Button) .....</b>	<b>85</b>
15.1 Data Type .....	85
15.1.1 pbc_ops.....	85
15.2 Function Call.....	85
15.2.1 wps_pbc_fail_cb .....	85
15.2.2 wps_pbc_timeout_cb .....	86
15.2.3 wps_pbc_success_cb .....	86
15.2.4 wps_pbc_button_pressed_event .....	86
15.2.5 wps_pbc_set_fail_cb.....	87
15.2.6 wps_pbc_set_timeout_cb.....	87
15.2.7 wps_pbc_set_success_cb .....	87
15.2.8 wps_pbc_set_btn_pressed_cb .....	88
15.2.9 init_wps_pbc.....	88
<b>16 Middleware API Reference.....</b>	<b>89</b>
16.1 FreeRTOS.....	89
16.2 WPA_suppllicant.....	89
16.3 lwIP.....	89
16.4 MbedTLS.....	90
16.5 NVS library.....	90
<b>17 S1G Channel .....</b>	<b>91</b>
17.1 Overview .....	91
17.2 Channel .....	91
17.2.1 US (United States) Channel.....	91
17.2.2 KR (Korea) Channel .....	93
17.2.3 JP (Japan) channel.....	93



17.2.4 TW (Taiwan) channel .....94

17.2.5 EU (Europe) channel .....94

17.2.6 CN (China) channel.....95

17.2.7 NZ (New Zealand) channel .....95

17.2.8 AU (Australia) channel .....96

**18    Abbreviations..... 97**

**19    Revision history..... 98**

# List of Tables

Table 2.1	Error Type.....	14
Table 3.1	tWIFI_STATUS .....	15
Table 3.2	tWIFI_DEVICE_MODE.....	15
Table 3.3	tWIFI_STATE_ID .....	16
Table 3.4	tWIFI_COUNTRY_CODE.....	16
Table 3.5	tWIFI_SECURITY .....	17
Table 3.6	tWIFI_BANDWIDTH.....	17
Table 3.7	tWIFI_IP_MODE .....	17
Table 3.8	SCAN_RESULT.....	18
Table 3.9	Security Flags.....	18
Table 3.10	SCAN_RESULTS.....	18
Table 3.11	tWIFI_EVENT_ID.....	37
Table 4.1	TRACE_LEVEL.....	38
Table 4.2	TRACE_TYPES .....	38
Table 5.1	TIMER_INFO .....	43
Table 5.2	TIMER_STRUCT.....	43
Table 6.1	NRC_UART_CHANNEL.....	46
Table 6.2	NRC_UART_DATA_BIT.....	46
Table 6.3	NRC_UART_STOP_BIT .....	46
Table 6.4	NRC_UART_PARITY_BIT .....	47
Table 6.5	NRC_UART_HW_FLOW_CTRL .....	47
Table 6.6	NRC_UART_FIFO .....	47
Table 6.7	NRC_UART_CONFIG .....	47
Table 6.8	NRC_UART_INT_TYPE .....	48
Table 7.1	NRC_GPIO_PIN.....	53
Table 7.2	NRC_GPIO_DIR.....	53
Table 7.3	NRC_GPIO_MODE .....	54
Table 7.4	NRC_GPIO_LEVEL.....	54
Table 7.5	NRC_GPIO_ALT.....	54
Table 7.6	NRC_GPIO_CONFIG.....	54
Table 9.1	ADC_CH .....	62
Table 10.1	PWM_CH.....	64
Table 11.1	SPI_MODE .....	67
Table 11.2	SPI_FRAME_BITS.....	67
Table 12.1	httpc_ret_e .....	72
Table 12.2	Default define values .....	72
Table 12.3	con_handle_t .....	73
Table 12.4	ssl_certs_t .....	73
Table 12.5	httpc_data_t .....	73
Table 13.1	FOTA_INFO.....	78

Table 14.1	POWER_SAVE_SLEEP_MODE .....	82
Table 14.2	POWER_SAVE_TIM_MODE .....	82
Table 14.3	power save wakeup source.....	82
Table 15.1	pbcs_ops .....	85
Table 17.1	US Channel .....	91
Table 17.2	KR USN Channel .....	93
Table 17.3	KR MIC Channel .....	93
Table 17.4	JP Channel .....	93
Table 17.5	TW Channel .....	94
Table 17.6	EU Channel .....	94
Table 17.7	CN Channel .....	95
Table 17.8	NZ Channel .....	95
Table 17.9	AU Channel.....	96
Table 18.1	Abbreviations and acronyms .....	97

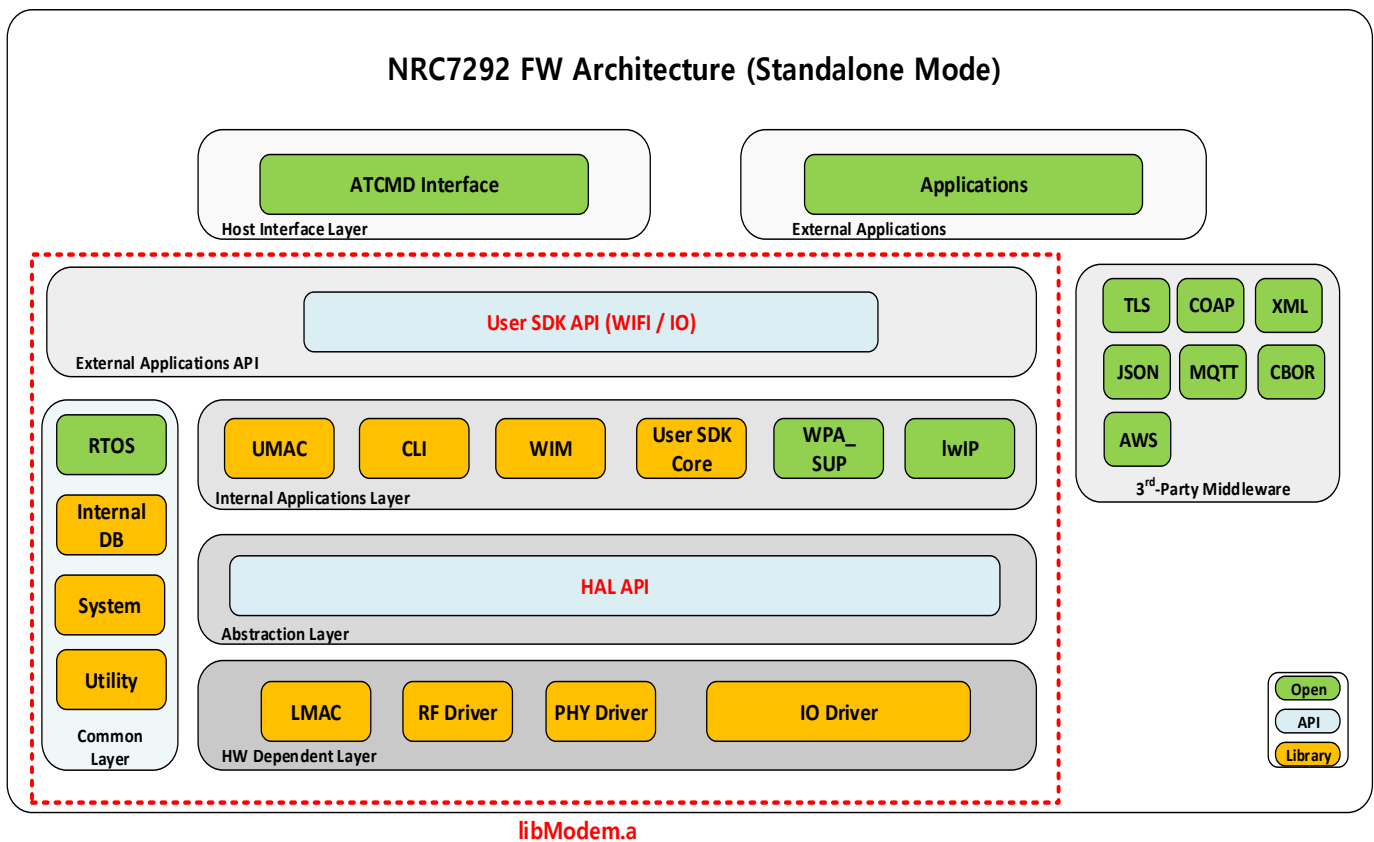
# List of Figures

Figure 1.1	NRC7292 FreeRTOS Host Architecture .....	13
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# 1 Overview

This document introduces the Application Programming Interface (API) for standalone NRC7292 Software Development Kit (SDK). These APIs are used for Wi-Fi operations and events and other peripherals on the NRC7292 Evaluation Boards (EVB).

The user application is implemented using SDK API, 3rd party libraries and system hal APIs. The lwIP is used for TCP/IP related codes. The mbedtls is related to encryption and decryption. stack is SDK API is used for Wi-Fi operations and getting configurations. The FreeRTOS is a real-time operating system kernel for embedded devices. It provides methods for multiple threads or tasks, mutexes, semaphores and software timers. Wifi API is implemented based on wpa\_supplicant. It provides the general Wi-Fi operations such as scan, connect, set Wi-Fi configurations, and get system status information such as RSSI, SNR.



**Figure 1.1 NRC7292 FreeRTOS Host Architecture**

## 2 General

The general data types are defined at the “NRC7292/API/Inc/nrc\_types.h”.

### 2.1.1 Error Type

nrc\_err\_t is an operation function return type. These types are defined at the “lib/sdk/inc/nrc\_types.h”.

**Table 2.1 Error Type**

Name	Description
NRC_SUCCESS	Operation was successful
NRC_FAIL	Operation failed

## 3 Wi-Fi

The Wi-Fi API provides functions to:

- Scan & connect to AP
- Configuration the wifi settings
- Set and get the IP address

### 3.1 Data Type

These types are defined at the “NRC7292/API/Inc/api\_wifi.h”.

#### 3.1.1 API Status Return Value

tWIFI\_STATUS is returned by API functions to indicate whether a function call succeeded or failed.

**Table 3.1 tWIFI\_STATUS**

Name	Description
WIFI_SUCCESS	Operation successful
WIFI_FAIL	Operation failed
WIFI_NOMEM	No memory
WIFI_INVALID	Invalid parameter
WIFI_INIT_FAIL	Wi-Fi initial is failed
WIFI_CONNECTION_FAIL	Wi-Fi connection is failed
WIFI_DHCP_FAIL	Get DHCP client is failed
WIFI_DHCP_TIMEOUT	Get IP address is timeout
WIFI_SET_IP_FAIL	Set IP address is failed
WIFI_SOFTAP_FAIL	SoftAP start is failed

#### 3.1.2 Device Mode

tWIFI\_DEVICE\_MODE is the bandwidth.

**Table 3.2 tWIFI\_DEVICE\_MODE**

Name	Description
WIFI_MODE_STATION	Station
WIFI_MODE_AP	Access Point
WIFI_MODE_MESH_POINT	Mesh Point

### 3.1.3 Wifi State

tWIFI\_STATE\_ID is the wifi state.

**Table 3.3 tWIFI\_STATE\_ID**

Name	Description
WIFI_STATE_INIT	Initial
WIFI_STATE_READY	Wi-Fi ready
WIFI_STATE_TRY_CONNECT	Try to connect
WIFI_STATE_CONNECTED	Connected
WIFI_STATE_TRY_GET_IP	Try to get IP address
WIFI_STATE_GET_IP	Get IP address
WIFI_STATE_TRY_DISCONNECT	Try to disconnect
WIFI_STATE_DISCONNECTED	Disconnected
WIFI_STATE_SOFTAP_CONF	Set the softAP configuration
WIFI_STATE_SOFTAP_START	SoftAP is started
WIFI_STATE_DHCP_START	DHCP server is started
WIFI_STATE_TRY_DISASSOC	Try to disassociate
WIFI_STATE_SCAN	Scan
WIFI_STATE_SCAN_DONE	Scan is finished

### 3.1.4 Country Code

tWIFI\_COUNTRY\_CODE is the country code.

**Table 3.4 tWIFI\_COUNTRY\_CODE**

Name	Description
WIFI_CC_UNKNOWN	Unknown value
WIFI_CC_JP	Japan
WIFI_CC_KR	Korea
WIFI_CC_TW	Taiwan
WIFI_CC_US	United States of America
WIFI_CC_EU	Europe
WIFI_CC_CN	China
WIFI_CC_NZ	New Zealand
WIFI_CC_AU	Australia



### 3.1.5 Security Mode

tWIFI\_SECURITY is the security mode.

**Table 3.5 tWIFI\_SECURITY**

Name	Description
WIFI_SEC_OPEN	Open
WIFI_SEC_WPA2	WPA2
WIFI_SEC_WPA3_OWE	WPA3 OWE
WIFI_SEC_WPA3_SAE	WPA3 SAE

### 3.1.6 Bandwidth

tWIFI\_BANDWIDTH is the bandwidth.

**Table 3.6 tWIFI\_BANDWIDTH**

Name	Description
WIFI_1M	1 Mhz bandwidth
WIFI_2M	2 Mhz bandwidth
WIFI_4M	4 Mhz bandwidth

### 3.1.7 IP Mode

tWIFI\_IP\_MODE is the IP mode.

**Table 3.7 tWIFI\_IP\_MODE**

Name	Description
WIFI_DYNAMIC_IP	Dynamic IP, which uses the DHCP client
WIFI_STATIC_IP	Static IP

### 3.1.8 SCAN\_RESULT

This is a union of data types for SCAN\_RESULTS.

**Table 3.8 SCAN\_RESULT**

Type	Element	Description
char*	items[5]	This is union values. Each array entry points members. items[0] : BSSID items[1] : Frequency items[2] : Signal level items[3] : Flags items[4] : SSID
char*	bssid	BSSID, which is fixed-length, colon-separated hexadecimal ASCII string. (Ex. "84:25:3f:01:5e:50")
char*	freq	Frequency. The frequency is equivalent WiFi channel (2.4 / 5G frequency) (Ex. "5205"). See the " <a href="#">S1G Channel</a> "
char*	sig_level	Numeric ASCII string of RSSI. (Ex. "-25"). The unit is dBm
char*	flags	ASCII string of the security model for the network. See the table 2.9.
char*	ssid	ASCII string of SSID.

**Table 3.9 Security Flags**

Name	Description
WPA2-EAP	Wi-Fi Protected Access 2 – Extensible Authentication Protocol
WPA2-PSK	Wi-Fi Protected Access 2 – Pre-Shared Key
WPA3-SAE	Wi-Fi Protected Access 3 - Simultaneous Authentication of Equals
WPA3-OWE	Wi-Fi Protected Access 3 - Opportunistic Wireless Encryption

### 3.1.9 SCAN\_RESULTS

This is a structure for function nrc\_wifi\_scan\_results().

**Table 3.10SCAN\_RESULTS**

Type	Element	Description
int	n_result	number of scanned bssid
SCAN_RESULT	result[SCAN_RESULT_NUM]	scan results

※ SCAN\_RESULT\_NUM is a maximum scan results number, defaults is 10.

## 3.2 Function Call

These APIs are defined at the "sdk/api/api\_wifi.h".

### 3.2.1 nrc\_wifi\_get\_ip\_mode

Get the IP mode.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_get_ip_mode(tWIFI_IP_MODE* mode)
```

**Input Parameters :**

mode

Type: tWIFI\_IP\_MODE\*

Purpose: Static IP or Dynamic IP.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.2 nrc\_wifi\_set\_ip\_mode

Get the IP mode.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_set_ip_mode(tWIFI_IP_MODE* mode, char* ip_addr)
```

**Input Parameters :**

mode

Type: tWIFI\_IP\_MODE\*

Purpose: Static IP or Dynamic IP ip\_addr

Type char\*

Purpose: A pointer to set static IP which is ASCII string. (Ex. "192.168.200.23")

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.3 nrc\_wifi\_set\_ip\_address

Set IP address. It requests a dynamic IP via DHCP or set a static IP.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_set_ip_address(void)
```

**Input Parameters :**

None

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.4 nrc\_wifi\_add\_network

Add a network index associated with the Wi-Fi connection.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_add_network(int *index)
```

**Input Parameters :**

index

Type: int\*

Purpose: A pointer to receive assigned network ID. This will output a number, which is the network ID.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.5 nrc\_wifi\_remove\_network

Remove a network index associated with the Wi-Fi connection.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_remove_network(int index)
```

**Input Parameters :**

index

Type: int

Purpose: Network index.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.6 nrc\_wifi\_get\_country

Get the country code.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_get_country(tWIFI_COUNTRY_CODE *country_code)
```

**Input Parameters :**

country\_code

Type: char\*

Purpose: country code. See "[Country Code](#)".

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.7 nrc\_wifi\_set\_country

Set the country code.

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_set\_set\_country (char \*country\_code)

**Input Parameters :**

country\_code

Type: char\*

Purpose: country code. See "[Country Code](#)".

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.8 nrc\_wifi\_set\_ssid

Set the SSID of the AP to connect. (\*STA only)

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_set\_ssid(int index, char \* ssid)

**Input Parameters :**

index

Type: int

Purpose: Network index.

ssid

Type: char\*

Purpose: A pointer to set ssid bssid which is ASCII string. . The maximum length of the name is 32 bytes.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.9 nrc\_wifi\_set\_bssid

Set the BSSID(Basic Service Set Identifier) of the AP to connect. (\*STA only)

**Prototype :**

```
tWIFI_STATUS nrc_wifi_set_bssid(int index, char * ssid)
```

**Input Parameters :**

index

Type: int  
Purpose: Network index.

bssid

Type: char\*  
Purpose: A pointer to set bssid which is colon-separated hexadecimal ASCII string. (Ex. "84:25:3f:01:5e:50"). The maximum length of the name is 17 bytes

**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

### 3.2.10 nrc\_wifi\_set\_scan\_freq

Set the scan channel list for scanning AP

**Prototype :**

```
tWIFI_STATUS nrc_wifi_set_scan_freq(int index, uint16_t *freq, uint8_t num_freq)
```

**Input Parameters :**

index

Type: int  
Purpose: Network index.

freq

Type: uint16\_t\*  
Purpose: A pointer to the frequency list. The frequency should be assigned equivalent WiFi channel(2.4 / 5G frequency) (Ex. "5205 5200). See the "[S1G Channel](#)"

num\_freq

Type: uint8\_t  
Purpose: number of frequencies.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

### 3.2.11 nrc\_wifi\_get\_bssid

Get the bssid.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_get_bssid(char *bssid)
```

**Input Parameters :**

bssid

Type: char\*

Purpose: A pointer to get bssid which is colon-separated hexadecimal ASCII string. (Ex. "84:25:3f:01:5e:50"). The maximum length of the name is 17 bytes.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.12 nrc\_wifi\_set\_security

Set the security parameters for Wi-Fi connection.

**Prototype :**

```
void nrc_wifi_set_security (int index, int mode, char *password)
```

**Input Parameters :**

index

Type: int

Purpose: Network index.

mode

Type: int

Purpose: security mode, See "[Security Mode](#)".

password

Type: char\*

Purpose: A pointer to set password which is ASCII string. (Ex. "123ABDC"). The maximum length of the password is 30 bytes.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.13 nrc\_wifi\_get\_enable\_key

Get information on whether security is active.

**Prototype :**

```
bool nrc_wifi_get_enable_key(void)
```

**Input Parameters :**

None

**Returns :**

TRUE, if the security is enabled.

FALSE, if the security is disabled.

### 3.2.14 nrc\_wifi\_scan

Scan the AP

**Prototype :**

int nrc\_wifi\_scan (void)

**Input Parameters :**

None

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.15 nrc\_wifi\_scan\_results

Get scan results.

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_scan\_results(SCAN\_RESULTS \*results)

**Input Parameters :**

results

Type: SCAN\_RESULTS\*

Purpose: scan lists. See "[SCAN RESULTS](#)".

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.16 nrc\_wifi\_abort\_scan

Stop the scan procedure.

**Prototype :**

int nrc\_wifi\_abort\_scan (void)

**Input Parameters :**

None



**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

**3.2.17 nrc\_wifi\_disassociate**

Disassociate all stations or a specific station equal to mac address.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_disassociate(char* mac_addr)
```

**Input Parameters :**

mac\_addr

Type: char\*

Purpose: A pointer to set broadcast(ff:ff:ff:ff:ff:ff) or single sta's MAC Address which is colon-separated hexadecimal ASCII string.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

**3.2.18 nrc\_wifi\_connect**

Connect to AP

※ The AP information such as ssid, security should be set before calling this function.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_connect (int index)
```

**Input Parameters :**

index

Type: int

Purpose: Network index.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

**3.2.19 nrc\_wifi\_disconnect**

Disconnect from the AP.

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_disconnect (int index)

**Input Parameters :**

index

Type: int

Purpose: Network index.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.20 nrc\_wifi\_get\_ip\_address

Get the current IP address.

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_get\_ip\_address(char \*\*ip\_addr)

**Input Parameters :**

ip\_addr

Type: char\*\*

Purpose: A double pointer to get the address of IP address.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.21 nrc\_wifi\_set\_state

Set the current Wi-Fi connection state.

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_set\_state(tWIFI\_STATE\_ID state)

**Input Parameters :**

state

Type: tWIFI\_STATE\_ID

Purpose: wifi state. See "[Wifi STATE](#)".

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.22 nrc\_wifi\_get\_state

Get the current Wi-Fi connection state.

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_get\_state(tWIFI\_STATE\_ID\* state)

**Input Parameters :**

state

Type: tWIFI\_STATE\_ID\*

Purpose: wifi state. See "[Wifi STATE](#)".

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.23 nrc\_wifi\_set\_tx\_power

Set TX power

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_set\_tx\_power(int txpower)

**Input Parameters :**

txpower

Type: int

Purpose: TX Power (in dBm) (8~18)

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.24 nrc\_wifi\_get\_tx\_power

Get the TX power.

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_set\_tx\_power(int txpower)

**Input Parameters :**

txpower

Type: int\*

Purpose: TX Power

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.25 nrc\_wifi\_register\_event\_handler

Register a Wi-Fi event handler callback function. The callback function will be called when a Wi-Fi event happens. See the [“Callback Functions & Events”](#)

**Prototype :**

```
tWIFI_STATUS nrc_wifi_register_event_handler(event_callback_fn fn)
```

**Input Parameters :**

fn

Type: event\_callback\_fn

Purpose: event handler for wifi connection and dhcp.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.26 nrc\_wifi\_get\_rssi

Get the RSSI value.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_get_rssi(int8_t *rssi)
```

**Input Parameters :**

rssi

Type: int8\_t\*

Purpose: A pointer to get RSSI. The RSSI is signed binary number.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.27 nrc\_wifi\_get\_snr

Get the SNR value.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_get_snr(uint8_t *snr)
```

**Input Parameters :**

snr

Type: uint8\_t\*

Purpose: A pointer to get SNR. The RSSI is unsigned binary number

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.28 nrc\_wifi\_get\_mac\_address

Get the MAC address.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_get_mac_address(char *addr)
```

**Input Parameters :**

addr

Type: char\*

Purpose: A pointer to get MAC address which is colon-separated hexadecimal ASCII string. (Ex. "84:25:32:11:5e:50").

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.29 nrc\_wifi\_get\_device\_mode

Get the device mode.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_get_device_mode(tWIFI_DEVICE_MODE *mode)
```

**Input Parameters :**

mode

Type: char\*

Purpose: device mode. See "[Device Mode](#)".

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.30 nrc\_wifi\_set\_rate\_control

Set the MCS rate control option.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_set_rate_control(bool enable)
```

**Input Parameters :**

enable

Type: bool

Purpose: rate control enable / disable

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.31 nrc\_wifi\_get\_rate\_control

Get the MCS rate control option.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_get_rate_control(bool *enable)
```

**Input Parameters :**

enable

Type: bool\*

Purpose: A pointer to get rate control enable / disable

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.32 nrc\_wifi\_get\_aid

Get the association ID, which is allocated by AP.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_get_aid(int *aid)
```

**Input Parameters :**

aid

Type: int\*

Purpose: A pointer to get association ID, which is signed binary number.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.33 nrc\_wifi\_get\_network\_index

Get the current network index from global network index.

**Prototype :**

```
tWIFI_STATUS nrc_wifi_get_network_index(int *index)
```

**Input Parameters :**

index

Type: int

Purpose: A pointer to get current network ID.

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.34 nrc\_wifi\_country\_from\_string

Get the country code from string.

**Prototype :**

tWIFI\_COUNTRY\_CODE nrc\_wifi\_country\_from\_string(const char \*str)

**Input Parameters :**

str

Type: const char\*

Purpose: A pointer to assign country code string which is ASCII string. See "[Country Code](#)".

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.35 nrc\_wifi\_country\_to\_string

Get string from country code index.

**Prototype :**

const char \*nrc\_wifi\_country\_to\_string(tWIFI\_COUNTRY\_CODE cc)

**Input Parameters :**

cc

Type: tWIFI\_COUNTRY\_CODE

Purpose: country code. See "[Country Code](#)".

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.36 register\_vendor\_ie\_handler

Register vendor ie handler

**Prototype :**

tWIFI\_STATUS register\_vendor\_ie\_handler(int cmd, vendor\_ie\_event\_callback\_fn func)

**Input Parameters :**

cmd

Type: int

Purpose: command value (0xF0 ~ 0xF4)

cc

Type: vendor\_ie\_event\_callback\_fn

Purpose: event callback function

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.37 unregister\_vendor\_ie\_handler

Unregister vendor ie handler

**Prototype :**

tWIFI\_STATUS register\_vendor\_ie\_handler(int cmd)

**Input Parameters :**

cmd

Type: int

Purpose: command value (0xF0 ~ 0xF4)

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.2.38 nrc\_wifi\_set\_s1g\_config

Set S1G channel

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_set\_s1g\_config(uint16\_t s1g\_channel)

**Input Parameters :**

s1g\_channel

Type: uint16\_t

Purpose: S1G channel.



**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

**3.2.39 nrc\_wifi\_wps\_pbc**

Set WPS Pushbutton

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_wps\_pbc()

**Input Parameters :**

N/A

**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

**3.2.40 nrc\_wifi\_set\_channel**

Set frequency (Sub-1GHz)

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_set\_channel(uint32\_t s1g\_freq)

**Input Parameters :**

s1g\_freq  
Type: uint32\_t  
Purpose: S1G channel frequency (MHz/10)

**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

**3.2.41 nrc\_wifi\_get\_channel**

Get frequency (Sub-1GHz)

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_get\_channel(uint32\_t \*s1g\_freq)

**Input Parameters :**

s1g\_freq  
Type: uint32\_t \*  
Purpose: S1G channel frequency (MHz/10)

**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

**3.2.42 nrc\_wifi\_get\_ch\_bw**

Get channel bandwidth

**Prototype :**

```
tWIFI_STATUS nrc_wifi_get_ch_bw(uint8_t *bandwidth)
```

**Input Parameters :**

bandwidth  
Type: uint8\_t \*  
Purpose: 0(1M BW) or 1(2M BW) or 2(4M BW)

**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

**3.2.43 nrc\_wifi\_softap\_set\_ip**

Set IP for softap

**Prototype :**

```
tWIFI_STATUS nrc_wifi_softap_set_ip(char *ip_addr)
```

**Input Parameters :**

ip\_addr  
Type: char \*  
Purpose: Set IP address for softap

**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

**3.2.44 nrc\_wifi\_softap\_set\_conf**

Set configuration for softap

**Prototype :**

```
tWIFI_STATUS nrc_wifi_softap_set_conf(int index, char *ssid, int channel, int sec_mode, char *password)
```

**Input Parameters :**

index

Type: int  
Purpose: network index

ssid

Type: char \*  
Purpose: SSID

channel

Type: int  
Purpose: 11ah channel

sec\_mode

Type: int  
Purpose: security mode (tWIFI\_SECURITY) See "[Country Code](#)"

password

Type: char \*  
Purpose: PASSWORD

**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

### 3.2.45 nrc\_wifi\_softap\_start

Start softap

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_softap\_start(int index)

**Input Parameters :**

index

Type: int  
Purpose: network index

**Returns :**

WIFI\_SUCCESS, if the operation was successful.  
Error code(tWIFI\_STATUS), all other errors.

### 3.2.46 nrc\_wifi\_softap\_start\_dhcp\_server

Start DHCP Server

**Prototype :**

tWIFI\_STATUS nrc\_wifi\_softap\_start\_dhcp\_server(void)

**Input Parameters :**

N/A

**Returns :**

WIFI\_SUCCESS, if the operation was successful.

Error code(tWIFI\_STATUS), all other errors.

### 3.3 Callback Functions & Events

**Prototype :**

```
void (*event_callback_fn)(tWIFI_EVENT_ID event)
```

**Input Parameters :**

event

Type: tWIFI\_EVENT\_ID

Purpose: Wi-Fi Event

**Table 3.11tWIFI\_EVENT\_ID**

Name	Description
WIFI_EVT_CONNECT_SUCCESS	Connection
WIFI_EVT_CONNECT_FAIL	Connection is failed
WIFI_EVT_GET_IP	Get IP address is success
WIFI_EVT_GET_IP_FAIL	Get IP address is failed
WIFI_EVT_DISCONNECT	Disconnection
WIFI_EVT_START_SOFT_AP	SoftAP is started
WIFI_EVT_SET_SOFT_AP_IP	IP address is assigned to SoftAP
WIFI_EVT_START_DHCP_SERVER	DHCP server is started
WIFI_EVT_SCAN	Scan is started
WIFI_EVT_SCAN_DONE	Scan is finished
WIFI_EVT_VENDOR_IE	Vendor IE

## 4 System

The system API provides functions to:

- Set and get the system configuration values
- Set the debug log level

### 4.1 Data Type

#### 4.1.1 Trace Level

TRACE\_LEVEL is a system log level. These types are defined at the “lib/modem/inc/util/util\_trach.h”.

**Table 4.1 TRACE\_LEVEL**

Name	Description
TL_VB	All messages logged with Trace level and Workflow Tracking logs
TL_INFO	All messages logged with Information or higher
TL_ERR	All messages logged with Error level or higher

#### 4.1.2 Trace Types

TRACE\_TYPE is the module name for trace log. These types are defined at the “lib/modem/inc/util/util\_trach.h”.

**Table 4.2 TRACE\_TYPES**

Name	Description	Default trace level
TT_QM	Queue manager	TL_ERR
TT_HIF	Host interface	TL_INFO
TT_WIM	Wireless information message	TL_INFO
TT_API	HAL API	TL_INFO
TT_MSG	Message	TL_INFO
TT_RX	Receive	TL_INFO
TT_TX	Transmit	TL_INFO
TT_DL	Downlink	TL_INFO
TT_UL	Uplink	TL_INFO
TT_PHY	Physical Layer	TL_INFO
TT_RF	Radio frequency	TL_ERR
TT_UMAC	Upper MAC	TL_INFO
TT_PS	Power save	TL_INFO
TT_TWT	Target wake time	TL_INFO
TT_HALOW	Halow certificate test	TL_INFO

TT_WPAS	Wpa supplicant	TL_INFO
TT_RC	Rate control	TL_INFO
TT_NET	Network	TL_INFO
TT_CMD	Command	TL_INFO
TT_MM	Memory manager	TL_INFO
TT_BA	Block ACK	TL_ERR
TT_FRAG	Fragmentation attack	TL_INFO
TT_SDK_GPIO	SDK GPIO API	TL_INFO
TT_SDK_HTTPC	SDK http client API	TL_INFO
TT_SDK_HTTPD	SDK http server daemon API	TL_INFO
TT_SDK_FOTA	SDK FOTA API	TL_INFO
TT_SDK_PS	SDK power save API	TL_INFO
TT_SDK_I2C	SDK I2C API	TL_ERR
TT_SDK_UART	SDK UART API	TL_ERR
TT_SDK_ADC	SDK ADC API	TL_INFO
TT_SDK_PWM	SDK PWM API	TL_INFO
TT_SDK_SPI	SDK SPI API	TL_INFO
TT_SDK_TIMER	SDK timer API	TL_INFO
TT_SDK_WIFI	SDK wifi API	TL_INFO
TT_SDK_WLAN_MANAGER	SDK wlan manager	TL_INFO
TT_RCV	Recovery	TL_INFO
TT_BMT	Beacon monitor	TL_INFO
TT_TEMP_SENSOR	Temperature sensor	TL_ERR

## 4.2 Function Call

The header file for system APIs are defined at the "sdk/inc/api\_system.h".

### 4.2.1 nrc\_wifi\_set\_bdf\_use

Set the board data usage. If the value is enabled, transmission power control(TPC) is applied.

(\*currently, not used)

**Prototype :**

```
nrc_err_t nrc_wifi_set_bdf_use(bool enable)
```

**Input Parameters :**

enable

Type: bool

Purpose: Enable(true) / disable(false) the board data

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 4.2.2 nrc\_wifi\_get\_bdf\_use

Get the board data en. (\*currently, not used)

**Prototype :**

```
nrc_err_t nrc_wifi_get_bdf_use(bool *enabled)
```

**Input Parameters :**

enable

Type: bool

Purpose: A pointer to get bdf\_use value.

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 4.2.3 nrc\_wifi\_set\_cal\_use

Set the calibration usage. If this value is enabled and RF calibration table is existed in serial flash, the calibration table value will be applied during transmission.

**Prototype :**

```
nrc_err_t nrc_wifi_set_cal_use(bool enable)
```

**Input Parameters :**



enable

Type: bool

Purpose: Enable(true) / disable(false) the calibration usage

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

#### 4.2.4 nrc\_wifi\_get\_cal\_use

Get the board data enable / disable for transmission power control. (\* currently, not used)

**Prototype :**

```
nrc_err_t nrc_wifi_get_cal_use(bool *enabled)
```

**Input Parameters :**

enable

Type: bool\*

Purpose: A pointer to get calibration usage value.

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

#### 4.2.5 nrc\_wifi\_set\_log\_level

Set the log level for type id

**Prototype :**

```
nrc_err_t nrc_wifi_set_log_level	TRACE_TYPES type_id, TRACE_LEVEL level)
```

**Input Parameters :**

type\_id

Type: TRACE\_TYPES

Purpose: trace module name. See the "[Trace Types](#)"

level

Type: TRACE\_LEVEL

Purpose: log level. See the "[Trace Level](#)"

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 4.2.6 nrc\_wifi\_get\_log\_level

Get the log level for type id

**Prototype :**

```
nrc_err_t nrc_wifi_get_log_level(TRACE_TYPES type_id, TRACE_LEVEL *level)
```

**Input Parameters :**

type\_id

Type: TRACE\_TYPES

Purpose: trace module name. See the "[Trace Types](#)"

level

Type: TRACE\_LEVEL\*

Purpose: A pointer to get log level. See the "[Trace Level](#)"

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

## 5 Timer

The timer API provides functions to:

- Start and stop the timer

### 5.1 Data Type

These types are defined at the "lib/sdk/inc/api\_timer.h".

#### 5.1.1 Timer Information Type

TIMER\_INFO is an information about timer.

**Table 5.1 TIMER\_INFO**

Name	Description
initialized	Timer is initialized
ch	Timer channel
cb	Timer callback function

※ Maximum 2 timers are supported in NRC7292. (32bits timer (channel 0), 64bits timer (channel 3))

#### 5.1.2 Timer Struct

TIMER Struct is an array of TIMER\_INFO\_T values.

**Table 5.2 TIMER\_STRUCT**

Name	Description
Timer[TIMER_MAX]	A list of timers

※ TIMER\_MAX is 2 in NRC7292.

## 5.2 Function Call

The header file for system APIs are defined at the "sdk/inc/api\_timer.h".

### 5.2.1 nrc\_hw\_timer\_init

Initialize the hardware timer and register callback function.

**Prototype :**

```
nrc_err_t nrc_hw_timer_init(int ch, timer_callback isr_cb)
```

**Input Parameters :**

ch

Type: int

Purpose: timer channel

isr\_cb

Type: timer\_callback

Purpose: callback handler function when the timer expired

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

**5.2.2 nrc\_hw\_timer\_deinit**

De-initialize the hardware timer.

**Prototype :**

nrc\_err\_t nrc\_hw\_timer\_deinit(int ch)

**Input Parameters :**

ch

Type: int

Purpose: timer channel

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

**5.2.3 nrc\_hw\_timer\_start**

Start the hardware timer.

**Prototype :**

nrc\_err\_t nrc\_hw\_timer\_start(int ch, uint64\_t time)

**Input Parameters :**

ch

Type: int

Purpose: timer channel

time

Type: time

Purpose: time duration

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 5.2.4 nrc\_hw\_timer\_stop

Stop the hardware timer with timer channel ID.

**Prototype :**

```
nrc_err_t nrc_hw_timer_stop(int ch)
```

**Input Parameters :**

ch

Type: int

Purpose: timer channel

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 5.2.5 nrc\_hw\_timer\_clear\_irq

Clear interrupt request (IRQ) with timer channel ID

※ The IRQ should be cleared in the timer ISR callback function.

**Prototype :**

```
nrc_err_t nrc_hw_timer_clear_irq(int ch)
```

**Input Parameters :**

ch

Type: int

Purpose: timer channel

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

## 5.3 Callback Functions & Events

**Prototype :**

```
typedef void (*timer_callback)(int vector)
```

**Input Parameters :**

vector

Type: int

Purpose: input vector

## 6 UART

The UART API provides functions to:

- Set the UART channel, configurations, interrupt handler and interrupt type
- Get and put a character and print strings

### 6.1 Data Type

These types are defined at the “lib/sdk/inc/api\_uart.h”.

#### 6.1.1 Channel

NRC\_UART\_CHANNEL is an UART channel.

**Table 6.1 NRC\_UART\_CHANNEL**

Name	Description
NRC_UART_CH0	Channel 0
NRC_UART_CH1	Channel 1
NRC_UART_CH2	Channel 2
NRC_UART_CH3	Channel 3

#### 6.1.2 UART Data Bit

NRC\_UART\_DATA\_BIT is a data bit size.

**Table 6.2 NRC\_UART\_DATA\_BIT**

Name	Description
NRC_UART_DB5	Data bit 5
NRC_UART_DB6	Data bit 6
NRC_UART_DB7	Data bit 7
NRC_UART_DB8	Data bit 8

#### 6.1.3 UART Stop Bit

NRC\_UART\_STOP\_BIT is a data bit size.

**Table 6.3 NRC\_UART\_STOP\_BIT**

Name	Description
NRC_UART_SB1	Stop bit 1
NRC_UART_SB2	Stop bit 2

### 6.1.4 UART Parity Bit

NRC\_UART\_PARITY\_BIT is a type of parity.

**Table 6.4 NRC\_UART\_PARITY\_BIT**

Name	Description
NRC_UART_PB_NONE	None
NRC_UART_PB_ODD	Odd parity bit
NRC_UART_PB_EVEN	Even parity bit

### 6.1.5 UART Hardware Flow Control

NRC\_UART\_HW\_FLOW\_CTRL indicate that a UART hardware flow control is enabled or disabled.

**Table 6.5 NRC\_UART\_HW\_FLOW\_CTRL**

Name	Description
NRC_UART_SB1	Stop bit 1
NRC_UART_SB2	Stop bit 2

### 6.1.6 UART FIFO

NRC\_UART\_FIFO indicate that a UART FIFO is enabled or disabled.

**Table 6.6 NRC\_UART\_FIFO**

Name	Description
NRC_UART_FIFO_DISABLE	Disable FIFO
NRC_UART_FIFO_ENABLE	Enable FIFO

### 6.1.7 UART Configuration

NRC\_UART\_CONFIG is a configuration about UART.

**Table 6.7 NRC\_UART\_CONFIG**

Name	Description
ch	Channel number
db	Data bit
br	Baudrate
stop_bit	Stop bit
parity_bit	Parity bit
hw_flow_ctrl	Enable or disable hardware flow control

---

fifo	Enable or disable FIFO
------	------------------------

---

### 6.1.8 UART Interrupt Type

NRC\_UART\_INT\_TYPE is an interrupt type.

**Table 6.8 NRC\_UART\_INT\_TYPE**

Name	Description
NRC_UART_INT_NONE	None
NRC_UART_INT_ERROR	Error
NRC_UART_INT_TIMEOUT	Timeout
NRC_UART_INT_RX_DONE	Rx is done
NRC_UART_INT_TX_EMPTY	Tx is empty

## 6.2 Function Call

The header file for system APIs are defined at the "sdk/inc/api\_uart.h".

### 6.2.1 nrc\_uart\_set\_config

Set the UART configurations.

**Prototype :**

```
nrc_err_t nrc_uart_set_config(NRC_UART_CONFIG *conf)
```

**Input Parameters :**

conf

Type: NRC\_UART\_CONFIG\*

Purpose: A pointer to set uart configurations. See "[UART Configuration](#)"

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 6.2.2 nrc\_hw\_set\_channel

Set the UART channel

**Prototype :**

```
nrc_err_t nrc_uart_set_channel(int ch)
```

**Input Parameters :**



ch

Type: int

Purpose: UART channel

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 6.2.3 nrc\_uart\_get\_interrupt\_type

Get the UART interrupt type.

**Prototype :**

```
nrc_err_t nrc_uart_get_interrupt_type(int ch, NRC_UART_INT_TYPE *type)
```

**Input Parameters :**

ch

Type: int

Purpose: UART channel

type

Type: NRC\_UART\_INT\_TYPE \*

Purpose: A pointer to set UART interrupt type. See "[UART Interrupt Type](#)"

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 6.2.4 nrc\_uart\_set\_interrupt

Set the UART interrupt.

**Prototype :**

```
nrc_err_t nrc_uart_set_interrupt(int ch, bool tx_en, bool rx_en)
```

**Input Parameters :**

ch

Type: int

Purpose: UART channel

tx\_en

Type: bool

Purpose: Tx enable flag

rx\_en

Type: bool

Purpose: Rx enable flag

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 6.2.5 nrc\_uart\_clear\_interrupt

Clear the UART interrupt.

**Prototype :**

```
nrc_err_t nrc_uart_clear_interrupt(int ch, bool tx_int, bool rx_int , bool timeout_int )
```

**Input Parameters :**

ch

Type: int

Purpose: UART channel

tx\_en

Type: bool

Purpose: Tx enable flagh

rx\_en

Type: bool

Purpose: Rx enable flag

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 6.2.6 nrc\_uart\_put

Put the character data to UART.

**Prototype :**

```
nrc_err_t nrc_uart_put(int ch, char data)
```

**Input Parameters :**

ch

Type: int

Purpose: UART channel

data

Type: char

Purpose: data

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 6.2.7 nrc\_uart\_get

Get the character data from UART.

**Prototype :**

```
nrc_err_t nrc_uart_get(int ch, char *data)
```

**Input Parameters :**

ch

Type: int

Purpose: UART channel

data

Type: char\*

Purpose: A pointer to get data

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 6.2.8 nrc\_uart\_register\_interrupt\_handler

Register user callback function for UART input.

**Prototype :**

```
nrc_err_t nrc_uart_register_interrupt_handler(int ch, intr_handler_fn cb)
```

**Input Parameters :**

ch

Type: int

Purpose: timer channel

cb

Type: intr\_handler\_fn

Purpose: callback function

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 6.2.9 nrc\_uart\_console\_enable

Enable uart console.

**Prototype :**

```
nrc_err_t nrc_uart_console_enable(void)
```

**Input Parameters :**

N/A

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 6.2.10 nrc\_uart\_printf

print log on the console.

**Prototype :**

```
nrc_err_t nrc_uart_printf(const char *f, ...)
```

**Input Parameters :**

f

Type: const char \*

Purpose: A pointer for parameters

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

## 6.3 Callback Functions & Events

The interrupt handler function pointer type is defined at the "sdk/inc/nrc\_types.h".

**Prototype :**

```
typedef void (*intr_handler_fn)(int vector)
```

**Input Parameters :**

vector

Type: int

Purpose: input vector

## 7 GPIO

The GPIO API provides functions to:

- Set the GPIO configurations and interrupt handler
- Get GPIO input values and set GPIO output values

### 7.1 Data Type

These types are defined at the “lib/sdk/inc/api\_gpio.h”.

#### 7.1.1 GPIO Pin

NRC\_GPIO\_PIN is a GPIO pin number.

**Table 7.1 NRC\_GPIO\_PIN**

Name	Description
GPIO_00	GPIO 0
GPIO_01	GPIO 1
GPIO_02	GPIO 2
GPIO_03	GPIO 3
GPIO_08	GPIO 8
GPIO_09	GPIO 9
GPIO_10	GPIO 10
GPIO_11	GPIO 11
GPIO_12	GPIO 12
GPIO_13	GPIO 13
GPIO_14	GPIO 14
GPIO_15	GPIO 15
GPIO_16	GPIO 16
GPIO_17	GPIO 17

※ These GPIOs are used for NRC7292. The supported GPIOs are different in each chip. Please reference the hardware guide document.

#### 7.1.2 GPIO Direction

NRC\_GPIO\_DIR is a GPIO direction.

**Table 7.2 NRC\_GPIO\_DIR**

Name	Description
GPIO_INPUT	Input direction
GPIO_OUTPUT	Output direction

### 7.1.3 GPIO Mode

NRC\_GPIO\_MODE is a GPIO mode.

**Table 7.3 NRC\_GPIO\_MODE**

Name	Description
GPIO_PULL_UP	Pull up
GPIO_PULL_DOWN	Pull down
GPIO_FLOATING	Floating

### 7.1.4 GPIO Level

NRC\_GPIO\_LEVEL is a GPIO level.

**Table 7.4 NRC\_GPIO\_LEVEL**

Name	Description
GPIO_LEVEL_LOW	0
GPIO_LEVEL_HIGH	1

### 7.1.5 GPIO Alternative Function

NRC\_GPIO\_ALT is a alternative function.

**Table 7.5 NRC\_GPIO\_ALT**

Name	Description
GPIO_FUNC	GPIO function
GPIO_NOMAL_OP	GPIO Normal operation

### 7.1.6 GPIO Configurations

NRC\_GPIO\_CONFIG is a GPIO configuration.

**Table 7.6 NRC\_GPIO\_CONFIG**

Name	Description
gpio_pin	Pin number
gpio_dir	Direction
gpio_alt	Alternative function
gpio_mode	Mode

## 7.2 Function Call

The header file for system APIs are defined at the "sdk/inc/api\_gpio.h".

### 7.2.1 nrc\_gpio\_config

Set the GPIO configuration.

**Prototype :**

```
nrc_err_t nrc_gpio_config(NRC_GPIO_CONFIG *conf)
```

**Input Parameters :**

conf

Type: NRC\_GPIO\_CONFIG\*

Purpose: A pointer to set GPIO configurations. See "[GPIO Configurations](#)"

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 7.2.2 nrc\_gpio\_output

Set the GPIO data (32bits).

**Prototype :**

```
nrc_err_t nrc_gpio_output(uint32_t *word)
```

**Input Parameters :**

conf

Type: uint32\_t \*

Purpose: A pointer to set GPIO output value (32bits)

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 7.2.3 nrc\_gpio\_outputb

Set the GPIO data for a specified pin number.

**Prototype :**

```
nrc_err_t nrc_gpio_outputb(int pin, int level)
```

**Input Parameters :**

pin

Type: int

Purpose: GPIO pin number

level

Type: int

Purpose: output value level

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

## 7.2.4 nrc\_gpio\_input

Get the GPIO data (32bits).

**Prototype :**

```
nrc_err_t nrc_gpio_input(uint32_t *word)
```

**Input Parameters :**

conf

Type: uint32\_t \*

Purpose: A pointer to get GPIO output value (32bits)

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

## 7.2.5 nrc\_gpio\_inputb

Get the GPIO data for a specified pin number.

**Prototype :**

```
nrc_err_t nrc_gpio_inputb(int pin, int *level)
```

**Input Parameters :**

pin

Type: int

Purpose: GPIO pin number

level

Type: int

Purpose: A pointer to get GPIO input value

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.



### 7.2.6 nrc\_gpio\_register\_interrupt\_handler

Register GPIO interrupt handler.

※NRC729 support level trigger.

**Prototype :**

```
nrc_gpio_register_interrupt_handler(int pin, intr_handler_fn cb)
```

**Input Parameters :**

pin

Type: int

Purpose: pin number

cb

Type: intr\_handler\_fn

Purpose: callback function

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

## 7.3 Callback Functions & Events

The interrupt handler function pointer type is defined at the "sdk/inc/nrc\_types.h".

**Prototype :**

```
typedef void (*intr_handler_fn)(int vector)
```

**Input Parameters :**

vector

Type: int

Purpose: input vector

## 8 I2C

The I2C API provides functions to:

- Set the I2C configurations
- I2C initialize, enable, reset
- Read and write byte via I2C

### 8.1 Data Type

These types are defined at the "lib/sdk/inc/api\_i2c.h".

### 8.2 Function Call

The header file for system APIs are defined at the "sdk/inc/api\_i2c.h".

#### 8.2.1 nrc\_i2c\_init

Initialize the I2C controller.

**Prototype :**

```
nrc_err_t nrc_i2c_init(uint8_t scl, uint8_t sda, uint32_t clk)
```

**Input Parameters :**

scl

Type: uint8\_t

Purpose: Serial clock line for I2C

sda

Type: uint8\_t

Purpose: Serial data line for I2C

clk

Type: uint32\_t

Purpose: Clock speed of I2C controller. It can be set up to 400,000Hz.

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

#### 8.2.2 nrc\_i2c\_enable

Enable or disable the I2C controller.

✂ Please disable I2C only after a transaction is stopped.

**Prototype :**

```
nrc_err_t nrc_i2c_enable(bool enable)
```

**Input Parameters :**

enable

Type: bool

Purpose: I2C controller enable or disable

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 8.2.3 nrc\_i2c\_reset

Reset the I2C controller.

**Prototype :**

```
nrc_err_t nrc_i2c_reset(void)
```

**Input Parameters :**

N/A

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 8.2.4 nrc\_i2c\_start

Start the I2C operation.

**Prototype :**

```
nrc_err_t nrc_i2c_start(void)
```

**Input Parameters :**

N/A

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 8.2.5 nrc\_i2c\_stop

Stop the I2C operation.

**Prototype :**

```
nrc_err_t nrc_i2c_stop(void)
```

**Input Parameters :**

N/A

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 8.2.6 nrc\_i2c\_waitack

Wait until receiving ACK or NACK from the I2C operation.

**Prototype :**

```
nrc_err_t nrc_i2c_waitack(void)
```

**Input Parameters :**

N/A

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 8.2.7 nrc\_i2c\_writebyte

Write data to the I2C controller.

**Prototype :**

```
nrc_err_t nrc_i2c_writebyte(uint8_t data)
```

**Input Parameters :**

data

Type: uint8\_t

Purpose: data

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 8.2.8 nrc\_i2c\_readbyte

Read data from the I2C controller.

**Prototype :**

```
nrc_err_t nrc_i2c_readbyte(uint8_t *data, bool ack)
```

**Input Parameters :**

data

Type: uint8\_t\*

Purpose: A pointer to store the read data

ack

Type: bool

Purpose: ACK flag. if there's no further reading registers, then false. otherwise, true

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

## 9 ADC

The ADC API provides functions to:

- Initialize / De-initialize the ADC controller
- Read the ADC controller data

### 9.1 Data Type

These types are defined at the "lib/sdk/inc/api\_adc.h".

#### 9.1.1 ADC Channel

ADC\_CH is an ADC channel.

**Table 9.1 ADC\_CH**

Name	Description
ADC1	ADC channel 1
ADC2	ADC channel 2
ADC3	ADC channel 3

### 9.2 Function Call

The header file for system APIs are defined at the "sdk/inc/api\_adc.h".

#### 9.2.1 nrc\_adc\_init

Initialize the ADC controller.

**Prototype :**

```
nrc_err_t nrc_adc_init(void)
```

**Input Parameters :**

N/A

**Returns :**

NRC\_SUCCESS, if the operation was successful.  
NRC\_FAIL, all other errors.

#### 9.2.2 nrc\_adc\_deinit

De-initialize the ADC controller.

**Prototype :**

```
nrc_err_t nrc_adc_deinit(void)
```

**Input Parameters :**

N/A

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 9.2.3 nrc\_adc\_get\_data

Read the data from the ADC controller.

**Prototype :**

```
nrc_err_t nrc_adc_get_data(uint32_t id, uint16_t *data)
```

**Input Parameters :**

id

Type: uint32\_t

Purpose: Channel ID

data

Type: uint16\_t \*

Purpose: A pointer for of data(Max value : 0x1FF)

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

NRC\_FAIL, all other errors.

## 10 PWM

The PWM API provides functions to:

- Initialize the PWM controller
- Set configuration and enable for PWM

### 10.1 Data Type

These types are defined at the "lib/sdk/inc/api\_pwm.h".

#### 10.1.1 PWM Channel

PWM\_CH is an PWM channel.

**Table 10.1**PWM\_CH

Name	Description
PWM_CH0	PWM channel 0
PWM_CH1	PWM channel 1
PWM_CH2	PWM channel 2
PWM_CH3	PWM channel 3

※ These PWM channel are used for NRC7292. The supported PWM channels are different in each chip. Please reference the hardware guide document.

### 10.2 Function Call

The header file for system APIs are defined at the "sdk/inc/api\_pwm.h".

#### 10.2.1 nrc\_pwm\_hw\_init

Initialize the ADC controller.

##### Prototype :

```
nrc_err_t nrc_pwm_hw_init(uint8_t ch, uint8_t gpio_num, uint8_t use_high_clk)
```

##### Input Parameters :

ch  
Type: uint8\_t  
Purpose: PWM channel ID. See "[PWM Channel](#)"

gpio\_num  
Type: uint8\_t  
Purpose: GPIO number assigned for PWM

use\_high\_clk



Type: uint8\_t

Purpose: If 0, then the pulse duration for 1-bit in each pattern is about 20.8us. Otherwise, about 10.4us

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 10.2.2 nrc\_pwm\_set\_config

Set configuration parameters of PWM. one duty cycle consists of 4 pulse patterns(total 128-bit).

※ It starts with the MSB of pattern1 and ends with the LSB of pattern4.

**Prototype :**

```
nrc_err_t nrc_pwm_set_config(uint8_t ch, uint32_t pattern1, uint32_t pattern2, uint32_t pattern3, uint32_t pattern4)
```

**Input Parameters :**

ch

Type: uint8\_t

Purpose: PWM channel ID. See "[PWM Channel](#)"

pattern1

Type: uint32\_t

Purpose: 1<sup>st</sup> pulse pattern(Pattern bits 0~31)

pattern2

Type: uint32\_t

Purpose: 2<sup>nd</sup> pulse pattern(Pattern bits 32~63)

pattern3

Type: uint32\_t

Purpose: 3<sup>rd</sup> pulse pattern(Pattern bits 64~95)

pattern4

Type: uint32\_t

Purpose: 4<sup>th</sup> pulse pattern(Pattern bits 96~127)

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 10.2.3 nrc\_pwm\_set\_enable

Enable the specified PWM channel.

**Prototype :**

```
nrc_err_t nrc_pwm_set_enable(uint32_t ch, bool enable)
```

**Input Parameters :**

ch

Type: uint32\_t

Purpose: PWM channel ID. See "[PWM Channel](#)"

enable

Type: bool

Purpose: Enable / disable

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

## 11 SPI

The SPI API provides functions to:

- Initialize and enable the SPI controller
- Write and read byte via SPI

### 11.1 Data Type

These types are defined at the “lib/sdk/inc/api\_spi.h”.

#### 11.1.1 SPI Mode

SPI\_MODE is a SPI mode, which is related to CPOL and CPHA values.

✕ Refer the Serial Peripheral Interface. ([https://en.wikipedia.org/wiki/Serial\\_Peripheral\\_Interface](https://en.wikipedia.org/wiki/Serial_Peripheral_Interface))

**Table 11.1 SPI\_MODE**

Name	Description
SPI_MODE0	SPI mode 0 (CPOL=0, CPHA=0)
SPI_MODE1	SPI mode 1 (CPOL=0, CPHA=1)
SPI_MODE2	SPI mode 2 (CPOL=1, CPHA=0)
SPI_MODE3	SPI mode 3 (CPOL=1, CPHA=1)

#### 11.1.2 SPI Frame Bits

SPI\_FRAME\_BITS is a number of frame bits.

**Table 11.2 SPI\_FRAME\_BITS**

Name	Description
SPI_BIT4	SPI 4-bit frame
SPI_BIT5	SPI 5-bit frame
SPI_BIT6	SPI 6-bit frame
SPI_BIT7	SPI 7-bit frame
SPI_BIT8	SPI 8-bit frame
SPI_BIT9	SPI 9-bit frame
SPI_BIT10	SPI 10-bit frame
SPI_BIT11	SPI 11-bit frame
SPI_BIT12	SPI 12-bit frame
SPI_BIT13	SPI 13-bit frame
SPI_BIT14	SPI 14-bit frame
SPI_BIT15	SPI 15-bit frame
SPI_BIT16	SPI 16-bit frame

## 11.2 Function Call

The header file for system APIs are defined at the “sdk/inc/api\_spi.h”.

### 11.2.1 nrc\_spi\_init

Initialize the SPI controller with the specified mode and bits

**Prototype :**

```
nrc_err_t nrc_spi_init(SPI_MODE mode, SPI_FRAME_BITS bits, uint32_t clock)
```

**Input Parameters :**

mode

Type: SPI\_MODE

Purpose: SPI mode. See “[SPI Mode](#)”

bits

Type: SPI\_FRAME\_BITS

Purpose: SPI frame bits. See “[SPI Frame Bits](#)”

clock

Type: uint32\_t

Purpose: SPI clock frequency. The unit is Hz.

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 11.2.2 nrc\_spi\_enable

Enable / disable the SPI controller.

**Prototype :**

```
nrc_err_t nrc_spi_enable(bool enable)
```

**Input Parameters :**

enable

Type: bool

Purpose: Enable / disable

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 11.2.3 nrc\_spi\_start\_xfer

Enable CS to continuously transfer data.

**Prototype :**

```
nrc_err_t nrc_spi_start_xfer(void)
```

**Input Parameters :**

N/A

**Returns :**

NRC\_SUCCESS, if the operation was successful.  
NRC\_FAIL, all other errors.

### 11.2.4 nrc\_spi\_stop\_xfer

Disable CS to continuously transfer data.

**Prototype :**

```
nrc_err_t nrc_spi_stop_xfer(void)
```

**Input Parameters :**

N/A

**Returns :**

NRC\_SUCCESS, if the operation was successful.  
NRC\_FAIL, all other errors.

### 11.2.5 nrc\_spi\_xfer

Transfer the data between master and slave. User can call nrc\_spi\_xfer multiple times to transmit data.

※ This function should run inside nrc\_spi\_start\_xfer() and nrc\_spi\_stop\_xfer().

**Prototype :**

```
nrc_err_t nrc_spi_xfer(uint8_t *wbuffer, uint8_t *rbuffer, uint32_t size)
```

**Input Parameters :**

wbuffer

Type: uint8\_t\*

Purpose: A pointer to write data

rbuffer

Type: uint8\_t\*

Purpose: A pointer to read data

size

Type: uint32\_t

Purpose: Number of bytes to transfer

**Returns :**

NRC\_SUCCESS, if the operation was successful.  
NRC\_FAIL, all other errors.

### 11.2.6 nrc\_spi\_writebyte\_value

Write one-byte data to the specified register address.

**Prototype :**

```
nrc_err_t nrc_spi_writebyte_value(uint8_t addr, uint8_t data);
```

**Input Parameters :**

addr

Type: uint8\_t

Purpose: register address to write data

data

Type: uint8\_t

Purpose: data to write

**Returns :**

NRC\_SUCCESS, if the operation was successful.  
NRC\_FAIL, all other errors.

### 11.2.7 nrc\_spi\_readbyte\_value

Read one-byte data to the specified register address.

**Prototype :**

```
nrc_err_t nrc_spi_readbyte_value(uint8_t addr, uint8_t data);
```

**Input Parameters :**

addr

Type: uint8\_t

Purpose: register address to read data

data

Type: uint8\_t\*

Purpose: A pointer to read data

**Returns :**

NRC\_SUCCESS, if the operation was successful.  
NRC\_FAIL, all other errors.

### 11.2.8 nrc\_spi\_write\_values

Write bytes data to the specified register address.

**Prototype :**

```
nrc_err_t nrc_spi_write_values(uint8_t addr, uint8_t *data, int size)
```

**Input Parameters :**

addr

Type: uint8\_t

Purpose: register address to write data

data

Type: uint8\_t\*

Purpose: A pointer to write data

size

Type: int

Purpose: write data size. The unit is bytes.

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 11.2.9 nrc\_spi\_read\_values

Read bytes data to the specified register address.

**Prototype :**

```
nrc_err_t nrc_spi_read_values(uint8_t addr, uint8_t *data, int size)
```

**Input Parameters :**

addr

Type: uint8\_t

Purpose: register address to read data

data

Type: uint8\_t\*

Purpose: A pointer to read data

size

Type: int

Purpose: read data size. The unit is bytes.

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

## 12 HTTP Client

The HTTP client API provides functions to:

- HTTP request method (GET, PUT, POST, DELETE)
- Retrieves the response data about request function

### 12.1 Data Type

These types are defined at the “lib/sdk/inc/api\_httpc.h”.

#### 12.1.1 HTTP Client Return Types

httpc\_ret\_e is a return type for HTTP client.

**Table 12.1 httpc\_ret\_e**

Name	Description
HTTPC_RET_ERROR_TLS_CONNECTION	TLS connection fail
HTTPC_RET_ERROR_PK_LOADING_FAIL	Private key loading fail
HTTPC_RET_ERROR_CERT_LOADING_FAIL	Certificate loading fail
HTTPC_RET_ERROR_SEED_FAIL	Seed creation fail
HTTPC_RET_ERROR_BODY_SEND_FAIL	Request body send fail
HTTPC_RET_ERROR_HEADER_SEND_FAIL	Request Header send fail
HTTPC_RET_ERROR_INVALID_HANDLE	Invalid handle
HTTPC_RET_ERROR_ALLOC_FAIL	Memory allocation fail
HTTPC_RET_ERROR_SCHEME_NOT_FOUND	Scheme(http:// or https://) not found
HTTPC_RET_ERROR_SOCKET_FAIL	Socket creation fail
HTTPC_RET_ERROR_RESOLVING_DNS	Cannot resolve the hostname
HTTPC_RET_ERROR_CONNECTION	Connection fail
HTTPC_RET_ERROR_UNKNOWN	Unknown error
HTTPC_RET_CON_CLOSED	Connection closed by remote
HTTPC_RET_OK	Success

#### 12.1.2 Define values

**Table 12.2 Default define values**

Define	Value
HTTP_PORT	80
HTTPS_PORT	443
INVALID_HANDLE	0xFFFFFFFF



### 12.1.3 HTTP Client Connection Handle

con\_handle\_t is a connection handle type for HTTP client.

**Table 12.3 con\_handle\_t**

Name	Description
con_handle_t	Connection handle

### 12.1.4 SSL Certificate Structure

ssl\_certs\_t is a SSL certificate structure type.

**Table 12.4 ssl\_certs\_t**

Name	Description
server_cert	Server certification
client_cert	Client certification
client_pk	Client private key
server_cert_length	Server certification length, server_cert buffer size
client_cert_length	Client certification length, client_cert buffer size
client_pk_length	Client private key length, client_pk buffer size

### 12.1.5 HTTP Client Data Type

httpc\_data\_t is a data type for HTTP client.

**Table 12.5 httpc\_data\_t**

Name	Description
data_out	Connection handle
data_out_length	Output buffer length
data_in	Pointer of the input buffer for data receiving
data_in_length	Input buffer length
recved_size	Actual received data size

## 12.2 Function Call

The header file for system APIs are defined at the "sdk/inc/api\_httpc.h".

### 12.2.1 nrc\_httpc\_get

Executes a GET request on a given URL.

**Prototype :**

```
httpc_ret_e nrc_httpc_get(con_handle_t *handle, const char *url, const char *custom_header,  
httpc_data_t *data, ssl_certs_t *certs)
```

**Input Parameters :**

handle

Type: con\_handle\_t\*

Purpose: Connection handle"

url

Type: const char \*

Purpose: URL for the request

custom\_header

Type: const char \*

Purpose: Customized request header. the request-line("<method> <uri> HTTP/1.1") and "Host: <host-name>" will be sent in default internally. Other headers can be set as null-terminated string format.

data

Type: httpc\_data\_t \*

Purpose: A pointer to the #httpc\_data\_t to manage the data sending and receiving

certs

Type: ssl\_certs\_t \*

Purpose: A pointer to the #ssl\_certs\_t for the certificates

**Returns :**

HTTPC\_RET\_OK, if the operation was successful.

Negative error value, all other errors.

**12.2.2 nrc\_httpc\_post**

Executes a POST request on a given URL.

**Prototype :**

```
httpc_ret_e nrc_httpc_post(con_handle_t *handle, const char *url, const char *custom_header,  
httpc_data_t *data, ssl_certs_t *certs)
```

**Input Parameters :**

handle

Type: con\_handle\_t\*

Purpose: Connection handle"

url

Type: const char \*

Purpose: URL for the request

custom\_header

Type: const char \*

Purpose: Customized request header. the request-line("<method> <uri> HTTP/1.1") and "Host: <host-name>" will be sent in default internally. Other headers can be set as null-terminated string format.

data

Type: `httpc_data_t *`

Purpose: A pointer to the `#httpc_data_t` to manage the data sending and receiving  
certs

Type: `ssl_certs_t *`

Purpose: A pointer to the `#ssl_certs_t` for the certificates

**Returns :**

HTTPC\_RET\_OK, if the operation was successful.

Negative error value, all other errors.

### 12.2.3 nrc\_httpc\_put

Executes a PUT request on a given URL.

**Prototype :**

```
httpc_ret_e nrc_httpc_put(con_handle_t *handle, const char *url, const char *custom_header,  
httpc_data_t *data, ssl_certs_t *certs)
```

**Input Parameters :**

handle

Type: `con_handle_t*`

Purpose: Connection handle"

url

Type: `const char *`

Purpose: URL for the request

custom\_header

Type: `const char *`

Purpose: Customized request header. the request-line("<method> <uri> HTTP/1.1") and  
"Host: <host-name>" will be sent in default internally. Other headers can be set  
as null-terminated string format.

data

Type: `httpc_data_t *`

Purpose: A pointer to the `#httpc_data_t` to manage the data sending and receiving

certs

Type: `ssl_certs_t *`

Purpose: A pointer to the `#ssl_certs_t` for the certificates

**Returns :**

HTTPC\_RET\_OK, if the operation was successful.

Negative error value, all other errors.

### 12.2.4 nrc\_httpc\_delete

Executes a DELETE request on a given URL.

**Prototype :**

```
httpc_ret_e nrc_httpc_delete(con_handle_t *handle, const char *url, const char *custom_header, httpc_data_t *data, ssl_certs_t *certs)
```

**Input Parameters :**

handle

Type: con\_handle\_t\*

Purpose: Connection handle"

url

Type: const char \*

Purpose: URL for the request

custom\_header

Type: const char \*

Purpose: Customized request header. the request-line("<method> <uri> HTTP/1.1") and "Host: <host-name>" will be sent in default internally. Other headers can be set as null-terminated string format.

data

Type: httpc\_data\_t \*

Purpose: A pointer to the #httpc\_data\_t to manage the data sending and receiving

certs

Type: ssl\_certs\_t \*

Purpose: A pointer to the #ssl\_certs\_t for the certificates

**Returns :**

HTTPC\_RET\_OK, if the operation was successful.

Negative error value, all other errors.

### 12.2.5 nrc\_httpc\_delete

Executes a DELETE request on a given URL.

**Prototype :**

```
httpc_ret_e nrc_httpc_delete(con_handle_t *handle, const char *url, const char *custom_header, httpc_data_t *data, ssl_certs_t *certs)
```

**Input Parameters :**

handle

Type: con\_handle\_t\*

Purpose: Connection handle"

url

Type: const char \*

Purpose: URL for the request

custom\_header

Type: const char \*

**Purpose:** Customized request header. the request-line("<method> <uri> HTTP/1.1") and "Host: <host-name>" will be sent in default internally. Other headers can be set as null-terminated string format.

**data**

**Type:** httpc\_data\_t \*

**Purpose:** A pointer to the #httpc\_data\_t to manage the data sending and receiving

**certs**

**Type:** ssl\_certs\_t \*

**Purpose:** A pointer to the #ssl\_certs\_t for the certificates

**Returns :**

HTTPC\_RET\_OK, if the operation was successful.

Negative error value, all other errors.

### 12.2.6 nrc\_httpc\_rcv\_response

Retrieves the response data when there are remains after executing the request functions.

**Prototype :**

```
httpc_ret_e nrc_httpc_rcv_response(con_handle_t *handle, httpc_data_t *data);
```

**Input Parameters :**

**handle**

**Type:** con\_handle\_t\*

**Purpose:** Connection handle"

**data**

**Type:** httpc\_data\_t \*

**Purpose:** A pointer to the #httpc\_data\_t to manage the data sending and receiving

**Returns :**

HTTPC\_RET\_OK, if the operation was successful.

Negative error value, all other errors.

### 12.2.7 nrc\_httpc\_close

Close connection. Conneciont is included in each request method function.

**Prototype :**

```
void nrc_httpc_close(con_handle_t *handle)
```

**Input Parameters :**

**handle**

**Type:** bool

**Purpose:** Enable / disable

**Returns :**

N/A

## 13 FOTA

The FOTA API provides functions to:

- Check the support of FOTA and set FOTA information
- Erase and write FOTA area.
- Firmware and bootloader FOTA update done function.
- CRC32 calculation.

### 13.1 Data Type

These types are defined at the “lib/sdk/inc/api\_fota.h”.

#### 13.1.1 FOTA Information

FOTA\_INFO is an information about FOTA firmware.

**Table 13.1 FOTA\_INFO**

Name	Description
fw_length	Firmware length
crc	CRC32 value
ready	ready flag (Not used)

### 13.2 Function Call

The header file for system APIs are defined at the “sdk/inc/api\_fota.h”.

#### 13.2.1 nrc\_fota\_is\_support

Check the flash is able to support FOTA

**Prototype :**

bool nrc\_fota\_is\_support(void)

**Input Parameters :**

N/A

**Returns :**

True, if it supports FOTA.

False, if it does not support FOTA.

### 13.2.2 nrc\_fota\_write

Write len size from src to dst in fota memory area.

**Prototype :**

```
nrc_err_t nrc_fota_write(uint32_t dst, uint8_t *src, uint32_t len)
```

**Input Parameters :**

dst	Type: uint32_t
	Purpose: offset from fota_memory start address
src	Type: uint8_t*
	Purpose: source address
len	Type: uint32_t
	Purpose: source data length

**Returns :**

NRC\_SUCCESS, if the operation was successful.  
NRC\_FAIL, all other errors.

### 13.2.3 nrc\_fota\_erase

Erase len size from (fota start address + dst).

**Prototype :**

```
nrc_err_t nrc_fota_erase(uint32_t dst, uint32_t len)
```

**Input Parameters :**

dst	Type: uint32_t
	Purpose: offset from fota_memory start address
len	Type: uint32_t
	Purpose: source data length

**Returns :**

NRC\_SUCCESS, if the operation was successful.  
NRC\_FAIL, all other errors.

### 13.2.4 nrc\_fota\_set\_info

Set fota binary information (binary length and crc)

**Prototype :**

```
nrc_err_t nrc_fota_set_info(uint32_t len, uint32_t crc)
```

**Input Parameters :**

len

Type: uint32\_t

Purpose: binary size

crc

Type: uint32\_t

Purpose: crc value for binary

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 13.2.5 nrc\_fota\_update\_done

Updated firmware and reboot.

**Prototype :**

```
nrc_err_t nrc_fota_update_done(FOTA_INFO* fw_info)
```

**Input Parameters :**

fw\_info

Type: FOTA\_INFO\*

Purpose: fota binary information (binary length and crc)

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 13.2.6 nrc\_fota\_update\_done\_bootloader

Updated bootloader and reboot.

**Prototype :**

```
nrc_err_t nrc_fota_update_done_bootloader(FOTA_INFO* fw_info)
```

**Input Parameters :**

fw\_info

Type: FOTA\_INFO\*

Purpose: fota binary information (binary length and crc)

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.



### 13.2.7 nrc\_fota\_cal\_crc

Calculate crc32 value.

**Prototype :**

```
nrc_err_t nrc_fota_cal_crc(uint8_t* data, uint32_t len, uint32_t *crc)
```

**Input Parameters :**

data

Type: uint8\_t\*

Purpose: A pointer for data

len

Type: uint32\_t

Purpose: length for CRC

crc

Type: uint32\_t

Purpose: A pointer to store the calculated crc value

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

N/A

## 14 Power save

The power save memory API provides functions to:

- Set power save mode
- Set wakeup pin and source

### 14.1 Data Type

These types are defined at the “lib/sdk/inc/api\_ps.h”.

#### 14.1.1 Power Save Sleep Mode

POWER\_SAVE\_SLEEP\_MODE is a power save sleep mode.

**Table 14.1 POWER\_SAVE\_SLEEP\_MODE**

Name	Description
POWER_SAVE_MODEM_SLEEP_MODE	Modem sleep
POWER_SAVE_DEEP_SLEEP_MODE	Deep sleep

#### 14.1.2 Power Save TIM Mode

POWER\_SAVE\_TIM\_MODE is a power save TIM mode.

**Table 14.2 POWER\_SAVE\_TIM\_MODE**

Name	Description
POWER_SAVE_NON_TIM	Non TIM mode
POWER_SAVE_TIM	TIM mode

#### 14.1.3 Power Save Wakeup Source

These defines are related to wakeup source.

**Table 14.3 power save wakeup source**

Define	Value
WAKEUP_SOURCE_RTC	0x00000001L << 0
WAKEUP_SOURCE_GPIO	0x00000001L << 1

## 14.2 Function Call

The header file for system APIs are defined at the “sdk/inc/api\_ps.h”.

### 14.2.1 nrc\_ps\_set\_sleep

Set the power save mode & power save protocol.

**Prototype :**

```
nrc_err_t nrc_ps_set_sleep(uint8_t sleep_mode, uint64_t interval, uint32_t timeout)
```

**Input Parameters :**

sleep\_mode

Type: POWER\_SAVE\_SLEEP\_MODE

Purpose: power save sleep mode. See “[Power Save Sleep Mode](#)”

interval

Type: uint64\_t

Purpose: 0 (TIM mode) or non-zero (Non-TIM mode, interval >= 1000ms). The unit is ms.

timeout

Type: uint32\_t

Purpose: timeout. only works in TIM mode with modem sleep. The unit is ms.

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 14.2.2 nrc\_ps\_set\_modemsleep\_stop

Stop the modem sleep

**Prototype :**

```
nrc_err_t nrc_ps_set_modemsleep_stop(void)
```

**Input Parameters :**

s

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

### 14.2.3 nrc\_ps\_set\_gpio\_wakeup\_pin

Configure a wakeup-gpio-pin when system state is uCode or deepsleep.

✖ This function should be called before deepsleep, if user want to config the wakeup-gpio-pin.

**Prototype :**

```
nrc_err_t nrc_ps_set_gpio_wakeup_pin(bool check_debounce, int pin_number)
```

**Input Parameters :**

check\_debounce

Type: bool

Purpose: check mechanical vibration of a switch

pin\_number

Type: int

Purpose: GPIO pin number for wakeup when GPIO is enabled for wakeup source

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

#### 14.2.4 nrc\_ps\_set\_gpio\_wakeup\_source

Configure wakeup sources when system state is deepsleep.

✂ This function should be called before deepsleep, if user want to config the wakeup source.

**Prototype :**

```
nrc_err_t nrc_ps_set_wakeup_source(uint8_t wakeup_source)
```

**Input Parameters :**

wakeup\_source

Type: uint8\_t

Purpose: wakeup source. See "[Power Save Wakeup Source](#)"

**Returns :**

NRC\_SUCCESS, if the operation was successful.

NRC\_FAIL, all other errors.

## 15PBC (Push Button)

WPS-PBC for simple network configuration

### 15.1 Data Type

These types are defined at the “sdk/inc/api\_pbc.h”.

#### 15.1.1 pbc\_ops

pbc\_ops are a structure type.

Table 15.1 pbc\_ops

Name	Description
GPIO_PushButton	wps pbc GPIO for push button
nrc_wifi_wps_pbc_fail	wps pbc operation fail
nrc_wifi_wps_pbc_timeout	wps pbc operation timeout
nrc_wifi_wps_pbc_success	wps pbc operation success
nrc_wifi_wps_pbc_pressed	wps pbc operation press

### 15.2 Function Call

The header file for PBC APIs is defined at the “sdk/inc/api\_pbc.h”.

#### 15.2.1 wps\_pbc\_fail\_cb

This callback is called when wps pbc operation fail

**Prototype :**

void wps\_pbc\_fail\_cb(void)

**Input Parameters :**

N/A

**Returns :**

N/A

### 15.2.2 wps\_pbc\_timeout\_cb

This callback is called when there is no connection attempt for 120 second and timeout occurs.

**Prototype :**

void wps\_pbc\_timeout\_cb(void)

**Input Parameters :**

N/A

**Returns :**

N/A

### 15.2.3 wps\_pbc\_success\_cb

This callback is called when wps pbc operation succeeds

**Prototype :**

void wps\_pbc\_success\_cb(void)

**Input Parameters :**

N/A

**Returns :**

N/A

### 15.2.4 wps\_pbc\_button\_pressed\_event

This callback is called when user push the button which is connected with GPIO we register for interrupt.

\*

**Prototype :**

void wps\_pbc\_button\_pressed\_event(int vector)

**Input Parameters :**

vector

Type: int

Purpose: GPIO pin number for wakeup when GPIO is enabled for wakeup source

**Returns :**

N/A

### 15.2.5 wps\_pbc\_set\_fail\_cb

This callback is called when wps pbc set is failed

**Prototype :**

```
void wps_pbc_set_fail_cb(func_void cb)
```

**Input Parameters :**

cb

Type: func\_void

Purpose: callback to register

**Returns :**

N/A

### 15.2.6 wps\_pbc\_set\_timeout\_cb

This callback is called when wps pbc timeout is set

**Prototype :**

```
void wps_pbc_set_timeout_cb(func_void cb)
```

**Input Parameters :**

cb

Type: func\_void

Purpose: callback to register

**Returns :**

N/A

### 15.2.7 wps\_pbc\_set\_success\_cb

This callback is called when wps pbc set is succeed

**Prototype :**

```
void wps_pbc_set_timeout_cb(func_void cb)
```

**Input Parameters :**

cb

Type: func\_void

Purpose: callback to register

**Returns :**

N/A

### 15.2.8 wps\_pbc\_set\_btn\_pressed\_cb

This callback is called when wps pbc button is pressed

**Prototype :**

```
void wps_pbc_set_btn_pressed_cb(func_int cb)
```

**Input Parameters :**

cb

Type: func\_int

Purpose: callback to register

**Returns :**

N/A

### 15.2.9 init\_wps\_pbc

Initialize wps pbc function

**Prototype :**

```
void init_wps_pbc(struct pbc_ops *ops)
```

**Input Parameters :**

ops

Type: struct pbc\_ops \*

Purpose: structure contains GPIO and callbacks

**Returns :**

N/A



## 16 Middleware API Reference

### 16.1 FreeRTOS

FreeRTOS is a market-leading real-time operating system (RTOS) for microcontrollers and small microprocessors.

- Official Website:
  - <https://www.freertos.org/RTOS.html>
- Online Documentation:
  - <https://www.freertos.org/features.html>
- Git Repository:
  - <https://github.com/FreeRTOS/FreeRTOS>

### 16.2 WPA\_supplicant

Wpa\_supplicant is a WPA Supplicant for Linux, BSD, Mac OS X, and Windows with support for WPA and WPA2 (IEEE 802.11i / RSN). Supplicant is the IEEE 802.1X/WPA component that is used in the client stations. It implements key negotiation with a WPA authenticator, and it controls the roaming and IEEE 802.11 authentication/association of the wlan driver.

- Official website:
  - [https://w1.fi/wpa\\_supplicant/](https://w1.fi/wpa_supplicant/)
- Online Documentation:
  - [https://w1.fi/wpa\\_supplicant/devel/](https://w1.fi/wpa_supplicant/devel/)
- GitHub Page:
  - [git clone git://w1.fi/srv/git/hostap.git](https://github.com/w1fi/wpa_supplicant)

### 16.3 lwIP

lwIP (lightweight IP) is a widely used open-source TCP/IP stack designed for embedded systems.

- Official Website:
  - <http://savannah.nongnu.org/projects/lwip>
- Online Documentation:
  - <http://www.nongnu.org/lwip>
- Git Repository:
  - <https://git.savannah.nongnu.org/git/lwip.git>

## 16.4 MbedTLS

MbedTLS is an implementation of the TLS and SSL protocols and the respective cryptographic algorithms and support code required.

- Official Website:
  - <https://tls.mbed.org>
- Online API Reference:
  - <https://tls.mbed.org/api>
- GitHub Page:
  - <https://github.com/ARMmbed/mbedtls>

## 16.5 NVS library

NVS library used for storing data values in the flash memory. Data are stored in a non-volatile manner, so it is remaining in the memory after power-out or reboot. This lib is inspired and based on [TridentTD ESP32NVS](#) work.

The NVS stored data in the form of key-value. Keys are ASCII strings, up to 15 characters. Values can have one of the following types:

- integer types: uint8\_t, int8\_t, uint16\_t, int16\_t, uint32\_t, int32\_t, uint64\_t, int64\_t
- zero-terminated string
- variable length binary data (blob)

Refer to the NVS ESP32 lib [original documentation](#) for a details about internal NVS lib organization.

## 17S1G Channel

### 17.1 Overview

The wpa\_supplicant is required for the NRC7292 STA operation. As the wpa\_supplicant does not natively support S1G (Sub-1 GHz) channels, an internal channel mapping table is used within the firmware to uniquely associate each S1G channel to its pre-determined channel in the traditional 2.4/5GHz band.

As the set of available S1G channels is region-specific, a separate wpa\_supplicant configuration file is used to handle the usage for each supported region.

### 17.2 Channel

#### 17.2.1 US (United States) Channel

**Table 17.1 US Channel**

Available frequency band index	Bandwidth (MHz)	Sub-1GHz frequency	2.4 / 5G frequency
1	1	902.5	2412
3	1	903.5	2422
5	1	904.5	2432
7	1	905.5	2442
9	1	906.5	2452
11	1	907.5	2462
36	1	908.5	5180
37	1	909.5	5185
38	1	910.5	5190
39	1	911.5	5195
40	1	912.5	5200
41	1	913.5	5205
42	1	914.5	5210
43	1	915.5	5215
44	1	916.5	5220
45	1	917.5	5225
46	1	918.5	5230
47	1	919.5	5235
48	1	920.5	5240
149	1	921.5	5745
150	1	922.5	5750

151	1	923.5	5755
152	1	924.5	5760
100	1	925.5	5500
104	1	926.5	5520
108	1	927.5	5540
2	2	903	2417
6	2	905	2437
10	2	907	2457
153	2	909	5765
154	2	911	5770
155	2	913	5775
156	2	915	5780
157	2	917	5785
158	2	919	5790
159	2	921	5795
160	2	923	5800
161	2	925	5805
112	2	927	5560
8	4	906	2447
162	4	910	5810
163	4	914	5815
164	4	918	5820
165	4	922	5825
116	4	926	5580

### 17.2.2 KR (Korea) Channel

There are two kinds of packages for KR. The developer could see the 'KR MIC (922.5Mhz-929.0Mhz)' log for KR (Korea) Channel (925.5Mhz – 929.0Mhz).

#### 17.2.2.1 KR USN Package (921.5Mhz – 922.5Mhz)

**Table 17.2 KR USN Channel**

Available frequency band index	Bandwidth (MHz)	Sub-1GHz frequency	2.4 / 5G frequency
44	1	921.5	5220
45	1	922.5	5225

#### 17.2.2.2 KR MIC Package (925.5Mhz – 929.0Mhz)

**Table 17.3 KR MIC Channel**

Available frequency band index	Bandwidth (MHz)	Sub-1GHz frequency	2.4 / 5G frequency
37	1	926.5	5185
38	1	927.5	5190
39	1	928.5	5195
42	2	927.0	5210
43	2	929.0	5215

### 17.2.3 JP (Japan) channel

**Table 17.4 JP Channel**

Available frequency band index	Bandwidth (MHz)	Sub-1GHz frequency	2.4 / 5G frequency
36	1	917.0	5180
37	1	918.0	5185
38	1	919.0	5190
39	1	920.0	5195
40	1	921.0	5200
41	1	922.0	5205
42	1	923.0	5210
43	1	924.0	5215
44	1	925.0	5220
45	1	926.0	5725
46	2	927.0	5230

### 17.2.4 TW (Taiwan) channel

**Table 17.5 TW Channel**

Available frequency band index	Bandwidth (MHz)	Sub-1GHz frequency	2.4 / 5G frequency
36	1	839.0	5180
37	1	840.0	5185
38	1	841.0	5190
39	1	842.0	5195
40	1	843.0	5200
41	1	844.0	5205
42	1	845.0	5210
43	1	846.0	5215
44	1	847.0	5220
45	1	848.0	5225
46	1	849.0	5230
47	1	850.0	5235
48	1	851.0	5240
149	2	839.5	5745
150	2	841.5	5750
151	2	843.5	5755
152	2	845.5	5760
153	2	847.5	5765
154	2	849.5	5770
155	4	840.5	5775
156	4	844.5	5780
157	4	848.5	5785

### 17.2.5 EU (Europe) channel

**Table 17.6 EU Channel**

Available frequency band index	Bandwidth (MHz)	Sub-1GHz frequency	2.4 / 5G frequency
36	1	863.5	5180
37	1	864.5	5185
38	1	865.5	5190
39	1	866.5	5195
40	1	867.5	5200
41	2	864.0	5205
42	2	866.0	5210

### 17.2.6 CN (China) channel

**Table 17.7 CN Channel**

Available frequency band index	Bandwidth (MHz)	Sub-1GHz frequency	2.4 / 5G frequency
36	1	755.5	5180
37	1	756.5	5185
38	1	757.0	5190
39	1	758.5	5195
40	1	759.5	5200
41	1	760.5	5205
42	1	761.5	5210
43	1	762.5	5215
44	1	763.5	5220
45	1	764.5	5225
46	1	765.5	5230
47	1	766.5	5235
48	1	767.5	5240
149	1	768.5	5745
150	1	769.5	5750
151	1	770.5	5755
152	1	779.5	5760
153	1	780.5	5765
154	1	781.5	5770

### 17.2.7 NZ (New Zealand) channel

**Table 17.8 NZ Channel**

Available frequency band index	Bandwidth (MHz)	Sub-1GHz frequency	2.4 / 5G frequency
<b>36 (Default)</b>	1	915.5	5180
37	1	916.5	5185
38	1	917.5	5190
39	1	918.5	5195
40	1	919.5	5200
41	1	920.5	5205
42	1	921.5	5210
43	1	922.5	5215
44	1	923.5	5220
45	1	924.5	5225
46	1	925.5	5230

47	1	926.5	5235
48	1	927.5	5240
153	2	916.0	5765
154	2	918.0	5770
155	2	920.0	5775
156	2	922.0	5780
157	2	925.0	5785
158	2	927.0	5790
162	4	917.0	5810
163	4	921.0	5815
164	4	926.0	5820

### 17.2.8 AU (Australia) channel

**Table 17.9 AU Channel**

Available frequency band index	Bandwidth (MHz)	Sub-1GHz frequency	2.4 / 5G frequency
<b>36 (Default)</b>	1	915.5	5180
37	1	916.5	5185
38	1	917.5	5190
39	1	918.5	5195
40	1	919.5	5200
41	1	920.5	5205
42	1	921.5	5210
43	1	922.5	5215
44	1	923.5	5220
45	1	924.5	5225
46	1	925.5	5230
47	1	926.5	5235
48	1	927.5	5240
153	2	916.0	5765
154	2	918.0	5770
155	2	921.0	5775
156	2	923.0	5780
157	2	925.0	5785
158	2	927.0	5790
162	4	917.0	5810
163	4	922.0	5815
164	4	926.0	5820



## 18 Abbreviations

**Table 18.1 Abbreviations and acronyms**

Name	Description
IP	Internet Protocol
LwIP	Lightweight Internet Protocol
SDK	Software Development Kit
SDK	Software Development Kit
API	Application Programming Interface
EVB	Evaluation Board
AP	Access Point
STA	Station
SSID	Service Set Identifier
BSSID	Basic Service Set Identifier
RSSI	Received Signal Strength Indication
SNR	Signal-to-noise ratio
WPA2	Wi-Fi Protected Access 2
WPA3-SAE	Wi-Fi Protected Access 3 – Simultaneous Authentication of Equals
WPA3-OWE	Wi-Fi Protected Access 3 – Opportunistic Wireless Encryption
EAP	Extensible Authentication Protocol
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
AID	Association ID
MAC	Medium Access Control
dBm	decibel-Milliwatts
S1G	Sub 1 Ghz
HAL	Hardware Abstract Layer
ADC	Analog-to-Digital Converter
UART	Universal Asynchronous Receiver-Transmitter
PWM	Pulse-Width Modulation
SPI	Serial Peripheral Interface
TPC	Transmission Power Control
GPIO	General-purpose input/output
CPOL	Clock Polarity
CPHA	Clock Phase
TIM	Traffic Indication Map
NVS	Non-Volatile Storage

## 19 Revision history

Revision No	Date	Comments
Ver 1.0	11/01/2018	Initial version for customer release created
Ver 1.1	03/25/2019	APIs for Wi-Fi, Timer, ADC, and SPI updated
Ver 1.2	04/05/2019	APIs for Wi-Fi, Connection, Timer, I2C, ADC, SPI, PWM updated
Ver 1.3	07/02/2019	APIs for Wi-Fi, Connection updated
Ver 1.4	11/07/2019	Add HTTP Client API and FOTA API
Ver 1.5	07/05/2020	Add Serial Flash API
Ver 1.6	07/23/2020	Add Power save
Ver 1.7	08/20/2020	Add Wi-Fi BSSID setting. Change name 'nrc_wifi_add_network' and added 'nrc_wifi_remove_network'
Ver 1.8	11/20/2020	Add APIs for WIFI (GET: aid, bssid, country, channel, bw, security, device_mode, info, disassoc)
Ver 1.9	12/30/2020	Add APIs for System (bdf, cal, log_level)
Ver 2.0	01/14/2021	Update api_timer and api_i2c. Added wpa_supplicant and AWS IoT SDK in middleware api
Ver 2.1	03/17/2021	Add API for WIFI; nrc_wifi_abort_scan
Ver 3.0	07/26/2021	Update SDK return values
Ver 3.1	09/21/2021	Update pwm api
Ver 3.2	09/30/2021	Remove sflash api, Added NZ, AU channel table and NVS library
Ver 3.3	10/15/2021	Add APIs for WPS PBC