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Technical Support

Website

Our website contains much useful information: modules and stand-alone products information, user guides, configuration software and technical documents which can be accessed 24 hours a day.

Email

If you have technical problems or cannot find the required information in the provided documents, contact our Technical Support by email. Use our dedicated email address (arf@adeunis.com) rather than any personal email address of our staff. This makes sure that your request is processed as soon as possible.

Helpful Information when Contacting Technical Support

When contacting Technical Support please have the following information ready:

- Product type (e.g. Wireless M-Bus),
- Firmware version (e.g. V3.03)
- Clear description of your question or the problem
- A short description of the application
- Your complete contact details

Environmental recommendations

All superfluous packaging materials have been eliminated. We have done everything possible to make it easy to separate the packaging into three types of materials: cardboard (box), expanded polystyrene (filler material) and polyethylene (packets, foam protective sheets). Your device is composed of materials that can be recycled and reused if it is dismantled by a specialist company. Please observe local regulations concerning the manner in which waste packaging material, used batteries and your obsolete equipment are disposed of.

Warnings

Valid for the following product:
ARF52840



Read the instructions in the manual



The safety of this product is only guaranteed when it is used in accordance with its purpose. Maintenance should only be carried out by qualified persons.



Please note, do not install the equipment close to a heat source or in damp conditions.



Warning: Do not open the product, risk of electric shock.



Please note: for your own safety, you must ensure that equipment is switched off before carrying out any work on it.

Recommendations regarding use

- Before using the system, check that the power supply voltage shown in the user manual corresponds to your supply. If it doesn't, please consult your supplier.
- Place the device against a flat, firm and stable surface.
- The device must be installed in a location that is sufficiently ventilated so that there is no risk of internal heating and it must not be covered with objects such as newspapers, cloths, curtains, etc.
- The device's aerial must be free and at least 10 cm away from any conducting material.
- The device must never be exposed to heat sources such as heating equipment.
- Do not place the device close to objects with naked flames such as lit candles, blowtorches, etc.
- The device must not be exposed to aggressive chemical agents or solvents likely to damage the plastic or corrode the metal parts.
- Install your device close to its DC power supply.

COMPLIANCE TO FCC US/CAN

Important regulatory information

FCC ID : U3Z-ARF52840

IC : 7016A-ARF52840

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, may cause harmful interference to radiocommunication. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment OFF

and ON, the user is encouraged to try to correct the interference by one or more of the following measures :

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lower) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be chosen so that the equivalent isotropically radiated power (e.i.r.p.) is not superior than necessary for successful communication.

Cet équipement a été testé et déclaré conforme aux limites d'un appareil numérique de classe B, conformément à la partie 15 des règles de la FCC. Ces limites sont conçues pour fournir une protection raisonnable contre les interférences nuisibles dans une installation résidentielle. Cet équipement génère, utilise et peut émettre de l'énergie radiofréquence et, s'il n'est pas installé et utilisé conformément aux instructions, peut causer des interférences nuisibles aux radiocommunications. Il est cependant toujours possible que des interférences se produisent dans le cadre d'une installation particulière.

Si cet appareil produit des interférences nuisibles à la réception des programmes de radio et de télévision –détectables lors de la mise hors tension ou en tension de l'appareil-l'utilisateur est encouragé à mettre en œuvre une ou plusieurs des mesures suivantes pour remédier à ces interférences :

- Réorienter ou déplacer l'antenne de réception.
- Augmenter la distance entre l'équipement et le récepteur.
- Branchez le matériel à une sortie sur un circuit différent de celui auquel le récepteur est branché.
- Prendre conseil auprès du commerçant ou d'un technicien de radio/TV expérimenté.

Tout changement ou modification non expressément approuvé par la partie responsable des mesures de conformité peut amener l'utilisateur à se voir interdire l'usage de l'appareil.

Cet appareil est limité à l'exploitation des fréquences autorisées Partie 15, et ne peut pas être configuré par des utilisateurs finaux ou des installateurs professionnels à fonctionner en dehors des bandes autorisées.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

WARNING !

The OEM integrators are responsible for ensuring that the end-user has no manual instructions to remove or install module.

The module is limited to OEM installation ONLY

Les intégrateurs OEM sont responsables de s'assurer que l'utilisateur final ne dispose d'aucune instruction manuelle pour retirer ou installer le module.

Le module est limité à l'installation OEM UNIQUEMENT

• This device complies with part 15 of the FCC rules and Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions : (1). this device may not cause Harmful interference, and (2).this device must accept any interference received, including interference that may cause undesired operation of the device

Le présent appareil est conforme aux règles de la FCC et CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- 1. l'appareil ne doit pas produire de brouillage ;*
- 2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

ANY CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY ADEUNIS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

Tout changement ou modification non expressément approuvé par la partie responsable des mesures de conformité peut amener l'utilisateur à se voir interdire l'usage de l'appareil.

This equipment complies with FCC's and RSS102's radiation exposure limits set forth for an uncontrolled environment under the following conditions:

- 1. This equipment should be installed and operated such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and user's/nearby person's body at all times.*
- 2. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.*

Cet équipement est conforme aux limites d'expositions de la CNR102 et de la FCC applicables pour un environnement non contrôlé aux conditions suivantes:

- 1. Cet équipement devra être installé et fonctionner de telle manière qu'une distance minimale de séparation de 20 cm soit maintenue entre la partie rayonnante (l'antenne) et l'utilisateur / les personnes à proximité à tout moment.*
- 2. Cet émetteur ne doit pas être co-localisé ou opérer en conjonction avec toute autre antenne ou émetteur.*

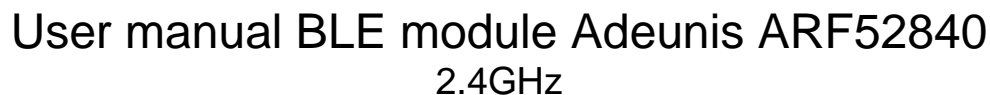
The RF module has been certified for mobile and fixed applications. If the module will be used for portable application the device must undergo SAR testing and the following instructions shall be reported on the User Manual:

Le module RF a été certifié pour les applications mobiles et fixes. Si le module est utilisé pour une application portable, l'appareil doit subir un test DAS et les instructions suivantes doivent être consignées dans le manuel de l'utilisateur:

If SAR measurement is not required:

This portable equipment with it's antenna complies with FCC's and RSS102's radiation exposure limits set forth for an uncontrolled environment. To maintain compliance, follow the instructions below :

- 1. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.*
- 2. Avoid direct contact to the antenna, or keep contact to a minimum while using this equipment.*



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(When the device is so small or for such use that it is not practicable to place the statement specified above on it, the information required shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed.)

installation OEM et étiquetage de conformité

Le module ARF52840 est étiqueté avec son propre numéro d'identification FCC. Si l'ID FCC n'est pas visible lorsque le module est installé dans un autre périphérique, l'extérieur du périphérique sur lequel il est installé doit également afficher une étiquette faisant référence au module.

Cette étiquette extérieure peut utiliser les libellés suivants:

"Contains Transmitter Module"	Contient le FCC ID: U3Z-ARF52840
	Contient IC : 7016A-ARF52840

Ce dispositif est conforme aux règles de la FCC part 15 et à la norme CNR-210 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes : (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explain this requirement. In the latter case, a copy of these instructions must be included in the application for equipment authorization.

Toute formulation similaire exprimant le même sens peut être utilisée. Le bénéficiaire peut soit fournir une telle étiquette, dont un exemple doit être inclus dans la demande d'autorisation d'équipement, soit fournir des instructions adéquates ainsi que le module qui explique cette exigence. Dans ce dernier cas, une copie de ces instructions doit être incluse dans la demande d'autorisation d'équipement

1 Globale Architecture

HW Interface

The nRF52 is the μ C master: it manages a large part of the IHM and controls the modem

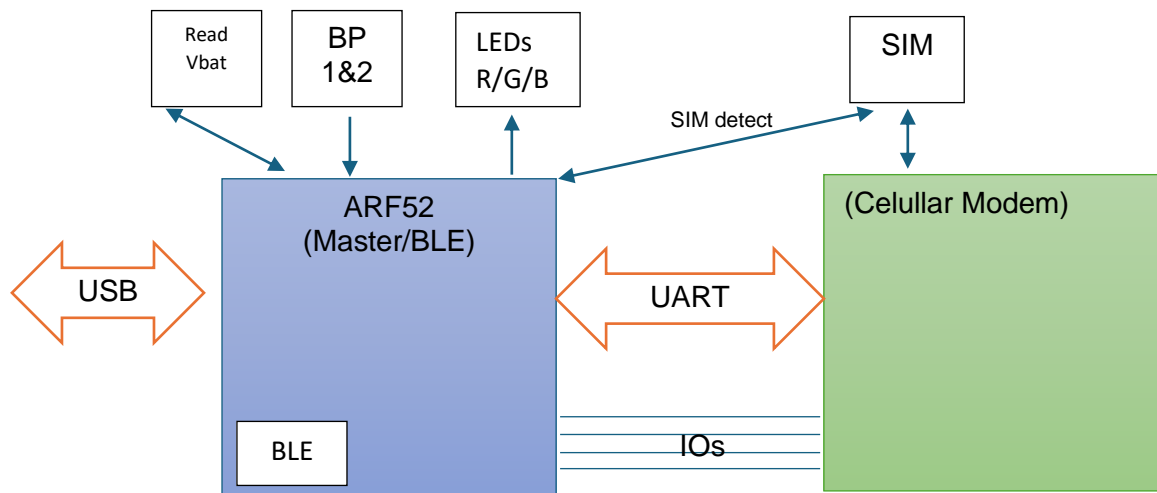


Figure 1 - Interfaces HW ARF52840

1.1 Pinout

Fonction	Name	Pin
UART modem	Tx	P0.6
	Rx	P0.8
USB	USB_D_P	D-
	USB_D_N	D+
UARTS DEBUG	Tx_debug	P0.07
	Rx_debug (opt)	P1.00
Gestion modem	RST (out)	P1.01
	Ready (in)	P1.02
	WakeUp (out)	P1.03
	Busy (in)	P1.04
	EN_IO	P1.05
	EN_PWR	P1.06
Battery	BAT_ADC (in)	P0.03
Button	BP_1	P0.13
	BP_2	P0.14
LED	LED_B	P0.30
	LED_R	P0.28
	LED_G	P0.29
SIM detect	En_SIM_Detect (out)	P0.25
	SIM_Detect (in)	P0.24

2 Specification ARF52840 (master / BLE)

Parameter	Value	Comment
Power supply	1.7 - 5.5 V	
Stand by consumption	75µA	
TX consumption	17mA	
RX consumption	9mA	
Operational T°C	-30 / +70°C	

UART setting	Default Value
Baud rate	115200
Data bits	8
Parity	None
Stop Bits	1
Flow Control	Disabled

3 Principle of Architecture

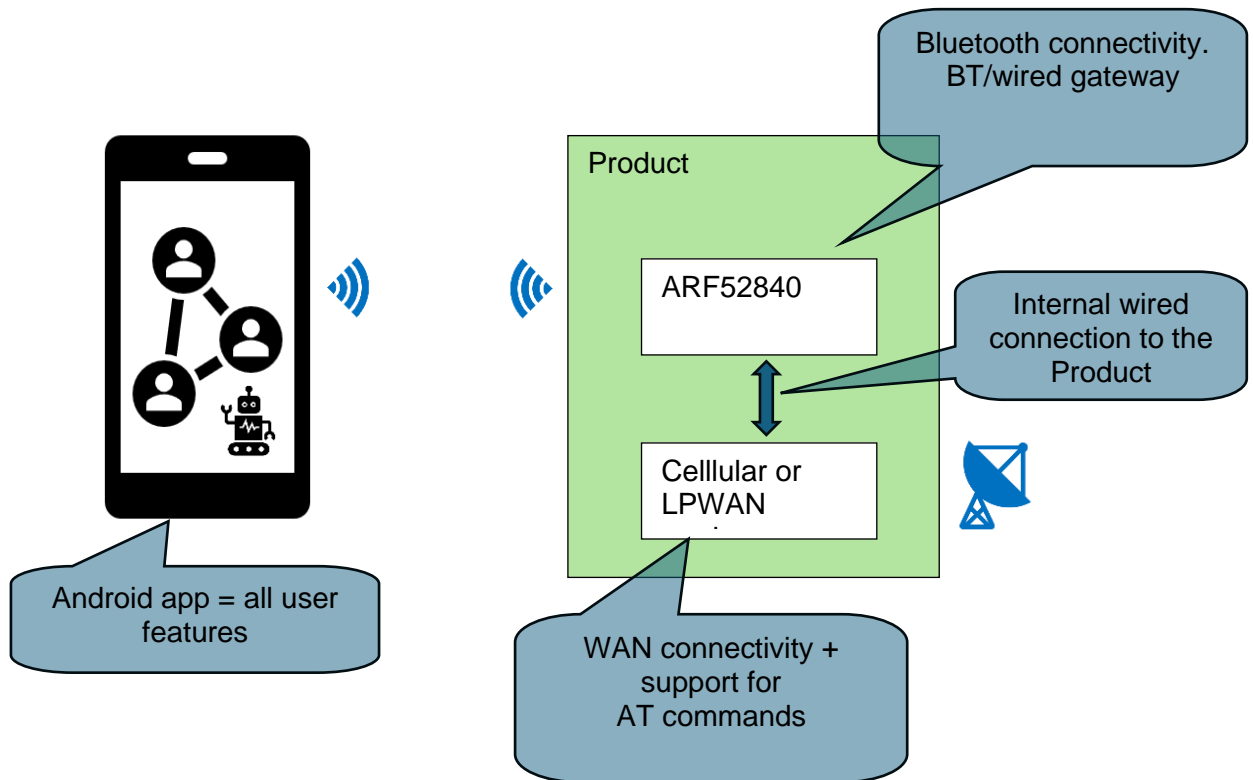


Figure 3 – Principle of Architecture

In nominal operation:

- The Android application issues commands (AT commands) over the Bluetooth link
- The nRF52 captures these commands and relays them to the nRF91/STM32 via their UARTs
- The nRF91/STM32 interprets the command and responds on its UART
- The nRF52 relays the response from the UART to the BT link
- The smartphone application receives the response and processes it (storage, formatting, analysis, etc.)
- Between them, the 2 microphones communicate via their UARTs.

The nRF52 only relays frames.

- He has no knowledge of modem or AT commands.
- It relays a BT to UART flow and a UART to BT flow which are from its point of view 2 independent and asynchronous flows.
- For example, if an AT command does not trigger the expected response, it does not detect it. This is the responsibility of the client application.

4 Main States

The main states and substates in the application are:

Etat	Sous-états	Commentaires
OFF	IDLE	State of almost total inactivity of the product: - Only the ARRF52840 is on - The modem is turned off (not in standby)
	COMMAND	Command Mode for RF Testing and Initial Setup
ON	NOT_CONNECTED	Product not connected to smartphone
	CONNECTED	State in which the product processes smartphone requests or button presses
	PAIRING BLE	Stack BLE switches to advertising (LED flashing)

5 List of services and features

Services	Caractéristiques	Commentaires
NUS (Nordic Service)	UART_RX	Customer writes to send AT command to modem
	UART_TX	The customer subscribes to receive responses to AT commands at modem
Batterie	Battery level	The customer subscribes to know the status of the battery
FTD_CTRL	Cmd	The customer writes to send an order specifically to the ARF52840.
	Rep	The customer subscribes to receive responses or acknowledgment to specific orders
	Button	Notification of button presses (e.g. short press of the (large) ON/OFF button on the front)
Device Information service	Show chapter dedicated	Contains various product information

All standard services are described here:

<https://www.bluetooth.com/specifications/assigned-numbers/>

Les UUID des caractéristiques custom sont :

- UART_TX_UUID = "6e400002-b5a3-f393-e0a9-e50e24dcca9e"
- UART_RX_UUID = "6e400003-b5a3-f393-e0a9-e50e24dcca9e"
- FTD_CTRL_TX_UUID = "29ebe4d7-37f9-4667-9129-33825f01882d"
- FTD_CTRL_RX_UUID = "29ebe4d8-37f9-4667-9129-33825f01882d"
- FTD_CTRL_BUTTON_UUID = "29ebe4d9-37f9-4667-9129-33825f01882d"

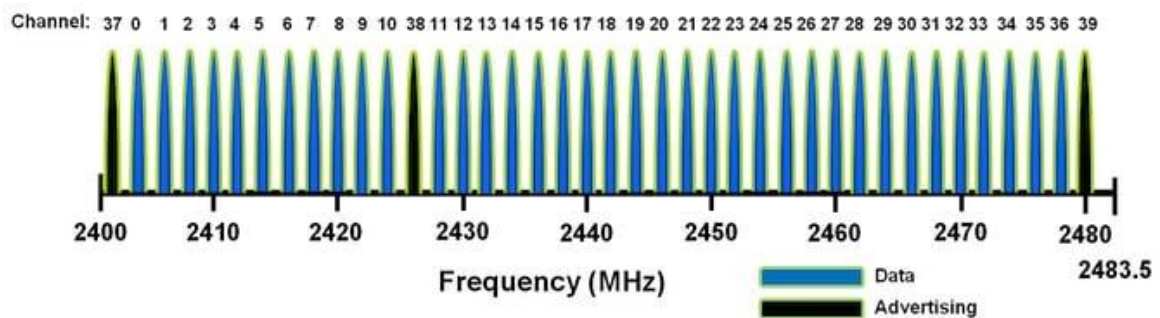
Format and commands supported by the Control service

Action	Commande	Retour	Commentaires
RESET nRF52	RESET52		Allows you to reset the ARF52840 (and therefore the product)
Check SIM	CHECKSIM	1 OK	Returns the status of the presence of the SIM (checked by the ARF52840)
Allumage LED	LED OFF => LED0 LED ON => LED1	OK	Allows you to control the LED

6 Channels description

The BLE frequency band

Bluetooth LE communication is in the globally unlicensed 2.4 GHz ISM (Industrial, Scientific and Medical) band. This band has been divided into 40 channels, each 2 MHz wide (Figure below).



Channels

Channel N°	DTS channels 2.4GHz	
N°	Frequency (MHz)	BW(Mhz)
37	2402	1
0	2404	1
1	2406	1
2	2408	1
3	2410	1
4	2412	1
5	2414	1
6	2416	1
7	2418	1
8	2420	1
9	2422	1
10	2424	1
38	2426	1
11	2428	1
12	2430	1
13	2432	1
14	2434	1
15	2436	1
16	2438	1
17	2440	1
18	2442	1
19	2444	1

20	2446	1
21	2448	1
22	2450	1
23	2452	1
24	2454	1
25	2456	1
26	2458	1
27	2460	1
28	2462	1
29	2464	1
30	2466	1
31	2468	1
32	2470	1
33	2472	1
34	2474	1
35	2476	1
36	2478	1
39	2480	1

6.1 Module operation

A radio packet contains the following fields: PREAMBLE, ADDRESS, S0, LENGTH, S1, PAYLOAD and CRC.

The content of a RADIOpacket is illustrated in On air packet layout. The RADIO sends the different fields in the packet in the order they are illustrated below, from left to right:



Figure 2. On air packet layout

Not shown in the figure is the static payload add-on (the length of which is defined in STATLEN, and which is 0 bytes long in a standard BLE packet). The static payload add-on is sent between PAYLOAD and CRC fields. The radio sends the different fields in the packet in the order they are illustrated above, from left to right. The preamble will be sent with least significant bit first on air.

Not shown in the figure above is the static payload add-on (the length of which is defined in PCNF1.STATLEN, and which is 0 bytes long in a standard BLE packet). The static payload add-on is sent between the PAYLOAD and CRC fields.

PREAMBLE is sent with least significant bit first on-air. The size of the PREAMBLE depends on the mode selected in the MODE register:

- The PREAMBLE is one byte for MODE = Ble_1Mbit as well as all Nordic proprietary operating modes (MODE = Nrf_1Mbit and MODE = Nrf_2Mbit), and the PLEN field in the PCNF0 register has to be set accordingly. If the first bit of the ADDRESS is 0 the preamble will be set to 0xAA otherwise the PREAMBLE will be set to 0x55.
- For MODE = Ble_2Mbit the PREAMBLE has to be set to 2 byte long through the PLEN field in the PCNF0 register. If the first bit of the ADDRESS is 0 the preamble will be set to 0xAAAA otherwise the PREAMBLE will be set to 0x5555.
- For MODE = Ble_LR125Kbit and MODE = Ble_LR500Kbit the PREAMBLE is 10 repetitions of 0x3C.

Radio packets are stored in memory inside instances of a radio packet data structure as illustrated in In-RAM representation of radio packet - S0, LENGTH and S1 are optional. The PREAMBLE, ADDRESS, CI, TERM1, TERM2 and CRC fields are omitted in this data structure.

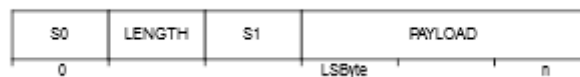


Figure 3. In-RAM representation of radio packet - S0, LENGTH and S1 are optional

The byte ordering on air is always least significant byte first for the ADDRESS and PAYLOAD fields and most significant byte first for the CRC field. The ADDRESS fields are always transmitted and received least significant bit first on air. The CRC field is always transmitted and received most significant bit first. The bit-endian, i.e. the order in which the bits are sent and received, of the S0, LENGTH, S1 and PAYLOAD fields can be configured via the ENDIAN in PCNF1.

The sizes of the S0, LENGTH and S1 fields can be individually configured via S0LEN, LFLen and S1LEN in PCNF0 respectively. If any of these fields are configured to be less than 8 bits long, the least significant bits of the fields are used.

If S0, LENGTH or S1 are specified with zero length their fields will be omitted in memory, otherwise each field will be represented as a separate byte, regardless of the number of bits in their on air counterpart.

Independent of the configuration of MAXLEN, the combined length of S0, LENGTH, S1 and PAYLOAD cannot exceed 258 bytes.

6.1.1 Radio states

Tasks and events are used to control the operating state of the RADIO.

The RADIO can enter the states described the table below.

State	Description
DISABLED	No operations are going on inside the radio and the power consumption is at a minimum
RXRU	The radio is ramping up and preparing for reception
RXIDLE	The radio is ready for reception to start
RX	Reception has been started and the addresses enabled in the RXADDRESSES register are being monitored
TXRU	The radio is ramping up and preparing for transmission
TXIDLE	The radio is ready for transmission to start
TX	The radio is transmitting a packet
RXDISABLE	The radio is disabling the receiver
TXDISABLE	The radio is disabling the transmitter

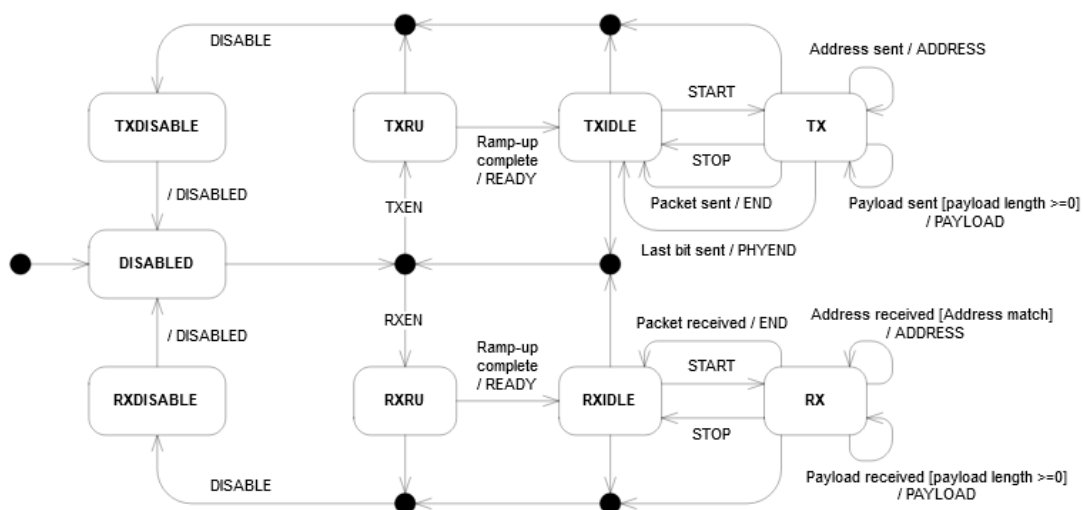


Figure 4. RADIO state diagram

6.1.2 Transmit sequence

Before the RADIO is able to transmit a packet, it must first ramp-up in TX mode. See TXRU in Radio states and Transmit sequence. A TXRU ramp-up sequence is initiated when the TXEN task is triggered. After the radio has successfully ramped up it will generate the READY event indicating that a packet transmission can be initiated. A packet transmission is initiated by triggering the START task. As illustrated in Radio states the START task can first be triggered after the RADIO has entered into the TXIDLE state.

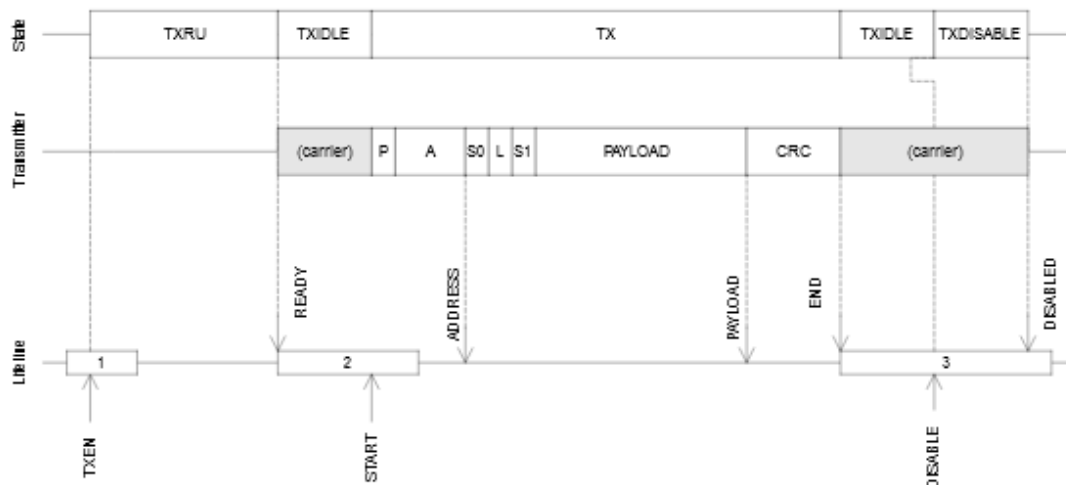
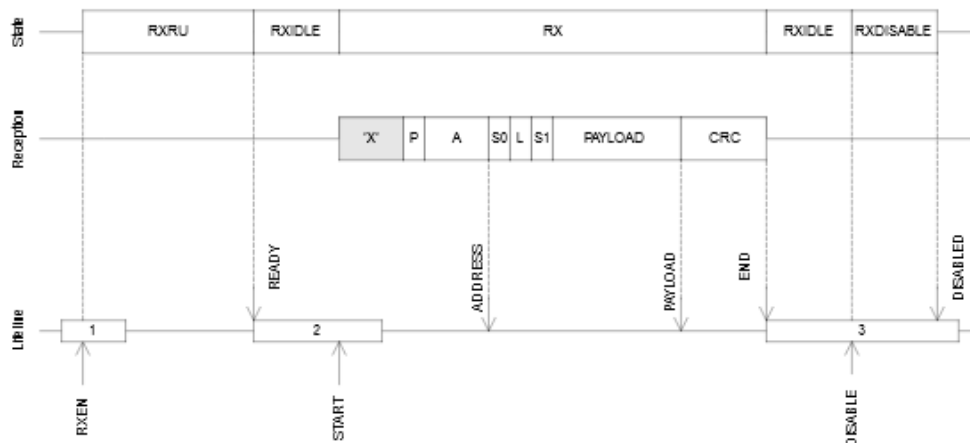


Figure 5. Transmit sequence

Transmit sequence illustrates a single packet transmission where the CPU manually triggers the different tasks needed to control the flow of the RADIO, i.e. no shortcuts are used. If shortcuts are not used, a certain amount of delay caused by CPU execution is expected between READY and START, and between END and DISABLE. As illustrated in Transmit sequence the RADIO will by default transmit '1's between READY and START, and between END and DISABLE. What is transmitted can be programmed through the DTX field in the MODECNF0 register.

6.1.3 Receive sequence

Before the RADIO is able to receive a packet, it must first ramp up in RX mode
See RXRU in Radio states and Receive sequence.



. Figure 6. Receive sequence

An RXRU ramp up sequence is initiated when the RXEN task is triggered. After the radio has successfully ramped up it will generate the READY event indicating that a packet reception can be initiated. A packet reception is initiated by triggering the START task. As illustrated in Radio states the START task can first be triggered after the RADIO has entered into the RXIDLE state.

Receive sequence illustrates a single packet reception where the CPU manually triggers the different tasks needed to control the flow of the RADIO, i.e. no shortcuts are used. If shortcuts are not used, a certain amount of delay caused by CPU execution is expected between READY and START, and between END and DISABLE. As illustrated Receive sequence the RADIO will be listening and possibly receiving undefined data, represented with an 'X', from START and until a packet with valid preamble (P) is received.

6.2 Interframe spacing

Interframe spacing is the time interval between two consecutive packets.

It is defined as the time, in microseconds, from the end of the last bit of the previous packet received and to the start of the first bit of the subsequent packet that is transmitted. The RADIO is able to enforce this interval, as specified in the TIFS register, as long as the TIFS is not specified to be shorter than the RADIO's turnaround time, i.e. the time needed to switch off the receiver, and then switch the transmitter back on. The TIFS register can be written any time before the last bit on air is received.

This timing is illustrated in the figure below.

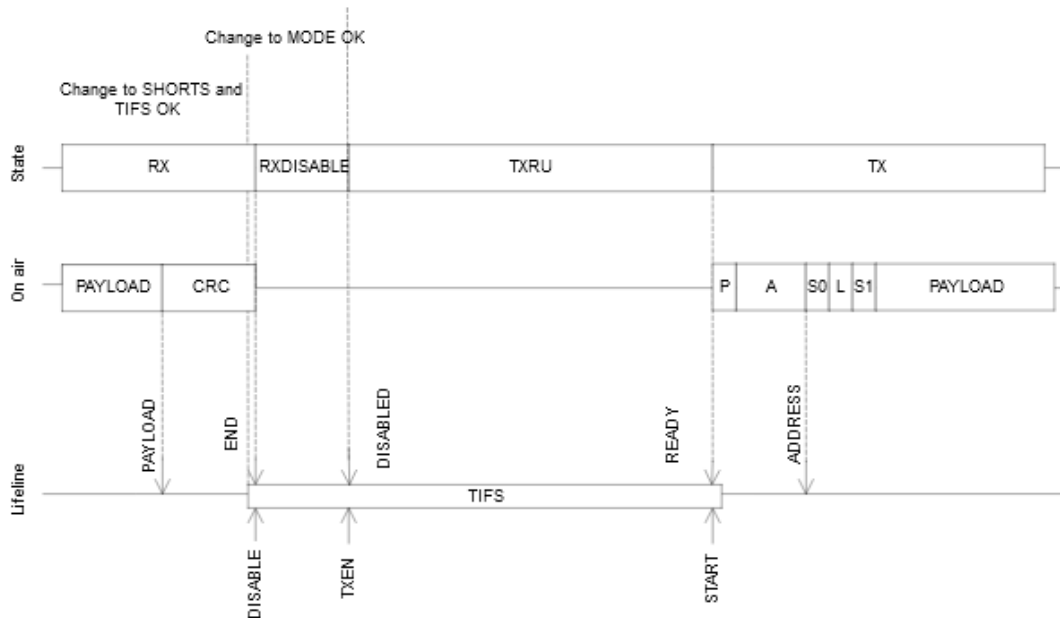


Figure 7. IFS timing detail