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Documentation

Boîtier radio LoRa

Fonctionnement des boîtiers

Révisions

A 20/10/16 Version initiale

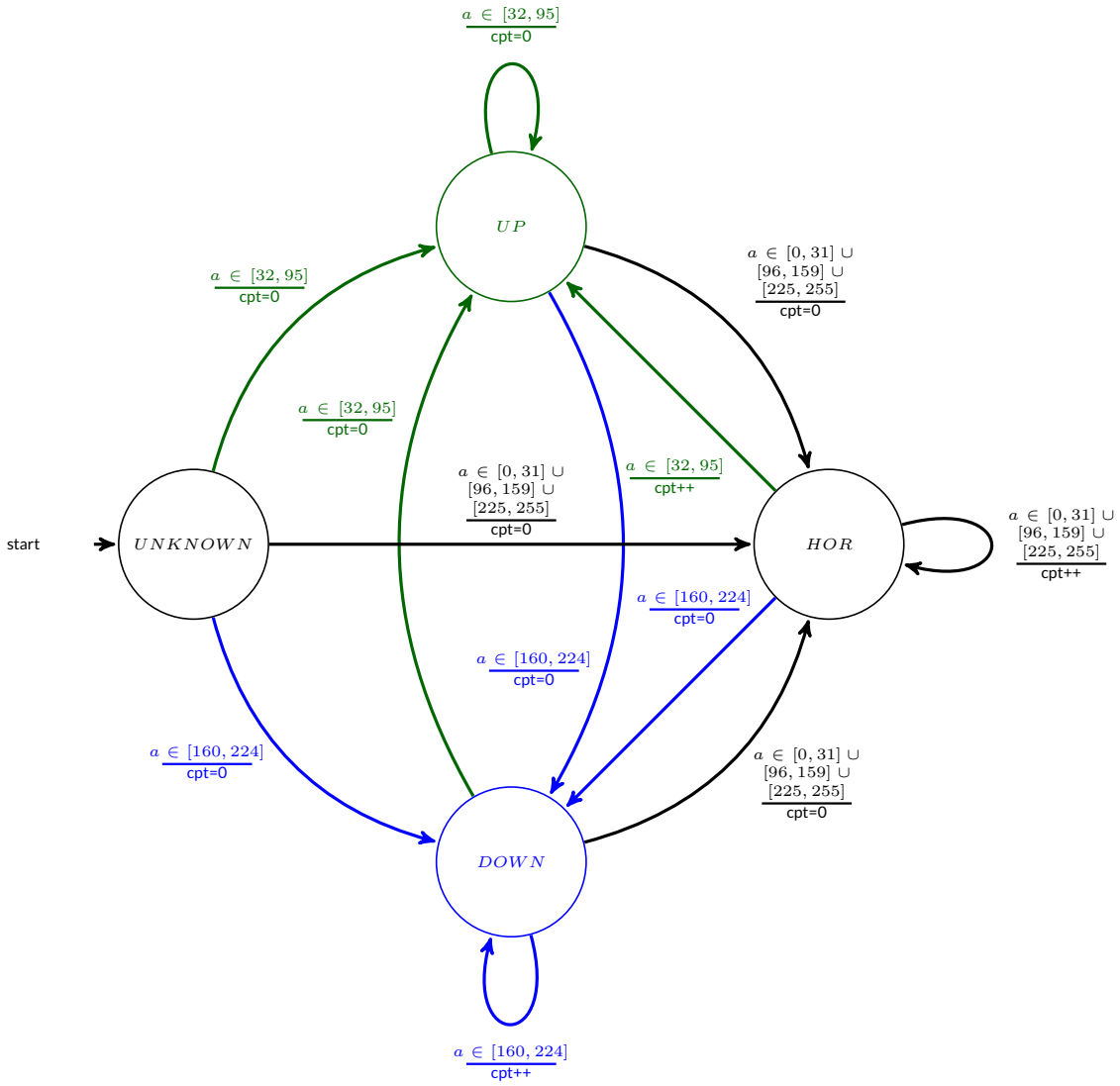
Table des matières

1 Codage de la LED

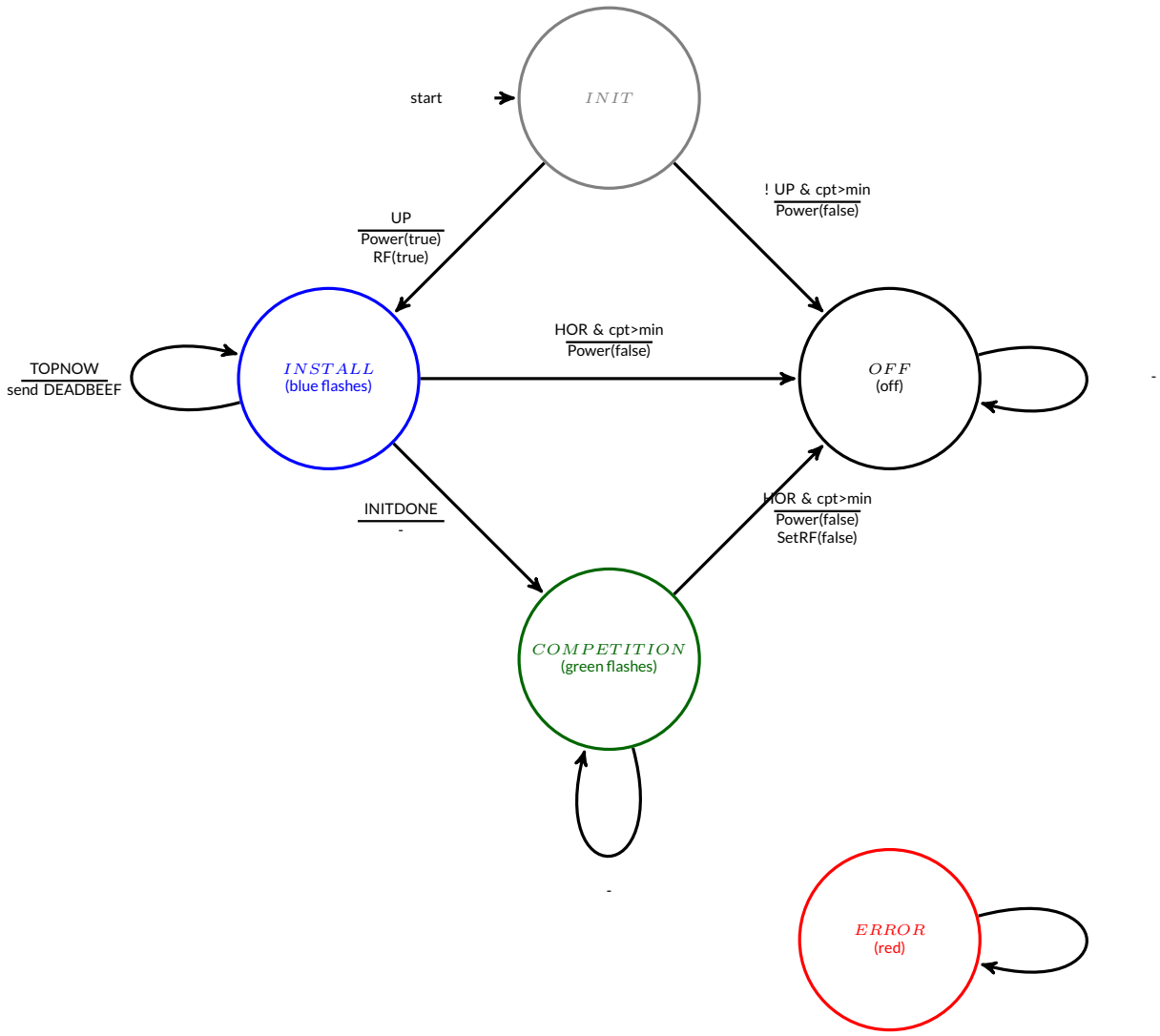
Couleur	Type	État	Signification	Flash	Répet.	Durée
Bleu	flash	INIT	Allumage	≈ 100 ms	-	1 flash
Bleu	flash	INSTALL	En mode installation	10 ms	5 s	∞
Vert	flash	COMPETITION	En mode compétition	10 ms	5 s	∞
Vert	flash	INST. & COMP.	Réception SRR	10 ms	-	1 flash
Vert	flash long	INST. & COMP.	Réception LoRa	100 ms	-	1 flash
Vert	flash long	INST. & COMP.	Transmission LoRa	200 ms	-	1 flash
Jaune	clignotant	INSTALL	SRR reçu	10 ms	200 ms	20 s
Jaune	clignotant	INSTALL	Niveau de réception	10 ms	100-700 ms	1.5 s
Rouge	flash long	OFF	Arrêt en cours	≈ 1 s	-	1 flash
Rouge	clignotant	ERROR	Arrêt en cours	200 ms	400 ms	∞

2 Machines d'état

2.1 Machine d'état de détection de position



2.2 Machine d'état principale



min stable time to change state : 3s

3 Firmware update

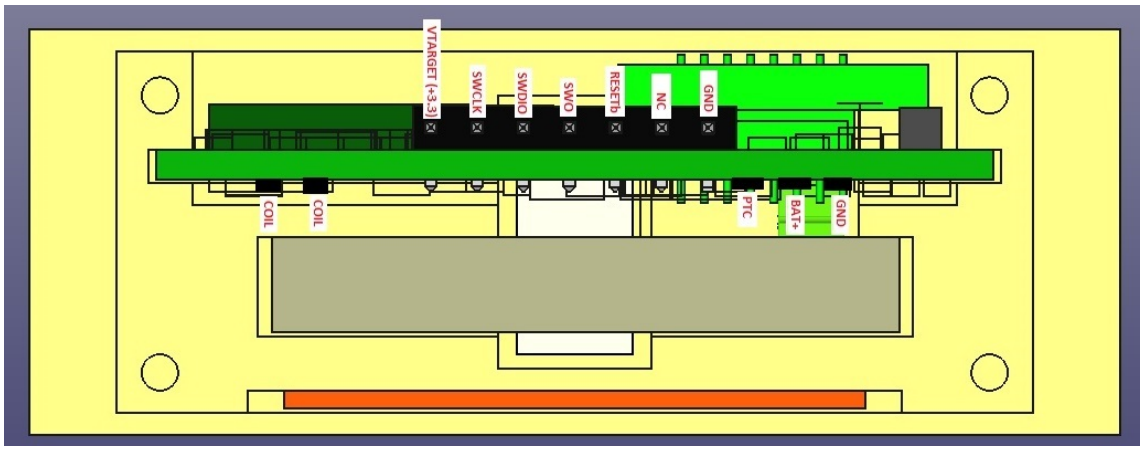


FIGURE 1. Radio module debug and program connector

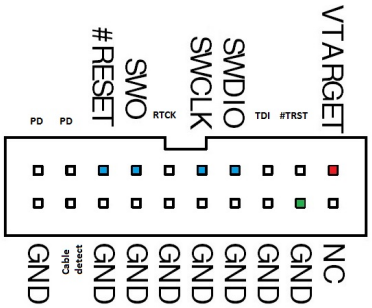


FIGURE 2. Kit debug and program connector

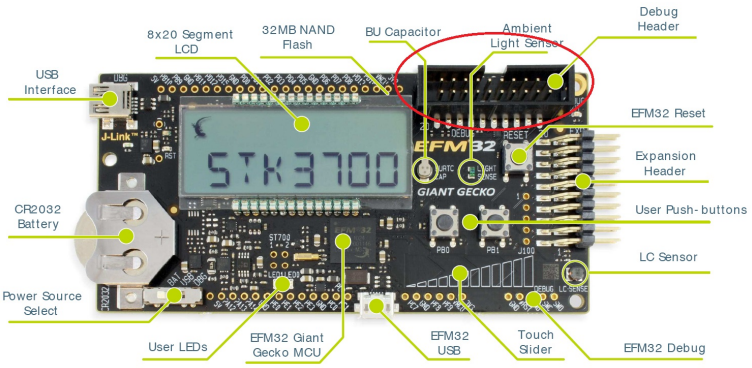


FIGURE 3. Silicon lab development kit

4 Communication protocol

4.1 Protocol over LoRa

Data are transmitted as an ASCII string.

At the receiver end, all leading FF are first discarded.

Data are encoded with a 2 letters command followed with actual data. For instance command 3A is actually transmitted as two consecutive bytes with value 0x33 and 0x41.

Recognized commands are :

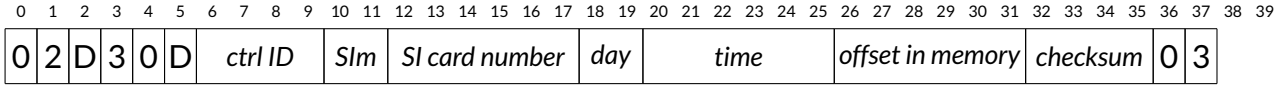
ASCII code	param chars	Description
02	38	punch
3A	8	battery and status of emitter
3B	6	receiving level
DE	6	keep alive
TO	4	installation beacon
IN	8	command to switch to competition mode

TABLE 1. Over the air commands

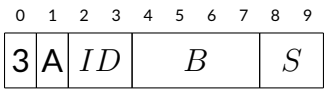
When messages pass throught relays, relays append their own message (mostly battery, status and received level) to the received messages before forwarding them.
If the ID of the relay is already present in the message, the relay will not retransmit the message to avoid infinite loops.

A message ends with \n, i.e. with a 0x10 byte.

4.1.1 Punch code



4.1.2 Battery and status



- ID is the ID of the radio for which the battery level and the status follows encoded in ASCII hexadecimal (00 to FF).
- B is the battery level expressed in mV and encoded in ASCII hexadecimal on 4 characters (0000 to FFFF).
- S is the status byte in ASCII encoded hexadecimal (00 to FF).

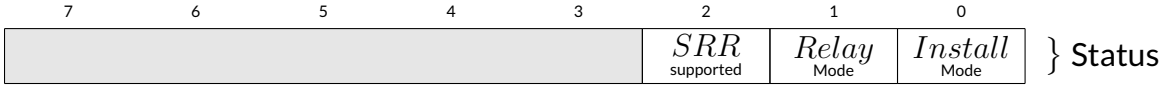
For instance if radio number 3 has a battery level of 3.7V and is in installation mode, the transmitted string is :

3A030E7401

And is transmitted as the following bytes :

0x33 0x41 0x30 0x33 0x30 0x45 0x37 0x34 0x30 0x31

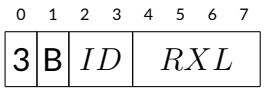
Status word organisation



Bit	Name	Description
0	Install	1 ↔ installation mode, 0 ↔ normal mode
1	Relay mode	1 ↔ relay mode, 0 ↔ normal mode
2	SRR supported	1 ↔ SRR supported, 0 ↔ No SRR (can be used as relay)
3		
⋮	*Reserved*	*Reserved*
7		

TABLE 2. Satus bits

4.1.3 Radio quality



- ID is the ID of the radio which received the message with the level that follows. ID is expressed in ASCII encoded hexadecimal (00 to FF)
- RXL is the absolute value of the reception level expressed in dB and encoded in ASCII hexadecimal on 4 characters (0000 to FFFF).

For instance if relay number 200 has received a message at a level of -87dB, the transmitted string is :

3BC80057

And it is transmitted as the following bytes :

0x33 0x42 0x43 0x38 0x30 0x30 0x35 0x37

4.1.4 Keep alive

0	1	2	3	4	5	6	7
D	E	A	D	B	E	E	F

The message is transmitted as the following bytes :

0x44 0x45 0x41 0x34 0x42 0x45 0x45 0x46

The *keep alive* message is transmitted at regular interval by control radios and relays when no punch has been transmitted for a while (default is 3 minutes).

4.1.5 Install beacon

0	1	2	3	4	5
T	O	P	N	O	W

The message is transmitted as the following bytes :

0x54 0x4F 0x50 0x4E 0x4F 0x57

The *install beacon* message is regularly transmitted by the receiver while in installation mode (default is every 10 seconds). It is forwaded by relays without appending any extra data. Control radios while in installation mode are constantly listening for this messages from the receiver and flash the LED according to received signal level.

Please note that while in installation mode, control radios and relays can nevertheless work properly and transmit punches and *keep alive* messages.

4.1.6 End of install

0	1	2	3	4	5	6	7	8	9
I	N	S	T	D	O	N	E	*	*

0	1	2	3	4	5	6	7	8	9
I	N	S	T	D	O	N	E	h	h

Where hh is the hexadecimal value of the ID of the control radio to switch out of install mode.

If ** is used it means all control radio IDs. These messages are respectively transmitted as the following bytes (for the second case an ID of 18=0x12 is used) :

0x49 0x4E 0x53 0x54 0x44 0x4F 0x4E 0x45 0x2A 0x2A
0x49 0x4E 0x53 0x54 0x44 0x4F 0x4E 0x45 0x31 0x32

The *end of install* message is transmitted on user request by the receiver. It is forwaded by relays. Control radio switch from installation mode where they were constantly listening for messages from the receiver to low consumption normal mode listening only to SRR.