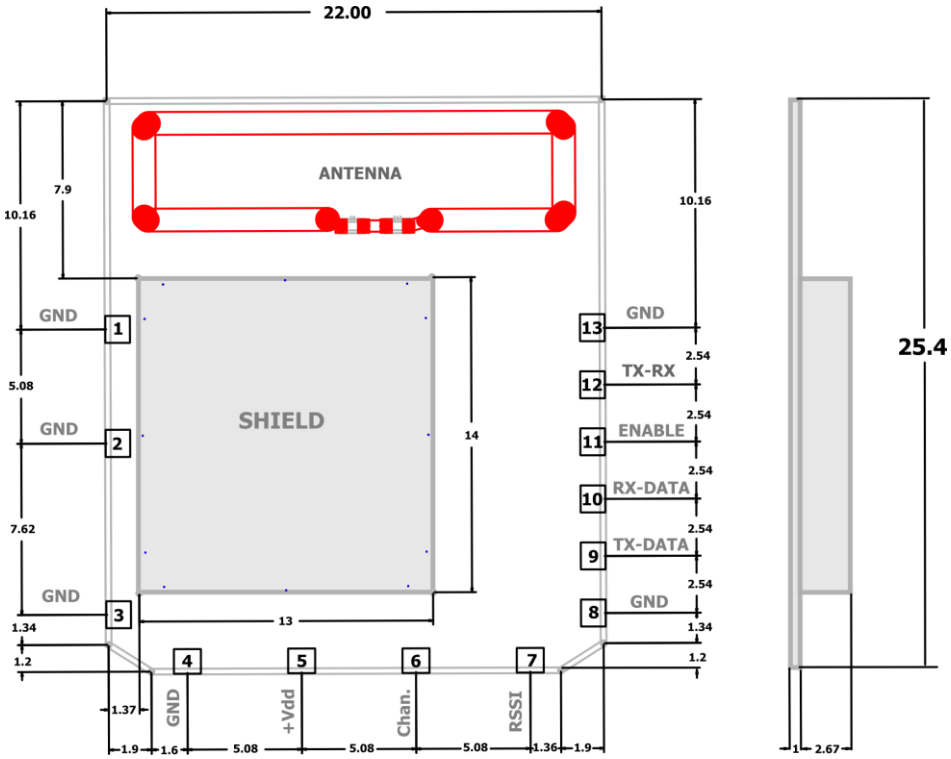
Digital radio transceiver half-duplex, operates in USA band 902-928MHz, FSK modulation and integrated antenna.
It operates in transparent mode in simple way, by 3 pins TX-data, RX-data and TX/RX, the user can transmit and receive custom packet until 4800bps (Manchester encoding).
The module has been designed for 3V supply with low consumption in receive mode (<6mA) and less than 1uA in power-down mode.
2 channels available, 915MHz and 916,5MHz, the RF output power is comply to FCC rules <2dBm ERP.
The module has FCC modular approval, it's easy to integrate in custom devices without perform FCC radio certification.
Module is available in SMD version, whose size is 25,4 X 22 X 3,7 mm. Tape & reel package for automatic assembling by pick and place.

PIN-OUT and dimensions



Pin-Out

1) GND
2) GND
3) GND
4) GND
5) +VCC
6) CHANNEL SELECTION
7) RSSI OUT
8) GND
9) TX DATA INPUT
10) RX DATA OUTPUT
11) ENABLE
12) TX/RX
13) GND

Absolute maximum values

Supply voltage	-0,3V +3,6V
Input voltage	-0,3V ÷ Vcc+0,6V
Output voltage	0V ÷ Vcc
Operating temperature	-20°C ÷ +70°C
Storage temperature	-40°C÷ +100°C

PIN description

Pin 1	**GND**	Ground connection or negative supply voltage pin.
Pin 2	**GND**	Ground connection or negative supply voltage pin.
Pin 3	**GND**	Ground connection or negative supply voltage pin.
Pin 4	**GND**	Ground connection or negative supply voltage pin.
Pin 5	**+Vcc**	Supply voltage +2,3V ÷ +3,6V
Pin 6	**CHANNEL SELECTION**	RF channel selection: 0 = frequency 915MHz 1 = frequency 916,5MHz
Pin 7	**RSSI**	Not implemented
Pin 8	**GND**	Ground connection or negative supply voltage pin.
Pin 9	**TX DATA INPUT**	Digital data input for transmission: 0: transmission 0 1: transmission 1 0-Vcc voltage range, 100k pull-down internal
Pin 10	**RX DATA OUTPUT**	Receiver digital data output, 0-Vcc voltage range
Pin 11	**ENABLE**	Driving low level in order to switch off the transceiver 0 = PWDN (device off, radio and uC in sleep-mode, consumption < 1uA) 1 = ON (device ON, ready to transmit or receive) Internal connected to 100K pull-down
Pin 12	**TX/RX**	Connected as following to switch from transmit to receive mode 0 = Reception (Receiver On, transmitter Off) 1 or NC = Transmission (Receiver Off, transmitter On) NOTE: See the technical feature table for switching-time Pin internally connected to pull-up
Pin 13	**GND**	Ground connection or negative supply voltage pin.

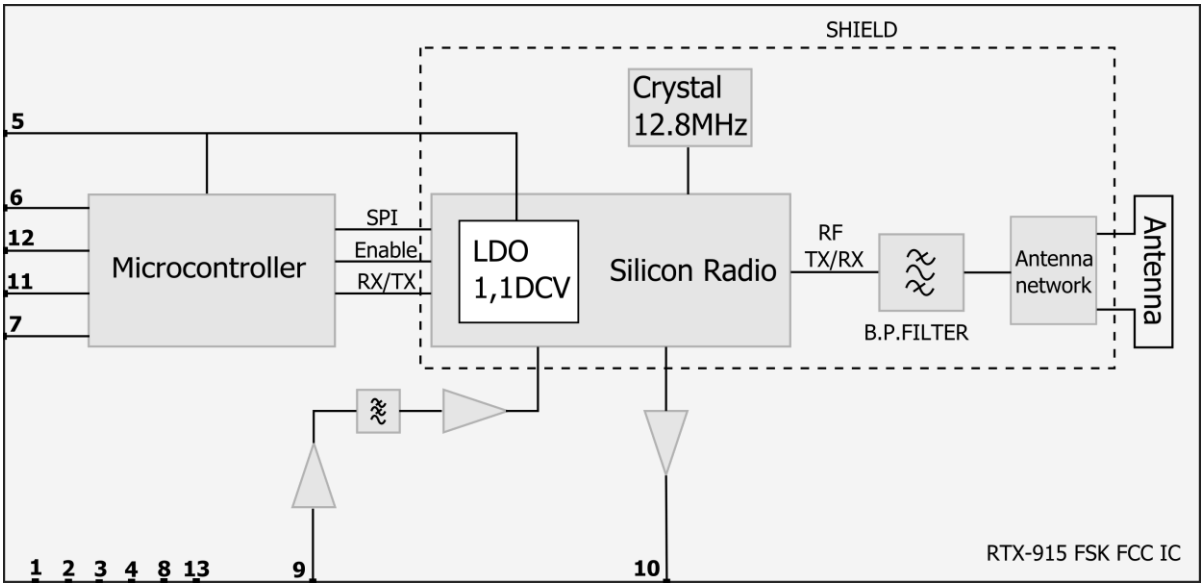
Note 1: NC = not connected

Technical features

	Min	Typical	*Max*	*Unit*	Notes
Supply voltage (pin.5)	2,3	3	3,6	**V**	
Current consumption in Power-Down mode **Pin 11 (ENABLE) = 0** **Pin 9 (Tx Data) = 0 or NC** **Pin 12 (TX/RX) = 1 or NC**			1	**uA**	
Current consumption in RX mode **Pin 11 (ENABLE) = 1** **Pin 12 (TX/RX) = 0**	4,7	5,3	6	**mA**	
Current consumption in TX mode **Pin 11 (ENABLE) = 1** **Pin 12 (TX/RX) = 1**		23	27	**mA**	
Centre frequency 1 **Pin 6 (CN_SEL) = 0**	914,982	915	915,018	**MHz**	
Centre frequency 2 **Pin 6 (CN_SEL) = 1**	916,48	916,5	916,518	**MHz**	
Receiver sensitivity square wave 1KHz		-105		**dBm**	
Receiver sensitivity square wave 4,8KHz		-101		**dBm**	
Power RF ERP		-4	-2	**dBm**	
Modulation FSK ΔF		±22		**KHz**	
Blocking test measured to ± 2MHz		72		**dB**	
Blocking test measured to ± 10MHz		90		**dB**	
BF digital output bandwidth (pin 10)	0,05	1	5	**KHz**	
BF digital input bandwidth (pin 9)	0,01		13	**kHz**	
Low level digital outputs			gnd+0,4	**V**	note 1
High level digital outputs	V_{cc}-0,25			**V**	note 1
High level digital inputs	Vs-0,6		Vs+0,6	**V**	
Low level digital inputs			0,4	**V**	
RSSI out impedance (pin7)		1		**Kohm**	
RF spurious emissions			-60	**dBm**	
RF harmonic spurious emission			-45	**dBm**	
Switch time PWRDN → TX-ON **Use condition:** **Pin 12 (TX/RX) = 1** **Pin 6 (ENABLE) = 0 → 1**	2,5		4	**ms**	Note 2
Switch time PWRDN → RX-ON **Use condition:** **Pin 12 (TX/RX) = 0** **Pin 6 (ENABLE) = 0 → 1**			4	**ms**	Note 2
Switch time TX → RX		1		**ms**	Note 2
Switch time RX → TX		1		**ms**	Note 2
Operating temperature	-20		+70	**°C**	
Dimensions	25,4 x 22 x 3,67 mm				

Note 1: Measured with 100K load.
Note 2: Time to reach the declared specifications.

Block diagram



Operating modes

AUR.EL RTX-915 FSK FCC IC, can work in 3 different modes:

1. **Power Down Mode**
2. **RF Transmission Mode**
3. **RF Reception Mode**

1. Power Down Mode

By driving low level pin 11 (ENABLE) the device enters the saving-energy mode, where consumption is less than 1uA: this mode the transceiver can't neither receive nor transmit.
In order to guarantee low consumption, observe the following table:

PIN description and number	Logic level
ENABLE (pin11)	0 or open
CHANNEL SELECTION (pin6)	0 or 1
TX/RX (pin12)	1
TX DATA INPUT (pin9)	0 or open

2. RF Transmission Mode

Transmission mode is selected by driving to high level pin 11 (ENABLE) and 12 (TX/RX).
Driving low or high pin 9 (TX DATA INPUT) the RF carrier modulated in FSK is emitted through antenna in the frequency selected by pin 6 CHANNEL SELECTION.

3. RF Reception Mode

Reception mode is selected by driving low pin 12 (TX/RX) and high pin 11 (ENABLE).
The data received are available at pin 10.
The change of the RF channel is permits in receive mode.

Device Usage

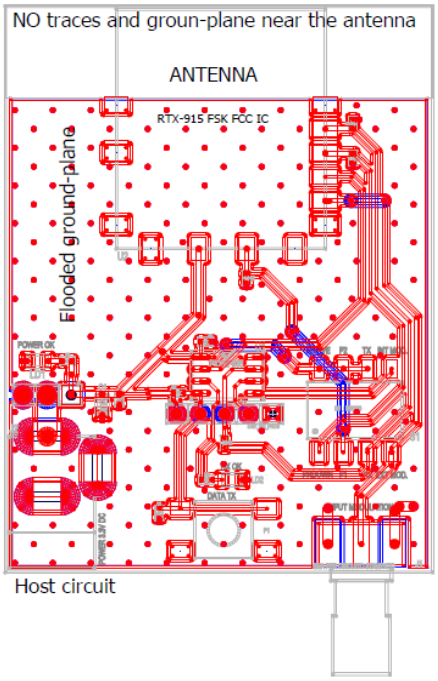
To take advantage of the performances detailed in the Technical Specifications, and in order to comply with the operating conditions which characterize the Certification, the transmitter must be fitted on a printed circuit considering the followings:

DC Supply:

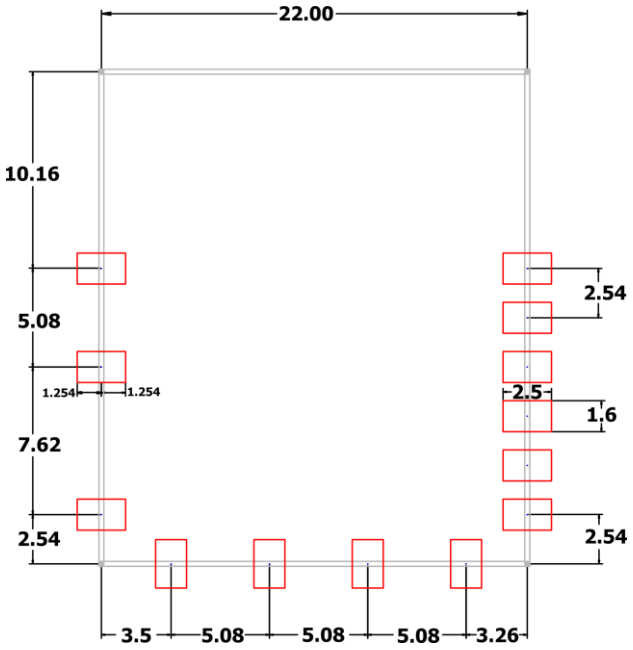
1. The transceiver must be supplied by a very low voltage source, safety protected against short circuits. Maximum voltage variations allowed: 2,3÷3,6V.
2. De-coupling, next to the transmitter, by means of a minimum 100nF ceramic capacitor.
3. Are preferable low noise linear voltage regulator circuits. Eventual voltage regulators DC-DC or AC-DC can decrease the sensitivity level of the receiver.

Ground:

A flooded ground plane must surround the module. The circuit must be double layer, with throughout vias to the ground planes.
Care must be taken to ensure there are no traces or ground planes under the area surrounding the antenna.
It is advise to place the antenna side module toward the edge of the host PCB or solder the module with antenna of the edge host pcb.
The picture show the PCB design to be follow for the host circuit:



Soldering and assembling SMD Layout



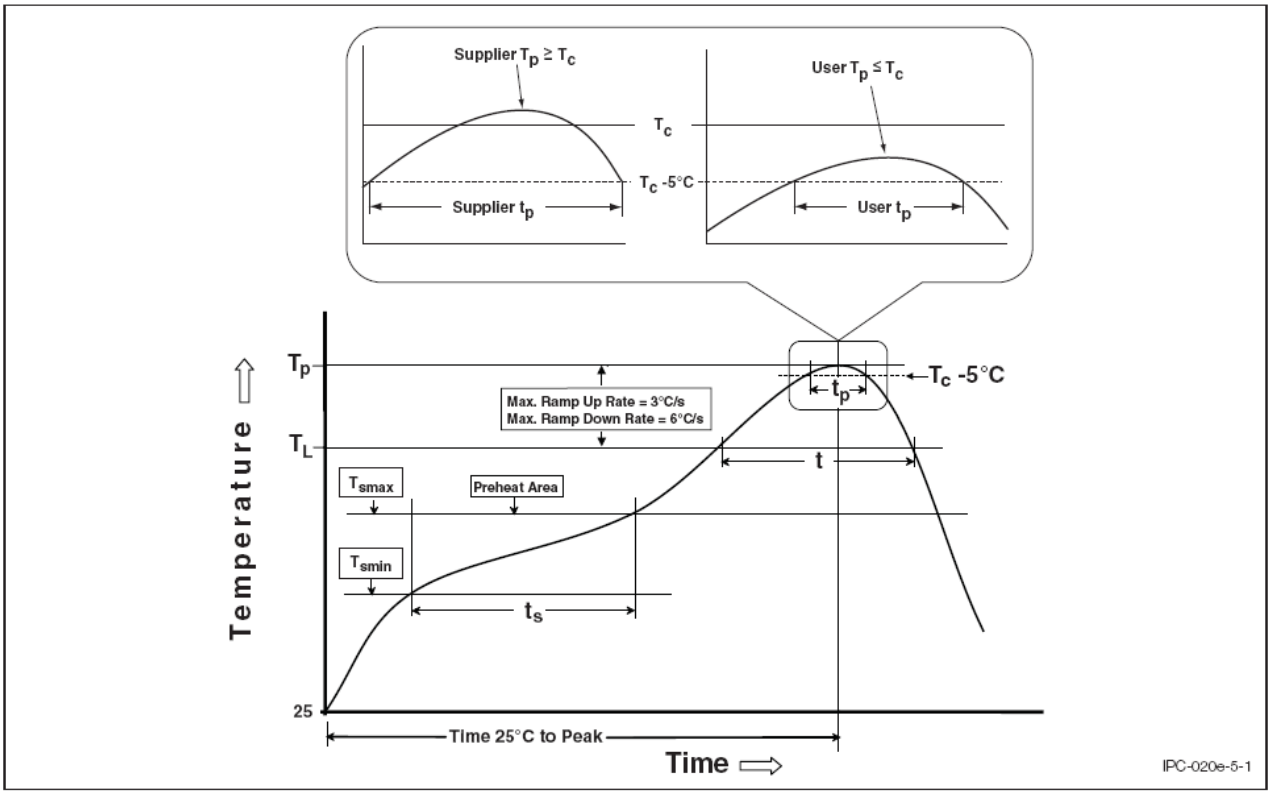
Picture 9: suggested layout for Host board

In order to ensure the correct assembly of the module, it has to apply a production process observing carefully the following recommendations:

- Soldering paste: Use soldering paste as SAC305 (96,5% Sn, 3% Ag, 0,5% Cu), screen printed according the layout of Picture 8, with a thickness> 150um.
- Assembly: the module can be assembled with automatic machine by using a suction cup tool, applied on bigger integrated circuit
- Soldering: the module can be soldered on host board, through a reflow profile for Lead-free components.
  Jedec standard "J-STD-020E"
  Standard Jedec "J-STD-020E" defines temperatures and exposure times, is attached below graph and profile table time / temperature recommended for the purpose.
  For host PCB that required more reflow cycles it is recommended to solder the module at the end of the host circuit soldering cycle, taking care to limit excessive vibrations during the terminal phase of reflow soldering paste.

Profile Feature	Pb-Free Assembly
Preheat/Soak Temperature Min (T_{smin}) Temperature Max (T_{smax}) Time (t_s) from (T_{smin} to T_{smax})	 150 °C 200 °C 60-140 seconds
Ramp-up rate (T_L to T_p)	2 °C/second max.
Liquidous temperature (T_L) Time (t_L) maintained above T_L	217 °C 60-150 seconds
Peak package body temperature (T_p)	240°
Time (t_p)* within 5 °C of the specified classification temperature (T_c), see Figure 9.	30* seconds
Ramp-down rate (T_p to T_L)	6 °C/second max.
Time 25 °C to peak temperature	5 minutes max.
* Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.	

Table 3: Detailed time / temperatures profile for soldering RTX-915 FSK FCC IC



Picture 10: Soldering profile for RTX-915 FSK FCC IC

FCC and IC certification

This module has been tested and found to comply with the FCC (Federal Communications Commission) part 15 rules and IC (Industry Canada) RSS-210.
These limits are designed to provide reasonable protection against harmful interference in approved installations. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference may not occur in a particular installation.
This device complies with part 15 of the FCC rules. 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.
Modifications or changes to this equipment not expressly approved by Aurel S.p.a may render void the user's authority to operate this equipment.

Certification FCC et IC (française)

Ce module a été testé et trouvé conforme aux FCC (Federal Communications Commission) partie 15 règles et IC (Industrie Canada) RSS-210.
Ces limites sont prévues pour fournir une protection raisonnable contre les interférences nocives dans installations approuvées.

Cet appareil génère, utilise et peut émettre de l'énergie radiofréquence et, si non installé et utilisé conformément aux instructions, il peut causer des interférences nocives aux communications radio.
Cependant, il n'y a aucune garantie que des interférences ne peuvent pas se produire dans une installation particulière. Cet appareil est conforme à la partie 15 des règles de la FCC. Le fonctionnement est soumis aux deux conditions suivants:

(1) Cet appareil ne peut pas causer d'interférences nuisibles et
(2) cet appareil doit accepter toute interférence reçue, y compris les interférences qui peuvent provoquer un indésirable opération.

Des modifications ou des changements à cet appareil non expressément approuvés par Aurel S.p.A peuvent frapper de nullité l'autorisation de l'utilisateur à utiliser cet appareil.

Modular approval

FCC ID: **RB4-RTX915FSK3V**
IC: **6699A-RTX915FSK3V**
In accordance with FCC (Federal Communications Commission) part 15, the "AUR.EL RTX-915 FSK FCC IC" is listed as a modular transmitter device.
This module is evaluated for stand-alone use only. Finished products incorporating multiple transmitters must comply with collocation and RF exposure requirements in accordance with FCC multi-transmitter product procedures.
Collocated transmitters operating in portable RF exposure conditions (e.g. <20 cm from persons including but not limited to body-worn and hand-held devices) may require separate approval.

Modular approval (française)

FCC ID: **RB4-RTX915FSK3V**
IC: **6699A-RTX915FSK3V**
Conformément à la FCC (Federal Communications Commission) partie 15, "AUR.EL RTX-915 FSK FCC IC" est listée sous un dispositif émetteur modulaire.
Ce module est évalué seulement pour une utilisation autonome. Les produits finis incorporant plusieurs émetteurs doivent se conformer au collocation et a l'exposition RF, conformément aux procédures de produits multi-émetteur FCC.
Transmetteurs colocalisés fonctionnant dans des conditions d'exposition aux RF portables (par exemple <20 cm de personnes, y compris mais sans s'y limiter à des dispositifs portés sur le corps et tenues en main) peuvent nécessiter une approbation distincte.

Labeling instructions

When integrating the "AUR.EL RTX-915 FSK FCC IC" into the final product, the OEM must ensure that the FCC (Federal Communications Commission) and IC module.
The label should state the following (or similar wording that conveys the same meaning):
Contains
FCC ID: **RB4-RTX915FSK3V**
IC: **6699A-RTX915FSK3V**
or
This product contains
FCC ID: **RB4-RTX915FSK3V**
IC: **6699A-RTX915FSK3V**

The OEM must include the following statements on the exterior of the final product unless the product is too small (e.g. less than 4 x 4 inches):
This device complies with Part 15 of the FCC (Federal Communications Commission) and RSS-210 of IC (Industry Canada) rules.
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 any interference that may cause undesired operation.

Instructions d'étiquetage (française)

Avec l'intégration de la "AUREL RTX-915 FSK FCC IC" dans le produit final, l'OEM doit garantir FCC (Federal Communications Commission) et le module IC.
L'étiquette doit indiquer ce qui suit (ou similaires mots qui ont le même sens):
Contient:
FCC ID: **RB4-RTX915FSK3V**
IC: **6699A-RTX915FSK3V**
ou
Ce produit contient:
FCC ID: **RB4-RTX915FSK3V**
IC: **6699A-RTX915FSK3V**
L'OEM doit inclure les énoncés suivants sur l'extérieur du produit final à moins que le produit est trop petit (par exemple moins de 4 x 4 "pouces"):
Cet appareil est conforme à la partie 15 de la FCC (Federal Communications Commission) et les règles RSS-210 d'IC (Industrie Canada).
Le fonctionnement est soumis aux deux conditions suivantes:
(1) ce dispositif ne peut pas causer d'interférences nuisibles et
(2) cet appareil doit accepter toute interférence reçue, y compris toutes interferences qui peuvent causer un mauvais fonctionnement.

Product manual instructions (for OEM application)

This section applies to OEM final products containing the "AUR.EL RTX-915 FSK FCC IC" module, subject to FCC (Federal Communications Commission) and IC (Industry Canada) compliance.
The final product manual must contain the following statement (or a similar statement that conveys the same meaning):
WARNING: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
In cases where an OEM seeks Class B of FCC (residential) limits for the final product, the following statement must be included in the final product manual:
NOTE: 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 instructions, may cause harmful interference to radio communications. 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.
In cases where an OEM seeks the lesser category of a Class A digital device for the final product, the following statement must be included in the final product manual:
NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC (Federal Communications Commission) rules.
These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his expense

Instructions du manuel du produit (pour une application OEM) (française)

Cette section concerne les OEM produits finaux contenant le module "AUR.EL RTX-915 FSK FCC IC", conforme à FCC (Federal Communications Commission) et IC (Industrie Canada).
Le manuel du produit final doit contenir la déclaration suivante (ou une déclaration similaire qui a le même sens):
AVERTISSEMENT: Les changements ou modifications non expressément approuvés par la partie responsable pour la conformité pourraient annuler l'autorisation de l'utilisateur à utiliser l'appareil.
Dans les cas où un OEM cherche limites Classe B de FCC (résidentiel) pour le produit final, la déclaration suivante doit être incluse dans le manuel du produit final:
NOTE: Cet appareil a été testé et déclaré conforme aux limites d'un appareil digital 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 appareil génère, utilise et peut émettre une énergie de radiofréquence et, si non installé et utilisé conformément aux instructions, il peut causer des interférences nuisibles aux communications radio. Cependant, il n'y a aucune garantie que l'interférence ne se produira pas dans une installation particulière.
Si cet appareil provoque des interférences nuisibles à la réception radio ou de télévision, ce qui peut être déterminé en mettant l'appareil dans/hors tension, l'utilisateur est invité à essayer de corriger l'interférence par une ou plusieurs des mesures suivantes:
- Réorienter ou déplacer l'antenne de réception.
- Augmenter la distance entre l'appareil et le récepteur.
- Connecter l'équipement à une prise sur un circuit différent de celui auquel le récepteur est connecté.
- Consulter le revendeur ou un technicien radio / TV expérimenté.
Dans les cas où un OEM cherche la catégorie inférieur d'un appareil digital de classe A pour le produit final, la déclaration suivante doit être incluse dans le manuel du produit final:
NOTE: Cet appareil a été testé et déclaré conforme aux limites de la classe A des appareils digitals, conformément à la partie 15 des règles de la FCC (Federal Communications Commission).
Ces limites sont conçues pour fournir une protection raisonnable contre les interférences nuisibles lorsque l'appareil est utilisé dans un environnement commercial. Cet appareil génère, utilise et peut émettre de l'énergie radiofréquence et, si non installé et utilisé conformément au manuel d'instruction, peut causer des interférences nuisibles aux communications radio.
Le fonctionnement de cet appareil dans une zone résidentielle est susceptible de provoquer des interférences nuisibles, dans ce cas l'utilisateur sera tenu à corriger les interférences à ses frais.

Version:

Issue date	Revision	Firmware version	Description of change
03/05/2015	0	1.5	Preliminary
20/05/2015	1	1.6	Version for FCC approval
10/06/2015	1.1	1.6	Block diagram crystal freq. value
14/07/2016	1.2	1.6	Inserted IC recommendations in French