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PROJECT :

WIZE'UP

DOCUMENT :

Technical manual

REFERENCE :

AL/RL/2107/007

DATE :	VERSION :	AUTHOR :
07/12/23	**1F**	**R.Lacoste / ALCIOM**

SUMMARY :

This documents is the technical manual of the Wize'Up 169MHz Wize module developped by ALCIOM under a grant contrat by the WIZE ALLIANCE, and compatible with the open-source Wize protocol stack developped by GRDF.

DOCUMENT HISTORY

DATE	VERSION	AUTHOR	COMMENT
16/02/2021	1A	R.Lacoste / ALCIOM	Initial version
17/02/2021	1B	R.Lacoste / ALCIOM	Reviewed version
18/05/2021	1C	R.Lacoste / ALCIOM	Updated version (SKY66121)
29/09/2021	1D	V.Le Gouis / ALCIOM	Added consumption measurement.
06/12/2023	1F	P. Rousseau / ALCIOM	Added baseboard V2

TABLE OF CONTENTS

1 Introduction

1.1 Document content

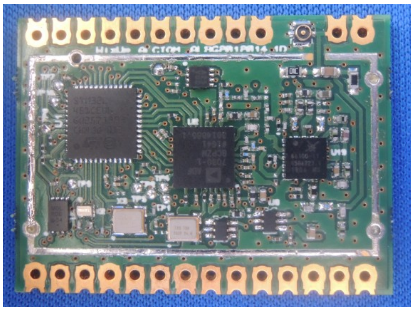
This document is the **technical manual** of the **Wize'Up 169MHz Wize module** developped by ALCIOM under a grant contrat by the WIZE ALLIANCE, and compatible with the open-source Wize protocol stack developped by GRDF. This document includes :

- Chapter 2 : Technical specifications and pinout of the module (datasheet) ;
- Chapter 3 : Recommandations for integration of Wize'Up in a custom Wize-compatible product ;
- Chapter 4 : Schematics and usage of the standard Wize'Up development kit ;
- Chapter 5 : Documentation on the internal design of the Wize'Up module for users who wish to modify it.

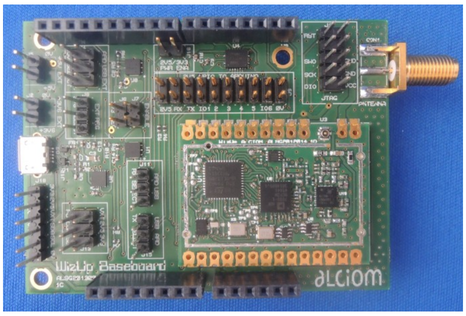
1.2 Wize'Up presentation

Wize is a long range low power wide aera networks (LPWAN) protocol, promoted and standardized by the Wize Alliance association (www.wize-alliance.com). This protocol, based on European standard EN13757-4/N2, uses a VHF low frequency band (169MHz in Europe) and provides deep indoor penetration, particularly useful for smart metering applications.

Wize'Up is a high-performance Wize-compatible module, developped by ALCIOM (www.alciom.com) under a grant contrat by the Wize Alliance. Wize'Up is provided by ALCIOM as **open source hardware** (see licence here under). The full design, including schematics, gerbers and test reports are provided free of charge by ALCIOM, and could be used for any Wize compatible product (*).



Wize'Up module



Wize'Up evaluation board

Wize'Up can either :

- Be directly purchased as a plug-in module from a Wize'Up module manufacturer, as ALCIOM, and integrated in any end products ;
- Be duplicated by any manufacturer, and integrated as a Wize'Up module in any end product (*) ;
- Be modified by any design house in order to make a customized Wize-compatible device based on the Wize'Up architecture (*). ALCIOM, as a design house, can of course help you in that job through design services.

(*) Assuming the conditions of the licence are respected, see here under (1.5).

Wize'Up is a hardware project and is software-agnostic, but it is designed to be compatible with the **open-source Wize protocol stack and framework** developped and provided independantly by GRDF.

1.3 Wize'Up software support

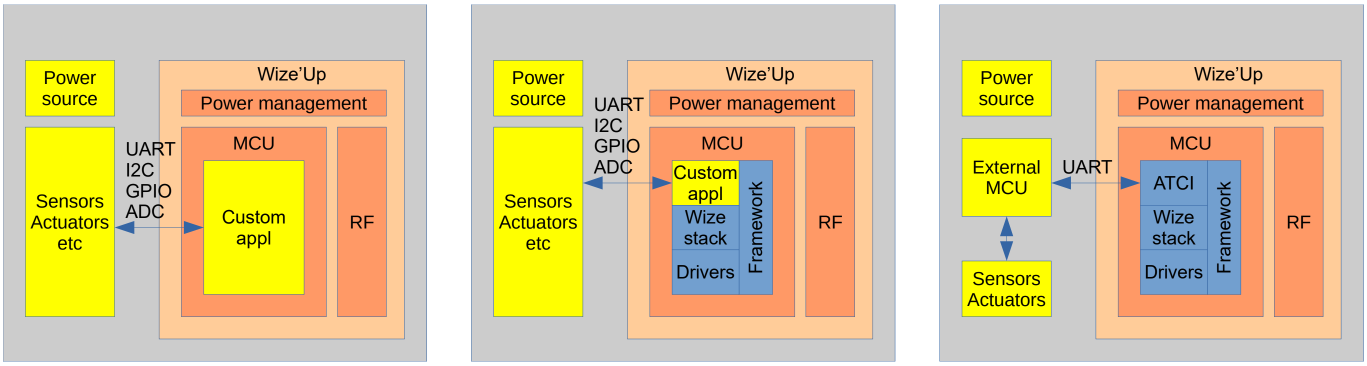
In terms of software, Wize'Up can be either :

- Programmed with any custom software developped from scratch by a third party, based on Wize'Up publicaly available schematic and documentation. This software then run directly on the Wize'Up on-board processor ;

- Programmed with a custom application developped by a third party but using the open-source Wize stack and framework provided by GRDF, both interfaced through the API specified in the accompanying documentation. In that case, both the application and the Wize stack are running on the Wize'Up on-board processor and could be interfaced to any external sensor or co-processor ;

- Programmed with a standard application provided as part of the open source Wize stack and framework distribution, and interfaced with any external host processor (microcontroler, PC, etc), which then run the application itself. This application includes the Wize stack and framework and an AT command interpreter (ATCI), co-developped by ALCIOM and GRDF, which allows to access to the features of the Wize stack from the external processor through a simple UART link.

These three modes are illustrated here below :



1.4 Reference documents

Specification of the AT command interpreter (ATCI), which could be used to drive a Wize'Up module and its accompanying Wize open-source stack by an externa host through a simple ASCII-coded UART interface, is provided in document [R1] :

[R1]	Title :	Wize'Up - AT command interpreter (ATCI) Specification
	Reference :	AL/RL/2031/008
	Version :	1E

Test report related to pre-compliance tests done on the Wize'Up module according to EN300220-4 regulation are documented in document[R2] :

[R2]	Title :	Wize'Up – EN300220-4 pre-compliance report
	Reference :	AL/RL/2107/008
	Version :	1A

1.5 Licence and warranty

2 Wize'Up module datasheet

2.1 Product description

Wize'Up : The open source Wize solution :

- Open-hardware design, provided by ALCIOM to the community under Permissive CERN-OHL v2 licence
- Developped as part of a grant contrat funded by the Wize Alliance
- Compatible with the open-source Wize protocol stack available independently from GrDF
- Full schematics, bill of materials, Gerbers and validation reports available free of charge from ALCIOM
- Assembled & tested modules and evaluation kits available from ALCIOM, as well as hardware customization, support and antenna design services

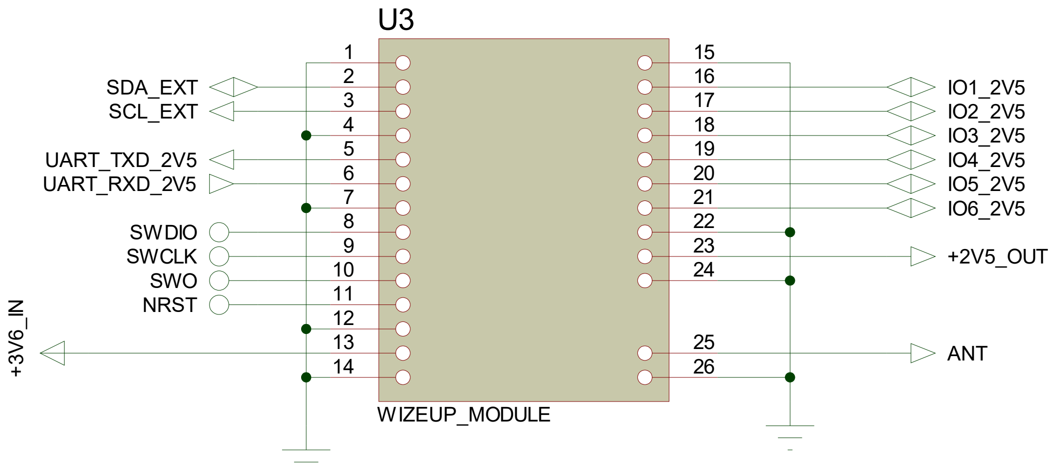
High performance design :

- >+25dBm output power, better than -120dBm sensitivity in WM2400, 10%PER
- 3,3V to 3,8V power supply, direcly compatible with LiSoCl2 primary batteries
- 2,5V logic level for best in class power consumption + sleep mode (<1µA)
- Flexible external interfaces : UART + I2C + 6 generic digital or analog I/Os
- Module size 38x28mm, SMT and PTH compatible, optional shield
- STM32L451CEU6 micro-processor (Cortex M4, 512KB flash, 160KB RAM, RTC)
- Additionnal 1Mb serial EEPROM for secure FOTA upgrades
- ADF7030-1 transceiver and SKY66121-11 front-end, on-module TCXO
- ESD protection and filtering of the antenne port
- EN300220-4 precompliance report provided by ALCIOM for information

Flexible integration :

- Wize'Up design (schematic and/or routing) can be easily cut & pasted in any custom Wize-compatible design
- Wize'Up module can be bough from ALCIOM or manufactured by anyone freely and directly used in the product
- Module can be soldered to the board (SMT) or plugged on 0.1inch headers for easy prototyping
- Application software can either run on the module or on an external application processor, using the open AT command interface developped by ALCIOM and integrated in GRDF open source Wize Stack

2.2 Pinout



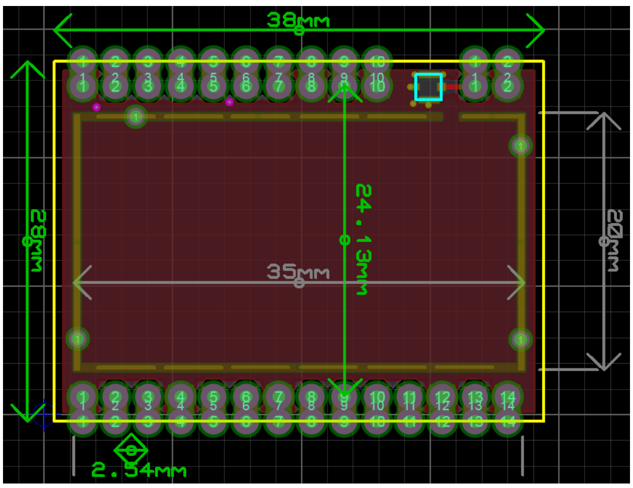
2.3 Pin specification

Pin name	Pin number	Type	Function
GND	1,4,7,12,14,15,22,24,26	Ground	Ground connections. All these pins must be connected to a common and full ground plane.
+3V6_IN	13	Power	Module power supply input. 1uF ceramic decoupling capacitor should be placed as close as possible to this pin.
SDA_EXT	2	Bidirectional	External I2C bus for ancillary devices. Could be left floating if not used. External 10K pull-up resistors must be added if used.
SCL_EXT	3	Bidirectional	
UART_TXD_2V5	5	Output	Main UART for AT command interpreter. 2V5 logic levels
UART_RXD_2V5	6	Input	
ANT	25	RF	169MHz antenna connection. A 50 ohm controlled impedance track must be connected to this pin and up to the antenna with respect of RF best practices
IO1_2V5	16	Bidirectional	Generic GPIO, could be used as logic input, logic output or analog input under firmware control. Application specific. 2V5 logic levels
IO2_2V5	17	Bidirectional	
IO3_2V5	18	Bidirectional	
IO4_2V5	19	Bidirectional	
IO5_2V5	20	Bidirectional	
IO6_2V5	21	Bidirectional	
+2V5_OUT	23	Output	2V5 regulator voltage output. Could be used to power external logic devices
SWDIO	8	Bidirectional	In-situ programming interface for the on-board STM32 microcontroleur.
SWCLK	9	Input	
SWO	10	Output	
NRST	11	Input	

2.4 Typical application circuit

See evaluation board schematics (chapter 4.5 here below).

2.5 Mechanical specification

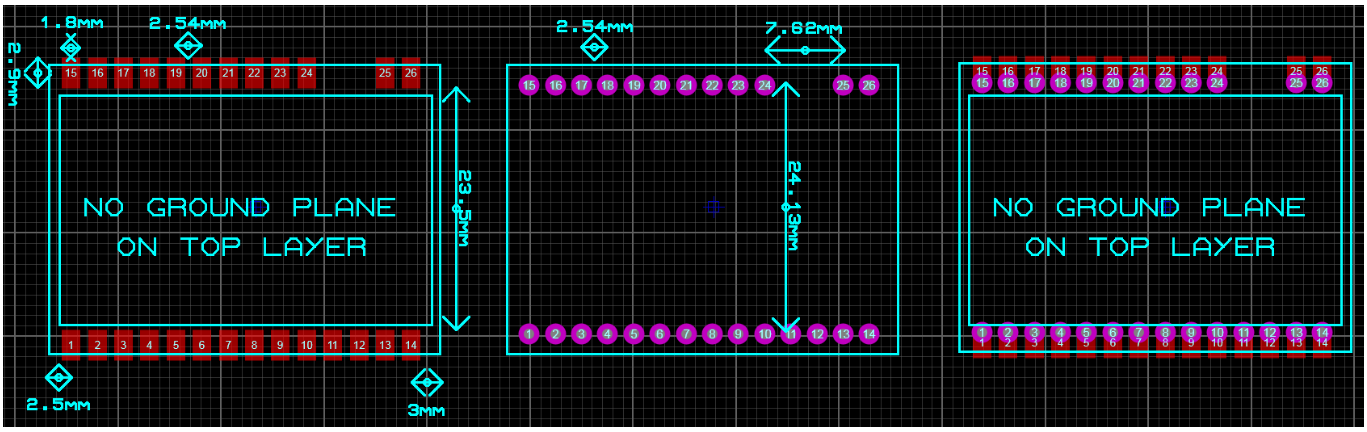


2.6 PCB footprint

The Wize'Up module can be fitted on the main PCB with either of the two following methods :

- Surface-mount soldered, using the half-pads on the edge of the PCB
- Through-hole mounted, using the second row and short 2.54mm male/male headers or male/female connectors
- A mixed configuration is also possible

SMT PTH Both supported



Warning : In case of surface mounted modules, no traces or ground plane should be present on the top layer of the carrier PCB under the Wize'Up module surface. A full ground plane is however recommanded on the first inner layer (cf 3.2).

2.7 Absolute maximum rating

Parameter	Min	Max	Comment
Input supply voltage on +3V6_IN	-0.3V	+3,8V	
Voltage applied on any other input pin	-0.3V	3.8V	
Current draw on any output pin		1mA	
Current draw on +2V5_DIG output		20mA	
VSWR on antenna port in 169MHz band		10:1	
RF input power in RX mode		+10dBm	
Ambiant temperature	-20°C	+85°C	
Transmission duty cycle		1 % over 1 hour period	As per REC/ERC/7003, user managed

2.8 Electrical specifications

Parameter	Min	Typ	Max	Comment
Operating frequency	169,4MHz		169,5MHz	
Input supply voltage on +3V6_IN	3.3V	3.6V	3.8V	
Low level input voltage	0		0.75V	
High level input voltage	1.75V		2.5V	
Low level output voltage			0.4V	
High level output voltage	2.0V			
Receive RF input power			-15dBm	
Transmit RF output power	-20dBm		+27dBm	
Transmit RF output power variation over temperature		Tbc		-20 to +85°C
Sleep current consumption		2.23uA (**)		3.6V input
Idle current consumption		Tbc		3.6V input, ATCI standard firmware waiting for a command
TX mode current consumtion		510mA(*)		3.6V input, +27dBm output
RX mode current consumption		38mA(*)		3.6V input, WM2400 mode
RX sensitivity		-120 dBm @10% PER		WM2400 mode

(*) With firmware realesed « App_WizeUp_06_07_2021 »
(**) With test software, all GPIO configured in their applicative mode, at low level (RF and EEPROM powered OFF) ; I2Cs and SPI not disabled ; UART disabled and RX pin reconfigured at EXTI in order to wakeup device when a charated is sent to wizeup module ; RTC is running (calendar only).

3 Cautions and advices for integration

3.1 Introduction

The Wize'Up module is provided as is by ALCIOM and could be integrated by any knowledgable third party. This chapter provides however some generic recommandations for best performances. ALCIOM is available, as a design house or as design service consulting, to help you if needed.

3.2 Module footprint and PCB integration

The best EMC and RF performances will be achieved with a direct SMT mounting of the Wize'Up module on the carrier PCB or, for large productions, with a direct implantation of the Wize'Up design on the main PCB. Through hole mounting must be reserved for initial evaluations or when top RF performance is not required as the usage of 2.54mm pin header is not compatible with a good 50-ohm impedance matching.

When using SMT mounting, it is mandatory to avoid placing any traces or ground plane on the top layer of the carrier PCB under the full Wize'Up module surface. A full ground plane is however recommanded on the first inner layer (cf 3.2)

Nota 1 : For specific applications, an MHF4 connector could be soldered on the Wize'Up module to replace the pin antenna connection.

Nota 2 : The Wize'Up module shouldn't be installed close to any noise generating circuit for best RF and EMC performances. If needed, a shielded version of the Wize'Up module could be provided as shield pads are present on the module.

3.3 Wize Antenna

Wize is based on VHF frequency band, for which the natural size of the antenna is very large (2m). Therefore, electrically short antennas are usually used for Wize devices. This implies that the selection and implantation of the antenna is very critical for good performance : As the antenna will be small compared to the wavelength, the full product will be radiating, not only the antenna. « Buying » a small 169MHz antenna and plugin it in an SMA connector will never provide reasonnable performances if not associated with a proper impedance matching network and stable environment.

We strongly recommand to study the proper antenna selection and implantation based on the specific needs and constraints of the project. This is true for all wireless projects, but far more crutial when using low frequency bands like Wize. If needed, please contact an antenna specialist for help, as Alciom...

Nota : A standard 169MHz antenna is nevertheless provided by Alciom as part of the Wize'Up evaluation kit, but its use should be restricted to experimentations and not high performance RF measurements.

3.4 Power supply

The Wize'Up module is designed to be directly powered by a LiSoCl2 primary battery for extra-low lifetime, up to 20 years with a couple of messages per day, or by a rechargeable LiIon/LiPo battery (3.6V nominal). Care should be taken to support the high current pulses drawn on the battery when transmitting, as such pulses may degrade the battery life far quiquer than planned. The best solution is either to use a quite large battery size, which support higher current pulses (LS17500 for example), or specific batteries designed for high current pulses. Please contact the battery suppliers for advices. A standard buffer capacitor is usually not a good solution due to high current leakage.

3.5 UART and connections

Care should be taken as all UART and GPIOs of the Wize'Up modules are using 2.5V logic levels. Voltage translation circuits must be included on the carrier board if other voltages are used. The 2.5V power supply, generated by the Wize'Up module from the 3.6V input using an ultra low power LDO regulator, is available on one of the module pins and could be used to power small external circuitry. Care should be taken ont to connect any noise generating circuit on this power supply output in order to avoid any loss in performance. An exemple of low power 2.5V/3.3V convertion circuit is provided on the WUEB evaluation board schematic, see here under.

3.6 Programming interface

The Wize'Up module includes a low power STM32 microprocessor. For module-based applications, the Wize'Up module is preprogrammed with a firmware including ATCI command interpreter and Wize stack. In order to update the Wize'Up module or to load any custom firmware, the STM32 in-circuit programming pins are available on the Wize'Up external connections. Alciom recommends the installation on the carrier board of a 6-pin connector with a 2.54mm pitch identical to the one present on the NUCLEO evaluation board.

Debug connector SWD

Connector	Pin number	Pin name	Signal name	STM32 pin	Function
SWD	1	1	VDD_TARGET: AIN_1	PA0	V_{DD} from application
	2	2	T_JTCK	PA5	SWD clock
	3	3	GND	PA12	Ground
	4	4	T_JTMS	PA14	SWD data input/output
	5	5	T_NRST	PB0	RESET of target STM32
	6	6	T_SWO	PA10	SWD out (optional)

This JTAG interface is compatible with standard JTAG tools. Alciom recommends the use of Seggert's J-LINK which has become the market reference.

3.7 Regulatory requirements

Even if the Wize'Up module is pre-tested against the key requirements of the EN300220-4 standard (harmonized standard for 169MHz devices as per the RED directive) as documented in [R2], it is the device manufacturer responsibility to test and insure compliance with all applicable standards : RED, EMC, safety, etc. In particular, the pre-compliance of the Wize'Up module doesn't imply that the full product will be compliant as antenna performance, EMC polution, power supply noise etc may lead to degraded performances. Please check with your test lab or ask for advices.

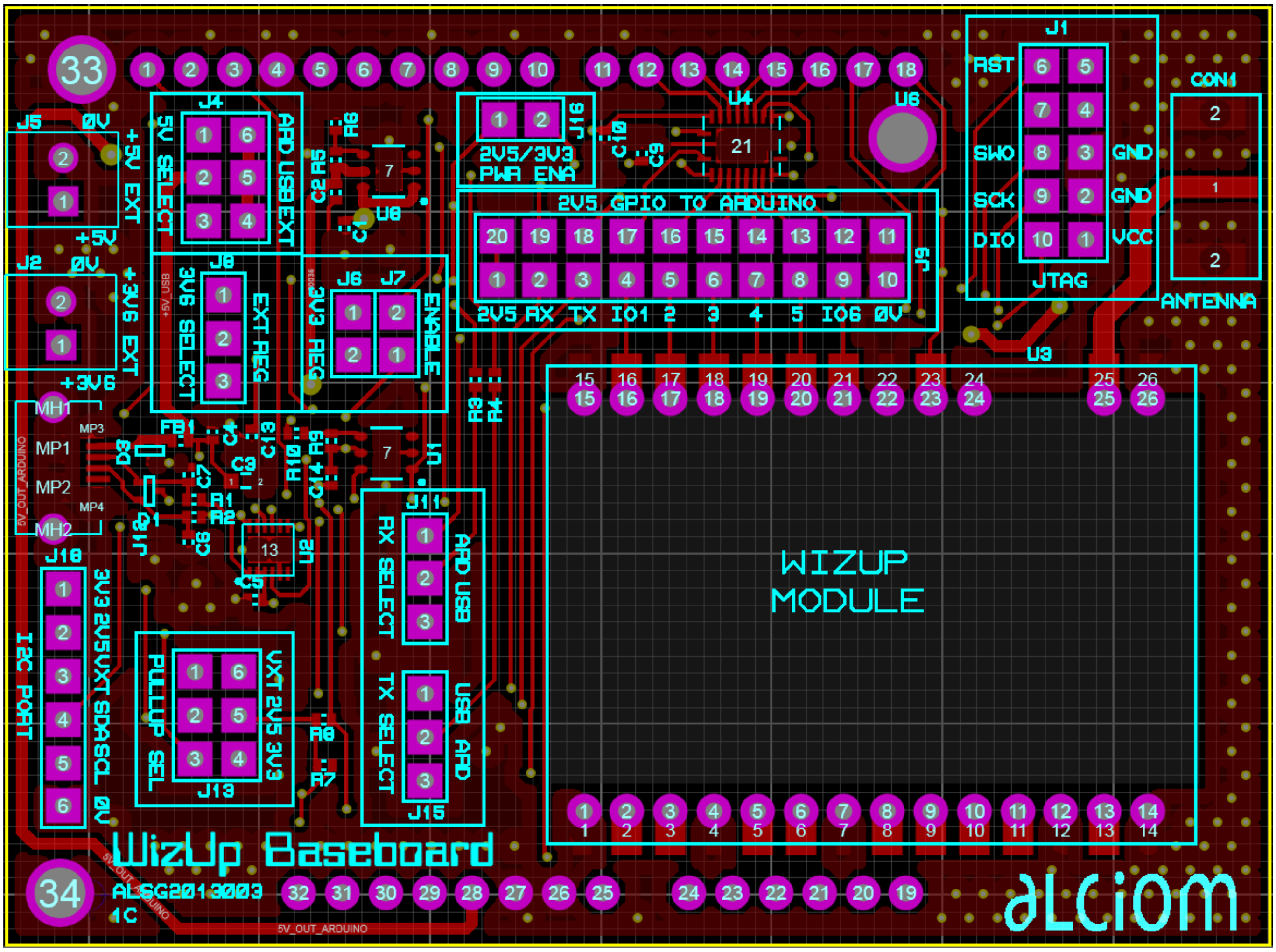
4 WUEB Wize'Up Evaluation Board Version 1C

4.1 Product description

The WUEB is a generic Wize'Up carrier board for evaluation and demonstration purposes. It allows :

- To simply connect the Wize'Up module to a controlling host through a USB interface. The module can also be powered by USB if needed ;
- To connected the Wize'Up module to any Arduino-compatible host microcontroller ;
- To connect external devices (sensors, etc) through GPIOs or I2C.

4.2 Physical layout



4.3 External connectors

Identifier	Function	Comment
J5	+5V external power supply	Optional 5V power supply input. If used, must be selected with J4 and J8 jumpers
J2	+3V6 external power supply	Optional 3.6V power supply input. If used, must be selected with J4 and J8 jumpers
J10	Micro-USB slave interface	Optional USB connector to a host computer. This port can also power the Wize'Up module, through proper configuration with J4 and J8 jumpers
J18	I2C interface	Allows to connect any I2C device to the Wize'Up module. 2.5V and 3.3V power supplies are available (for 3.3V, please check jumpers J6/J7). The jumper J13 must be set accordingly.
J9	GPIO header and jumper	Allows access to all Wize'Up module at 2.5V logic levels (IO1 to 6 and UART TX/RX). Used also as a jumper bloc for Arduino processors and USB interface (see here under)
J1	Debug interface	Standard ins-itu programming connector, to reflash and debug the Wize'Up microcontroller with updated firmware or custom application.
CON1	Antenna connector	SMA connector for external 169MHz antenna. Never leave this port open or the Wize'Up transceiver may be destroyed, if needed connect a 50-ohm dummy load in place of the antenna.
U6	Arduino compatible header	Allow to plug directly an Arduino processor module, with 3.3V I/O logic levels. J16 and J9 jumpers must be inserted.

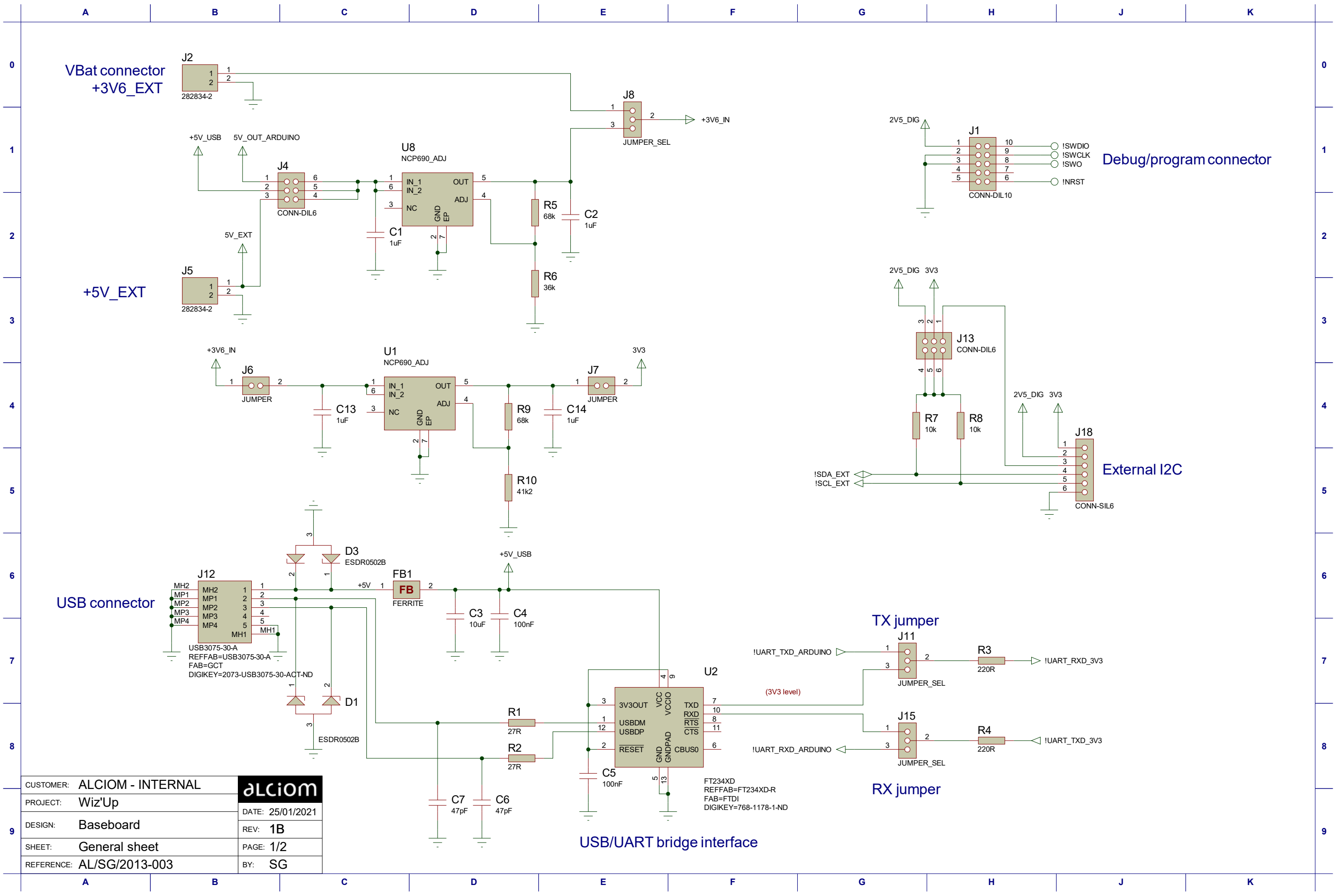
4.4 Configuration jumpers

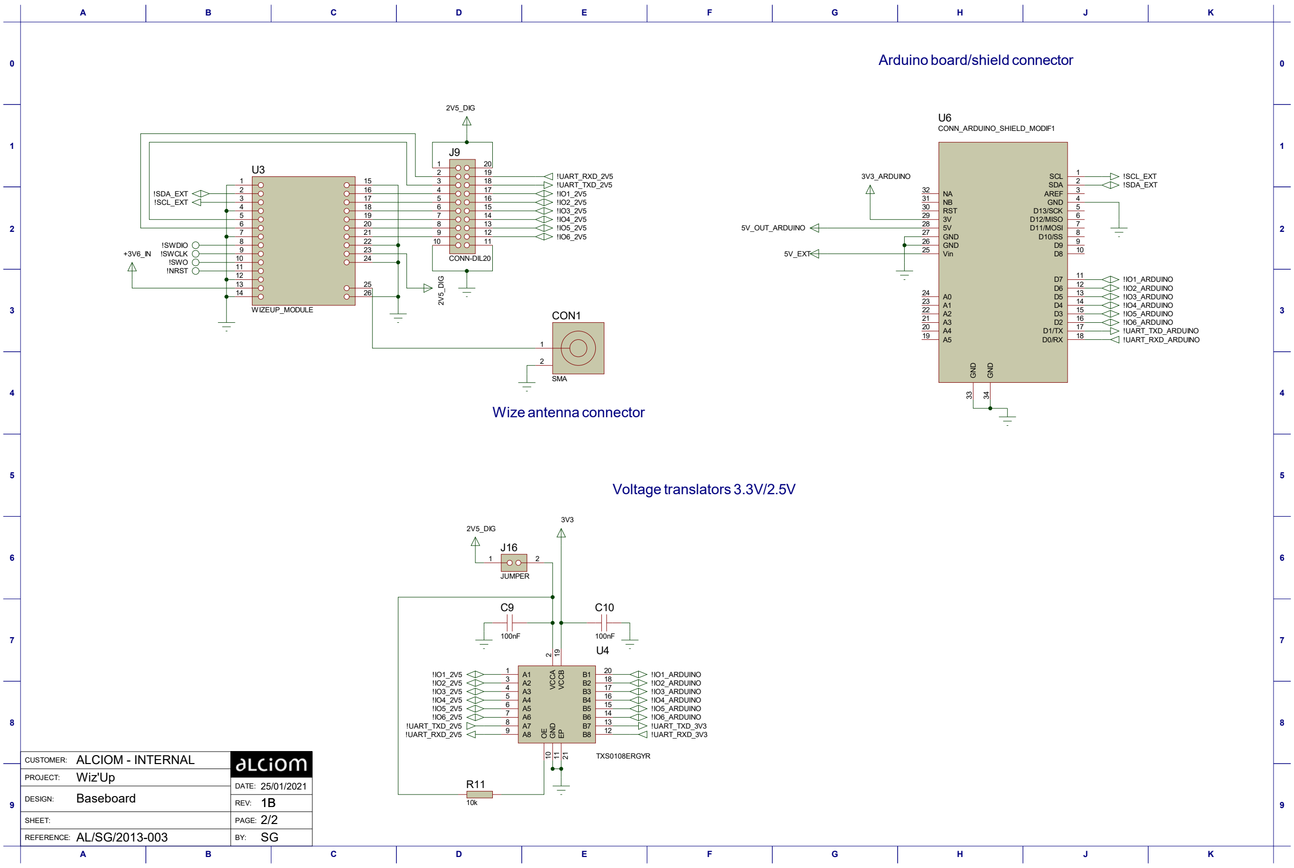
Identifier	Function	Comment
J4	5V selector	Must be properly configured if the Wize'Up module is powered by any of the three possible 5V power sources : - jump 3-4 if 5V is coming from 5V connector J5 - jump 2-5 if 5V is coming from the USB connector J10 - jump 1-6 if 5V is coming from the Arduino module
J6	3.6V selector	Must be properly configured to select the power supply source of the Wize'Up module : - jump 2-3 if the power source is any 5V source (selected by J4) - jump 1-2 if the power source is an external 3.6V through H2
J6/J7	3V3 regulator enable	Enable the internal 3V3 regulator, needed only when using USB or an Arduino module. Insert the two jumpers if 3V3 is needed, remove them if not to reduce power consumption.
J16	2V5/3V3 enable	Enable the 2V5/3V3 logic level translator, needed only when using USB or an Arduino module. Insert the jumper if 3V3 I/Os are needed, remove if not to reduce power consumption.
J13	Pull-up selector	Allow to select a proper voltage for the I2C pull up resistors, according to the peripherical voltage : - jump 3-4 for 2.5V - jump 2-5 for 3.3V (J6/J7 must be inserted) - jump 1-6 for any voltage coming from the slave
J11.J15	UART selector	Allow to route the Wize'Up UART port either to the USB interface or Arduino module : - jump 1-2 on J11 and 2-3 on J15 for Arduino - jump 2-3 on J11 and 1-2 on J15 for USB
J9	GPIO to Arduino link	Allow to route IO1 to IO6 and/or UART RX/TX from the Wize'Up module to a 2.5V/3.3V level translator, which is needed for Arduino or USB hosts. Leave open when neither USB or Arduino processor is used, jump if used. J9 is also used as header to connect external devices at 2.5V levels (see here above)

Nota : When shipped by ALCIOM as part of the development kit, the jumpers are configured to power and drive the Wize'Up module from the USB connector.

4.5 Schematic

The full schematic of the WUEP baseboard are the following. The could be used as a reference to design specific Wize'Up carrier boards.




Arduino board/shield connector
Wize antenna connector
Voltage translators 3.3V/2.5V
U3
WIZEUP_MODULE
J9
CONN-DIL20
U6
CONN_ARDUINO_SHIELD_MODIF1
CON1
SMA
J16
JUMPER
C9
100nF
C10
100nF
U4
TXS0108ERGYR
R11
10k
CUSTOMER: ALCIOM - INTERNAL
PROJECT: Wiz'Up
DESIGN: Baseboard
SHEET:
REFERENCE: AL/SG/2013-003
DATE: 25/01/2021
REV: 1B
PAGE: 2/2
BY: SG

4.6 Bill of materials

Category	Quantity	References	Value	fab	Ref Fab	PCB Package
Capacitors	4	C1-C2,C13-C14	1uF	AVX	CGB2A1X5R1A105K033BC	0402
Capacitors	1	C3	10uF	MURATA	GRM188R61A106KE69J	0603
Capacitors	4	C4-C5,C9-C10	100nF	YAGEO	CC0402KRX7R6BB104	0402
Capacitors	2	C6-C7	47pF	YAGEO	CC0402JRNPO9BN470	0402
Resistors	2	R1-R2	27R		ERJ-2RKF27R0X	0402_RES
Resistors	2	R3-R4	220R		CRGP0402F220R	0402_RES
Resistors	2	R5,R9	68k		RC0402FR-0768KL	0402_RES
Resistors	1	R6	36k		RC0402FR-0736KL	0402_RES
Resistors	2	R7-R8	10k		2302739	0402_RES
Resistors	1	R10	41k2		RMCF0402FT41K2	0402_RES
Resistors	1	R11	10k			NULL
Integrated Circuits	2	U1,U8	NCP690_ADJ	ONsemiconductor	NCP690MNADJT2G	SON95P300X310X80-7WEEA
Integrated Circuits	1	U2	FT234XD	FTDI	FT234XD-R	DFN-12 3X3MM 0P45
Integrated Circuits	1	U3	WIZEUP_MODULE			WIZUP_MODULE
Integrated Circuits	1	U4	TXS0108ERGYR	TEXASINSTRUMENT	TXS0108ERGYR	SN74LVC541ARGYR
Integrated Circuits	1	U6	CONN_ARDUINO		3049537,2751384,2356160	CONN_ARDUINO_UNO_MODIF1
Diodes	2	D1,D3	ESDR0502B	ON SEMICONDUCTOR	ESDR0502BT1G	SOT-416
Miscellaneous	1	CON1	SMA			SMA_CI
Miscellaneous	1	FB1	FERRITE	MURATA	BLM15PX331SN1D	0402
Miscellaneous	1	J1	CONN-DIL10		2751378	CONN-DIL10
Miscellaneous	2	J2,J5	282834-2	TEconnectivity	282834-2	282834-2_1
Miscellaneous	2	J4,J13	CONN-DIL6		2751377	CONN-DIL6
Miscellaneous	3	J6-J7,J16	JUMPER		2751379	CONN-SIL2
Miscellaneous	3	J8,J11,J15	JUMPER_SEL		2751450	CONN-SIL3
Miscellaneous	1	J9	CONN-DIL20		2856740	CONN-DIL20
Miscellaneous	1	J12	USB3075-30-A	GCT	USB3075-30-A	USB307530A
Miscellaneous	1	J18	CONN-SIL6		2751384	CONN-SIL6

5 WUEB Wize'Up Evaluation Board Version 2C

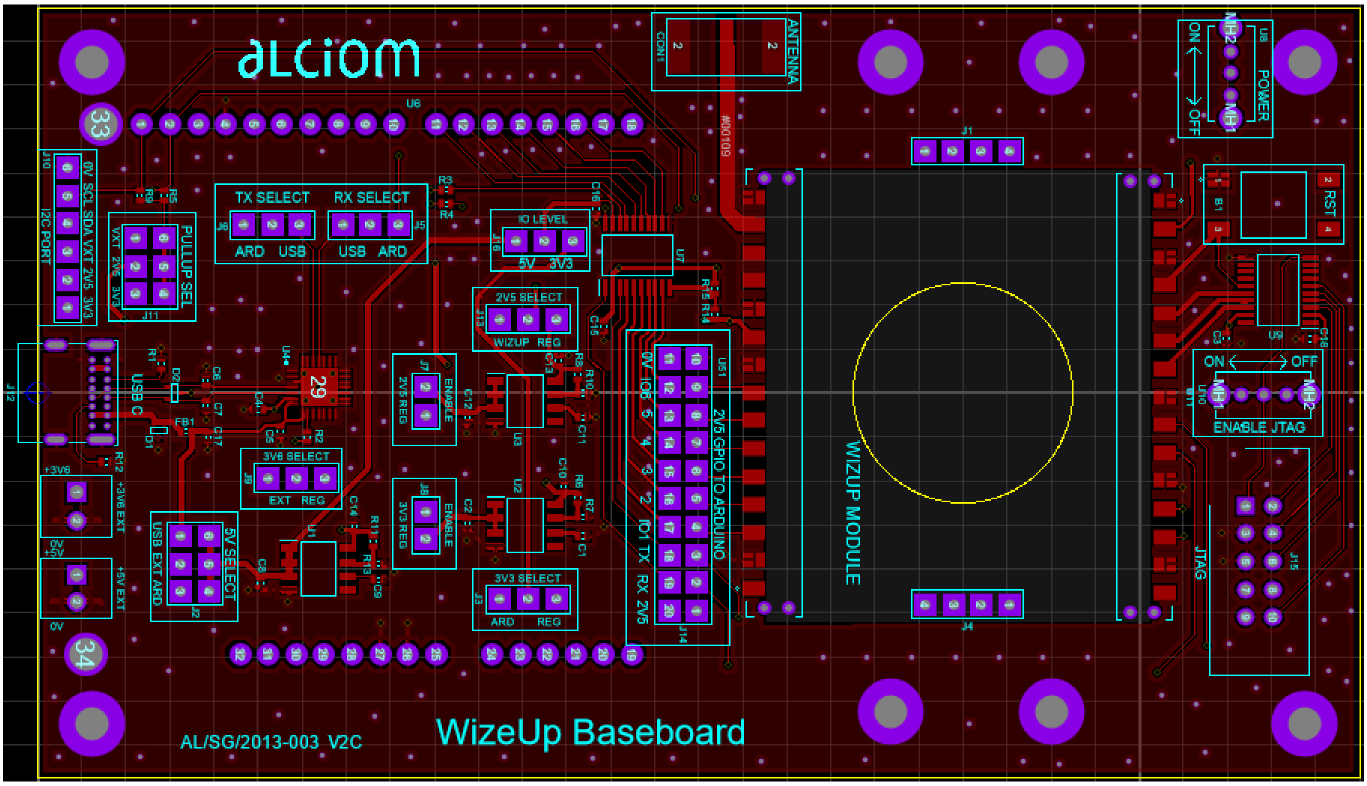
5.1 Product description

The WUEB is a generic Wize'Up carrier board for evaluation and demonstration purposes. It allows :

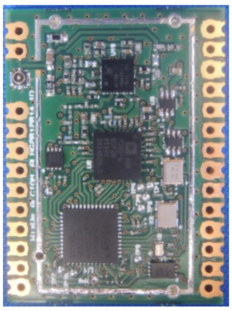
- To simply connect the Wize'Up module to a controlling host through a USB interface. The module can also be powered by USB if needed ;
- To connected the Wize'Up module to any Arduino-compatible host microcontroller ;
- To connect external devices (sensors, etc) through GPIOs or I2C.

This 2nd version as also be designed fort test bench.

5.2 Physical layout



The wizup module should be fitted between U11 and U51, on the top (between J1 and J4) with the the RF part on left-top :



5.3 External connectors

Identifier	Function	Comment
+5V EXT	+5V external power supply	Optional 5V power supply input. If used, must be selected with J4 and J8 jumpers
+3V6 EXT	+3V6 external power supply	Optional 3.6V power supply input. If used, must be selected with J4 and J8 jumpers
USB C (J12)	USB type C slave interface	Optional USB connector to a host computer. This port can also power the Wize'Up module, through proper configuration with J4 and J8 jumpers
I2C PORT (J10)	I2C interface	Allows to connect any I2C device to the Wize'Up module. 2.5V and 3.3V power supplies are available (for 3.3V, please check jumpers J6/J7). The jumper J13 must be set accordingly.
J14	GPIO header and jumper	Allows access to all Wize'Up module at 2.5V logic levels (IO1 to 6 and UART TX/RX). Used also as a jumper bloc for Arduino processors and USB interface (see here under)
JTAG (J15)	Debug interface	Standard ins-itu programming connector, to reflash and debug the Wize'Up microcontroller with updated firmware or custom application.
CON1	Antenna connector	SMA connector for external 169MHz antenna. Never leave this port open or the Wize'Up transceiver may be destroyed, if needed connect a 50-ohm dummy load in place of the antenna.
U6	Arduino compatible header	Allow to plug directly an Arduino processor module, with 3.3V I/O logic levels. J16 and J9 jumpers must be inserted.

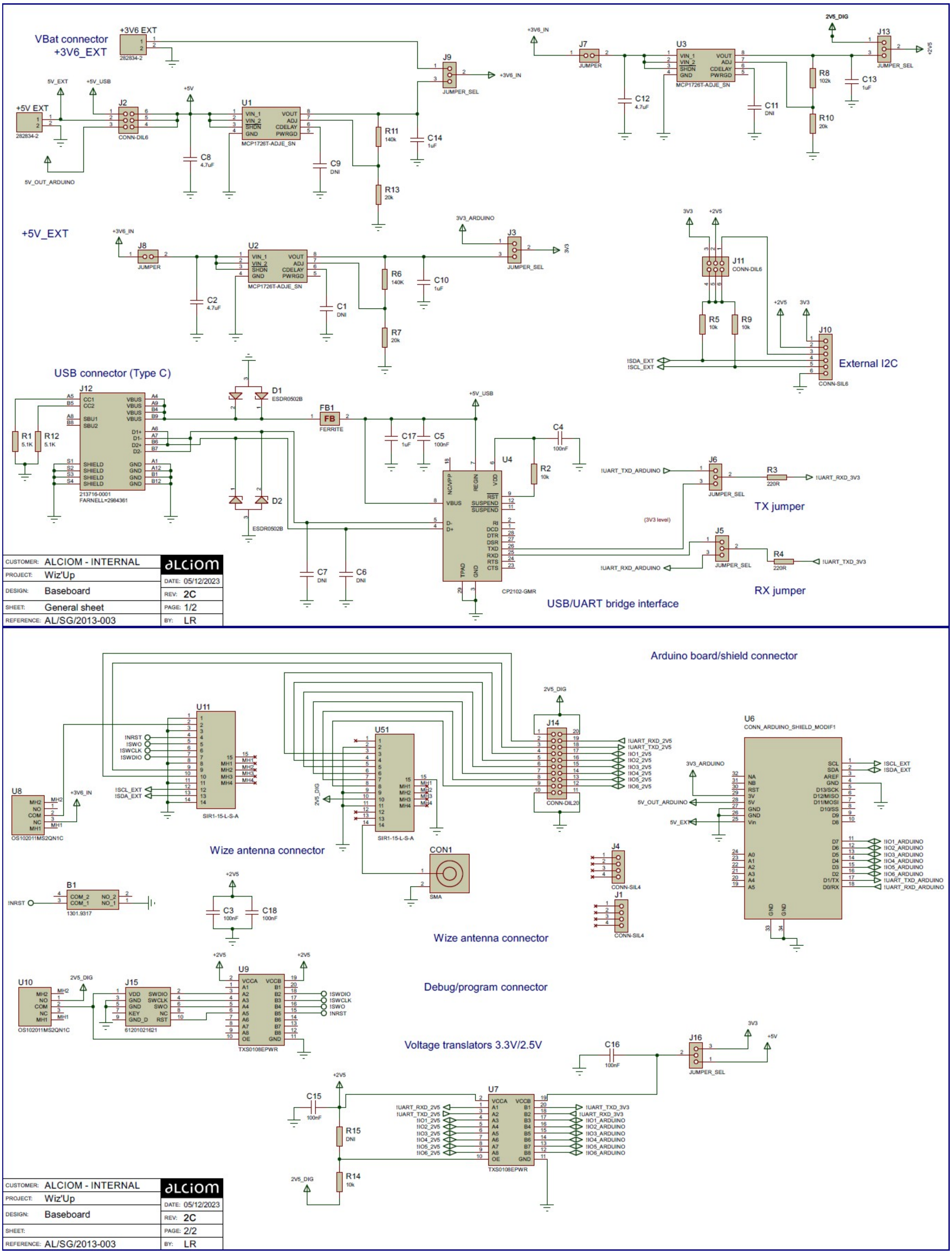
5.4 Switch and BP

Identifier	Function	Comment
POWER (U8)	Wizeup Power	Power or not the Wizeup module (swith OFF this power when connecting/disconnecting the wizeup board)
ENABLE JTAG (U10)	Enable programmation	Alternative way to connect/disconnect a programmation/debugging probe
RST (B1)	Reset	Press to reset the Wizeup module (do not use when programming)

5.5 Configuration jumpers

Identifier	Function	Comment
5V SELECT (J2)	5V selector	Must be properly configured if the Wize'Up module is powered by any of the three possible 5V power sources : - jump 3-4 (ARD) if 5V is coming from Arduino module - jump 2-5 (EXT) if 5V is coming from the +5V EXT connector - jump 1-6 (USB) if 5V is coming from the USB connector
3V6 SELECT (J9)	3.6V selector	Must be properly configured to select the power supply source of the Wize'Up module : - jump 2-3 (REG) if the power source is any 5V source (selected by 5V SELECT) - jump 1-2 (EXT) if the power source is an external 3.6V through +3V6 EXT
ENABLE 3V3 REG (J8)	3.3V internal LDO enable	Enable the internal 3V3 regulator. Needed when using USB. Insert a jumper to enable it
3V3 SELECT (J3)	3.3V selector	Select 3V3 source for externals IOs and UART (level shifter) and I2C pullup (if used). - jump 2-3 (REG) if the 3V3 source is from internal regulator - jump 1-2 (ARD) if the 3V3 source is from Arduino
IO LEVEL (J16)	IO and UART level	Select source for externals IOs and UART (level shifter) - jump 2-3 (3V3) to have 3V3 IOs and UART (see 3V3 SELECT), this mode when using USB - jump 1-2 (5V) to have 5V IOs and UART (any 5V source selected by 5V SELECT)
ENABLE 2V5 REG (J13)	2.5V internal LDO enable	Enable the internal 2V5 regulator. Needed when using 2V5 from baseboard instead from wizeup board. Insert a jumper to enable it
2V5 SELECT (J13)	2V5 internal selection	Select source for level shifter, Wizeup side : - jump 2-3 (REG) to power them from baseboard regulator - jump 1-2 (WIZUP) to power them from Wizeup board
TX SELECT (J6)	Wizup UART interface routing	Allow to route the Wize'Up UART port either to the USB interface or Arduino module : - jump J5 : 2-3 and J6 : 1-2 (ARD) to connect UART to Arduino - jump J5 : 1-2 and J6 : 2-3 (USB) to connect UART to USB (USB/UART bridge)
RX SELECT (J5)		
PULLUP SEL (J11)	Pull-up selector	Allow to select a proper voltage for the I2C pull up resistors, according to the peripherical voltage : - jump 1-6 (VXT) for any voltage coming from the slave - jump 2-5 (2V5) for 2.5V - jump 2-5 (3V3) for 3.3V
2V5 GPIO TO ARDUINO (J14)	GPIO to Arduino link	Allow to route IO1 to IO6 and/or UART RX/TX from the Wize'Up module to a 2.5V to 3.3V/5V level translator, which is needed for Arduino or USB hosts. Connect IOs and UART lines if they are connected to Arduino. Connect UART lines this USB interface (and Iosif they are used) J14 is also used as header to connect external devices at 2.5V levels (see here above)

5.6 Schematic



5.7 Bill of materials

Category	Quantity	References	Value	PCB Package	Manufacturer	Man. Ref.	Farnell	Digikey
Integrated Circuits	3	U1-U3	MCP1726T-ADJE_SN	SOIC127P600X175-8N	MICROCHIPsemiconductor	MCP1726-ADJE/SN	1834879	
Integrated Circuits	1	U4	CP2102-GMR	QFN50P500X500X100-29N-D	SILICON LABS	CP2102-GMR	2930578	
Integrated Circuits	1	U6	CONN_ARDUINO_SHIELD_MODIF1	CONN_ARDUINO_UNO_MODIF1		3049537,2751384,2356160		
Integrated Circuits	2	U7,U9	TXS0108EPWR	SOP65P640X120-20N	TEXAS INSTRUMENTS	TXS0108EPWR	3120988	
Integrated Circuits	2	U8,U10	OS102011MS2QN1C	OS102011MS2QN1C	C&K COMPONENTS	OS102011MS2QN1C	2435104	
Integrated Circuits	2	U11,U51	SIR1-15-L-S-A	SIR115LSA				
Capacitors	5	C1,C6-C7,C9,C11	DNI	0402				
Capacitors	3	C2,C8,C12	4.7uF	0402	MURATA	GRM155R61A475MEAAD	2688503	
Capacitors	6	C3-C5,C15-C16,C18	100nF	0402	YAGEO	CC0402KRX7R6BB104	3369149	
Capacitors	4	C10,C13-C14,C17	1uF	0402	TDK	CGB2A1X5R1A105K033BC	3416448	
Resistors	2	R1,R12	5.1K	0402_RES	PANASONIC	ERJ2RKF5101X	2302709	RMCF0402FT41K2CT-ND
Resistors	4	R2,R5,R9,R14	10k	0402_RES	PANASONIC	ERJ2RKF1002X	2302739	
Resistors	2	R3-R4	220R	0402_RES	PANASONIC	ERJ2RKF2200X	2302563	A130347CT-ND
Resistors	1	R6	140K	0402_RES	PANASONIC	ERJ2RKF6982X	2302824	311-68.0KLRCT-ND
Resistors	3	R7,R10,R13	20k	0402_RES	PANASONIC	ERJ2RKF2002X	2059160	
Resistors	1	R8	102k	0402_RES	PANASONIC	ERJ2RKF5112X	2302811	311-68.0KLRCT-ND
Resistors	1	R11	140k	0402_RES	VISHAY	CRCW0402154KFKED.	2140945	311-68.0KLRCT-ND
Resistors	1	R15	DNI	0402_RES				
Diodes	2	D1-D2	ESDR0502B	SOT-416	ON SEMICONDUCTOR	ESDR0502BT1G	2317492	ESDR0502BT1GOSCT-ND
Connectors	1	CON1	SMA	SMA_CI	MOLEX	73251-2120	1909303	
Connectors	2	J1,J4	CONN-SIL4	CONN-SIL4				
Connectors	2	J2,J11	CONN-DIL6	CONN-DIL6	AMPHENOL COMMUNICATION	67996-406HLF	2751377	
Connectors	6	J3,J5-J6,J9,J13,J16	JUMPER_SEL	CONN-SIL3	MOLEX	22-28-4031	3049527	
Connectors	2	J7-J8	JUMPER	CONN-SIL2	AMPHENOL COMMUNICATION	68000-102HLF	2751379	
Connectors	1	J10	CONN-SIL6	CONN-SIL6	AMPHENOL COMMUNICATION	68000-406HLF	2751384	
Connectors	1	J12	213716-0001	2137160001	WURTH ELEKTRONIK		2984361	
Connectors	1	J14	CONN-DIL20	CONN-DIL20	HARWIN	M20-9981045	1022241	
Connectors	1	J15	61201021621	SHDR10W64P254_2X5_2036X885X925P	WURTH ELEKTRONIK	61201021621	1642019	
Miscellaneous	2	+3V6 EXT,+5V EXT	282834-2	282834-2_1	TEconnectivity	282834-2		
Miscellaneous	1	B1	1301.9317	13019317	E-SWITCH	TL3305AF160QG	2830823	
Miscellaneous	1	FB1	FERRITE	0402	MURATA	BLM15PX331SN1D	3471087	490-11022-1-ND

6 Wize'Up module internal design

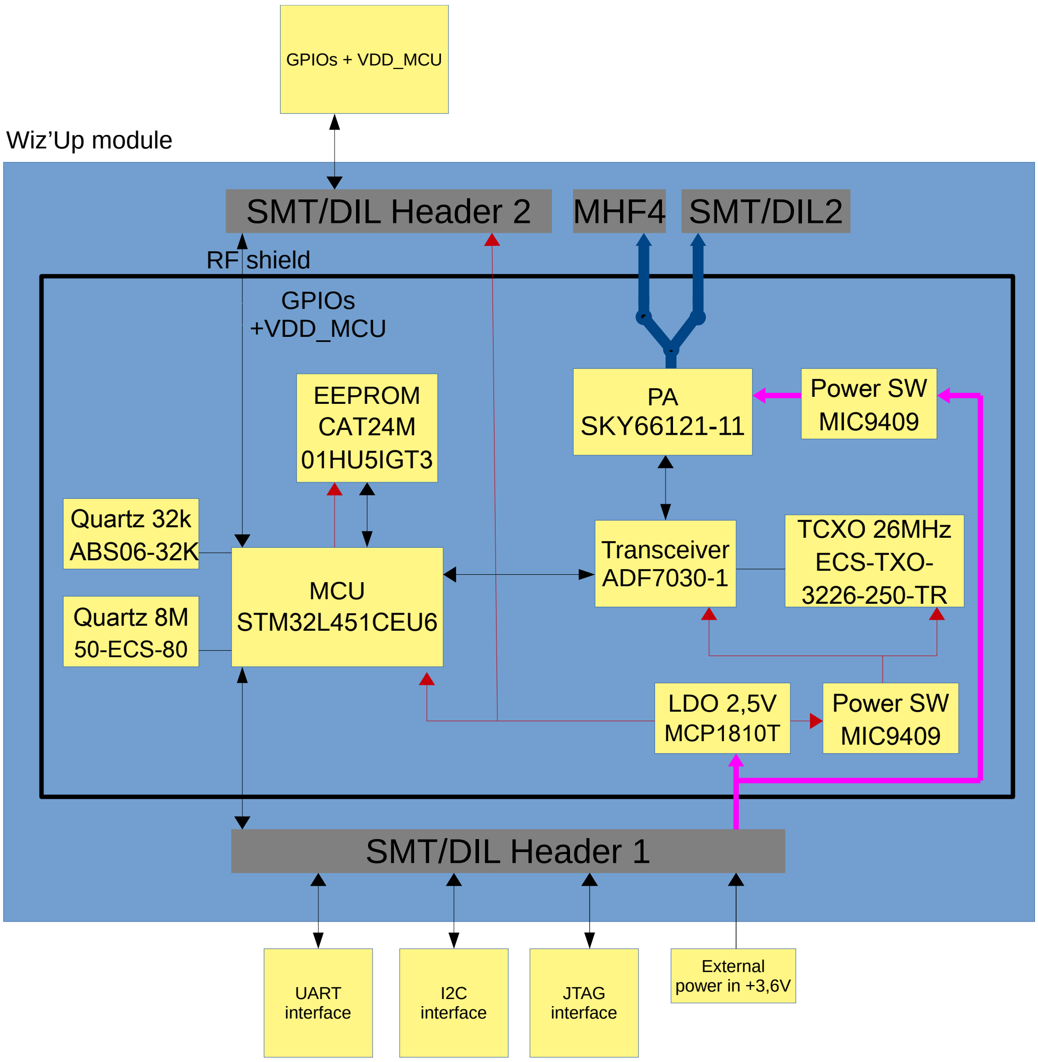
6.1 Architecture

The Wiz'Up module includes the following functions :

- A powerful microcontroller with ultra-low power consumption;
- A Wize radio frequency interface;
- Generic I/Os : GPIO, UART, I2C
- Connectors for external antennas
- A battery-compatible high efficiency power supply

Concerning RF connection, the 169MHz antenna pin is accessible both on one header and on a MHF4 connector.

The key parts of the Wize'Up module are the following :

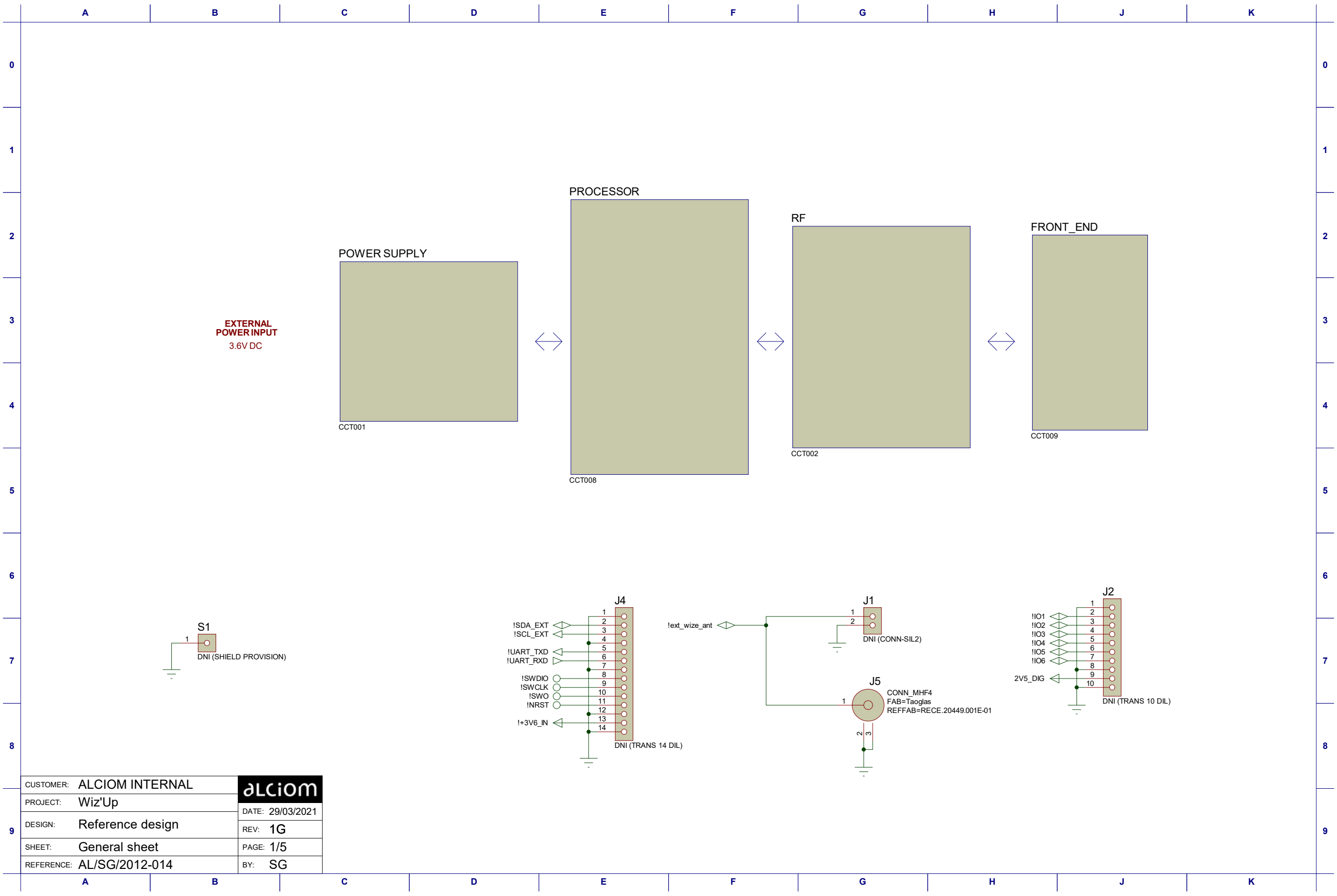


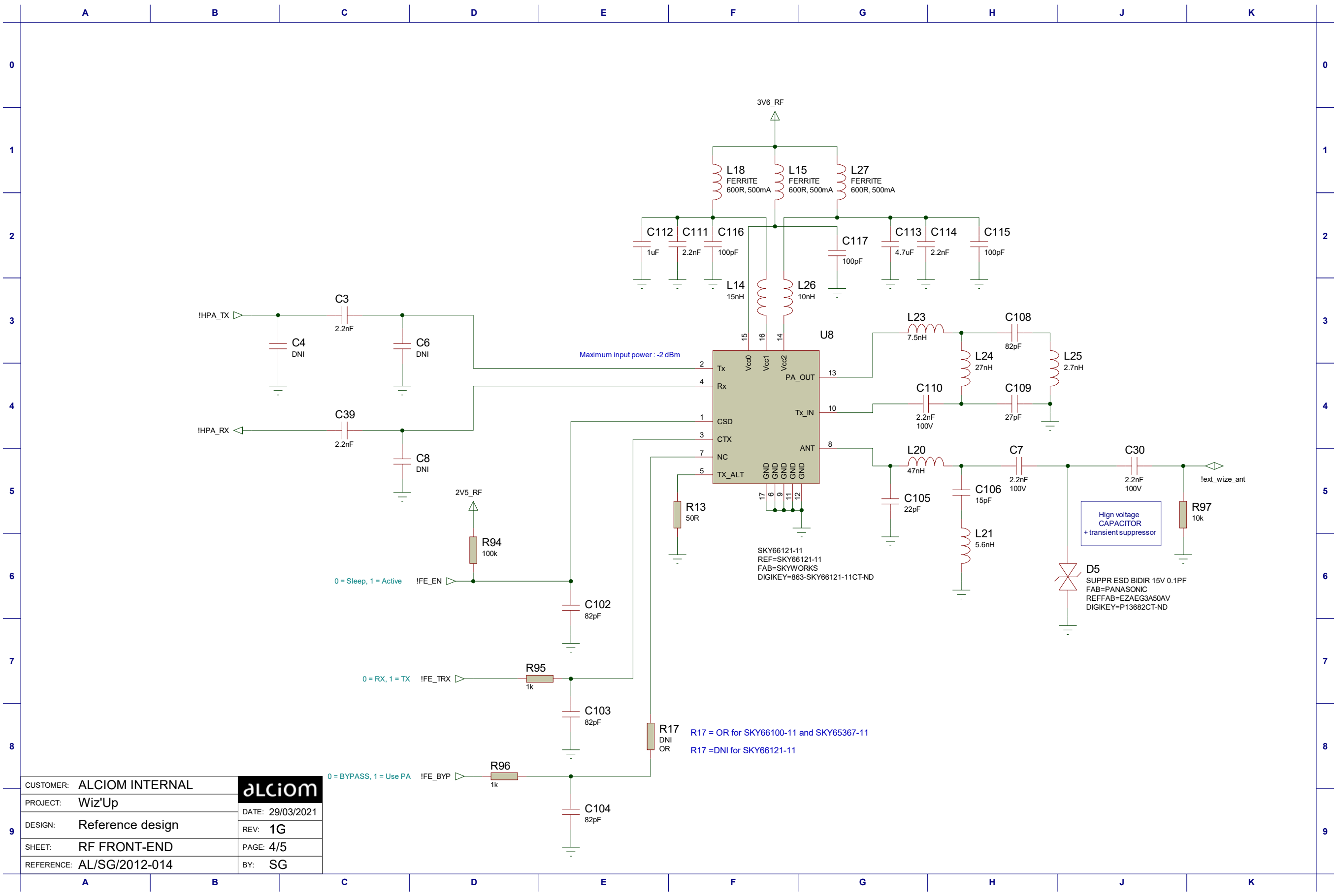
Wiz'Up module architecture

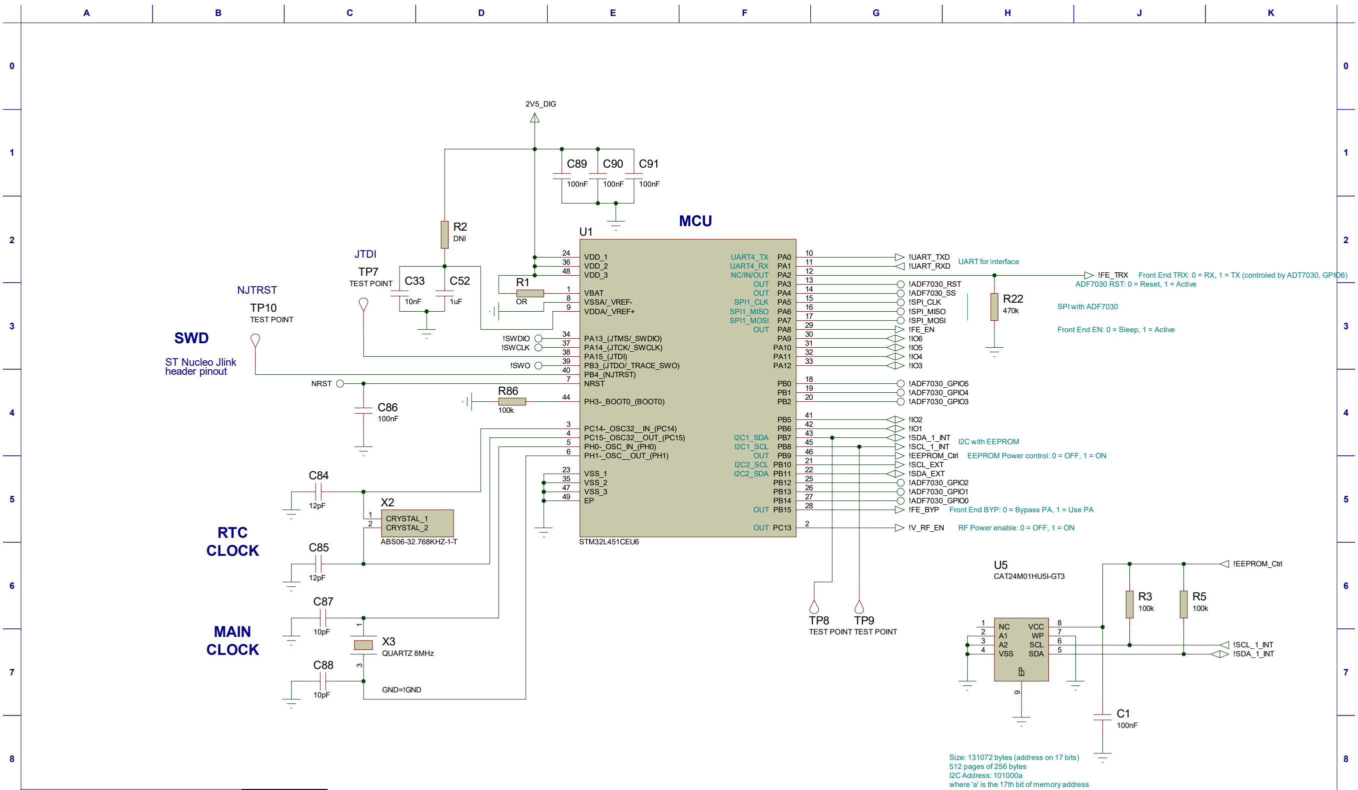
All parts are powered at 2.5V, generated through an on-board ultra-low power LDO, except the RF front-end which is directely powered from the 3.6V input.

6.2 Schematic

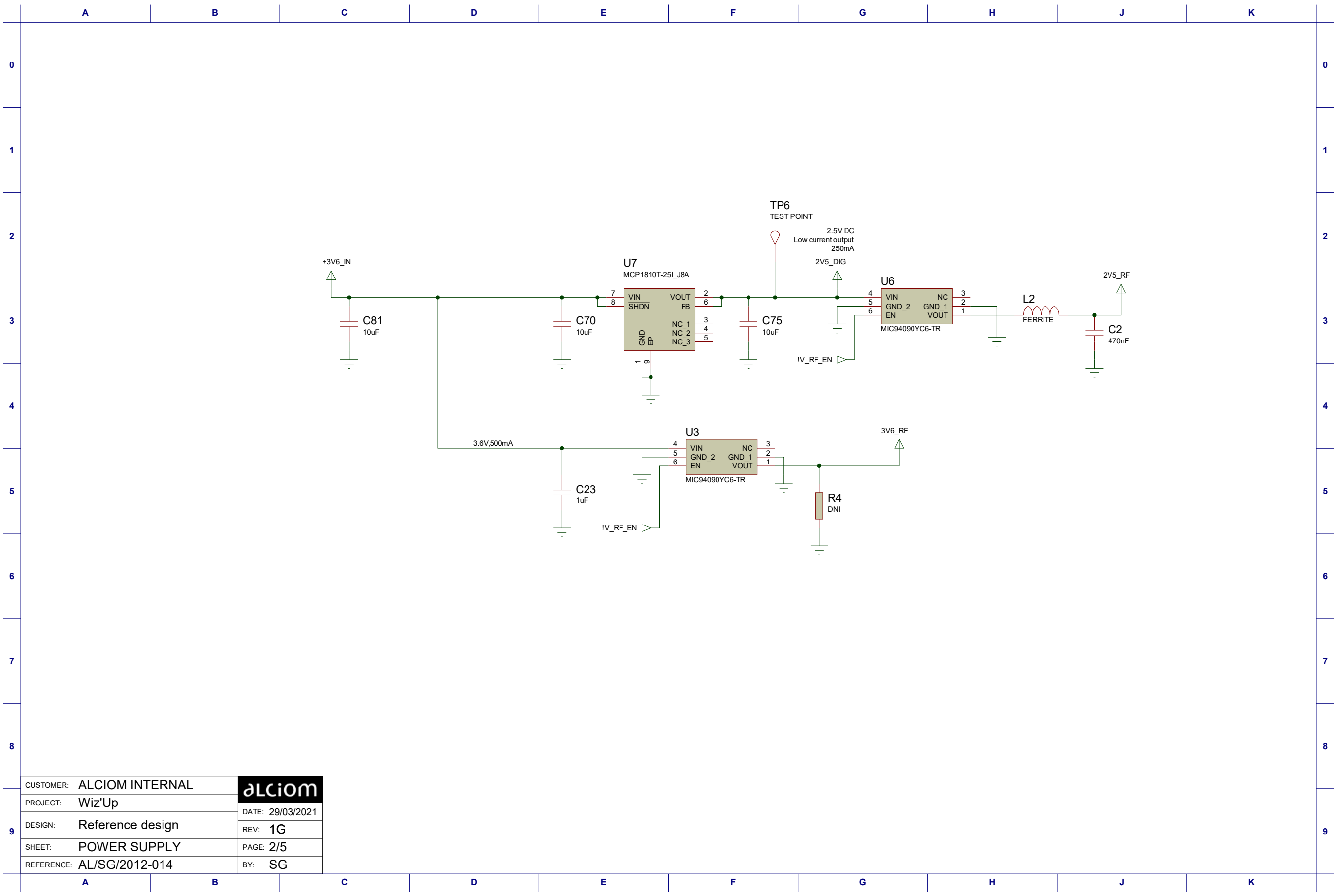
The full schematic of the Wize'Up module is reproced here after :

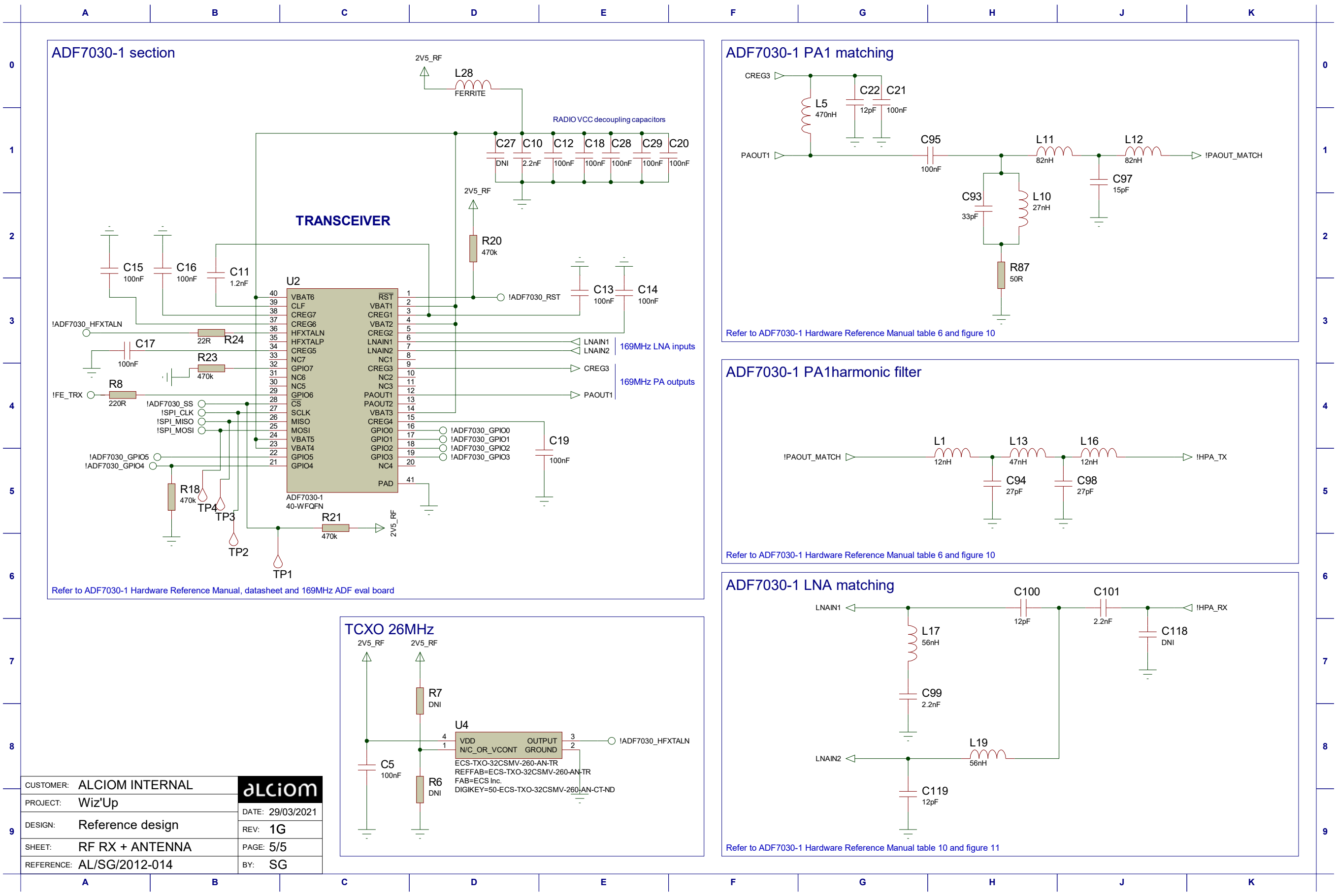



3V6_RF
L18
FERRITE
600R, 500mA
L15
FERRITE
600R, 500mA
L27
FERRITE
600R, 500mA
C112
1uF
C111
2.2nF
C116
100pF
C117
100pF
C113
4.7uF
C114
2.2nF
C115
100pF
L14
15nH
L26
10nH
!HPA_TX
C3
2.2nF
C4
DNI
C6
DNI
Maximum input power : -2 dBm
U8
Tx
Rx
CSD
CTX
NC
TX_ALT
Vcc0
Vcc1
Vcc2
PA_OUT
Tx_IN
ANT
GND
L23
7.5nH
C108
82pF
L24
27nH
L25
2.7nH
C110
2.2nF
100V
C109
27pF
!HPA_RX
C39
2.2nF
C8
DNI
L20
47nH
C7
2.2nF
100V
C30
2.2nF
100V
!ext_wize_ant
C106
15pF
C105
22pF
2V5_RF
R13
50R
R97
10k
Hign voltage
CAPACITOR
+ transient suppressor
R94
100k
L21
5.6nH
SKY66121-11
REF=SKY66121-11
FAB=SKYWORKS
DIGIKEY=863-SKY66121-11CT-ND
D5
SUPPR ESD BIDIR 15V 0.1PF
FAB=PANASONIC
REFFAB=EZAEG3A50AV
DIGIKEY=P13682CT-ND
0 = Sleep, 1 = Active
!FE_EN
C102
82pF
0 = RX, 1 = TX
!FE_TRX
R95
1k
C103
82pF
R17
DNI
OR
R17 = OR for SKY66100-11 and SKY65367-11
R17 =DNI for SKY66121-11
0 = BYPASS, 1 = Use PA
!FE_BYP
R96
1k
C104
82pF
CUSTOMER: ALCIOM INTERNAL
PROJECT: Wiz'Up
DESIGN: Reference design
SHEET: RF FRONT-END
REFERENCE: AL/SG/2012-014
DATE: 29/03/2021
REV: 1G
PAGE: 4/5
BY: SG



CUSTOMER:	ALCIOM INTERNAL		
PROJECT:	Wiz'Up	DATE:	29/03/2021
DESIGN:	Reference design	REV:	1G
SHEET:	CPU	PAGE:	3/5
REFERENCE:	AL/SG/2012-014	BY:	SG


TP6
TEST POINT
2.5V DC
Low current output
250mA
+3V6_IN
U7
MCP1810T-25I_J8A
VIN
SHDN
VOUT
FB
NC_1
NC_2
NC_3
GND
EP
C81
10uF
C70
10uF
C75
10uF
2V5_DIG
U6
VIN
GND_2
EN
NC
GND_1
VOUT
MIC94090YC6-TR
!V_RF_EN
L2
FERRITE
2V5_RF
C2
470nF
3.6V,500mA
U3
MIC94090YC6-TR
3V6_RF
C23
1uF
R4
DNI
CUSTOMER: ALCIOM INTERNAL
PROJECT: Wiz'Up
DESIGN: Reference design
SHEET: POWER SUPPLY
REFERENCE: AL/SG/2012-014
DATE: 29/03/2021
REV: 1G
PAGE: 2/5
BY: SG

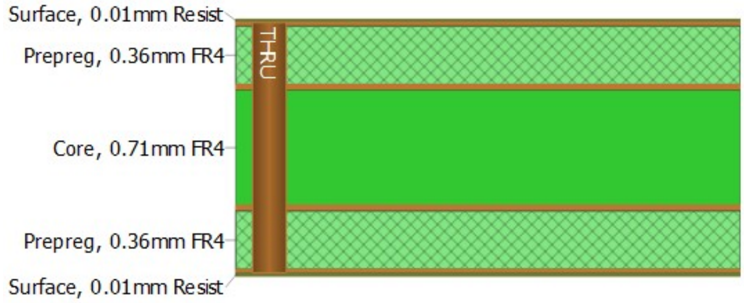

ADF7030-1 section
TRANSCEIVER
RADIO VCC decoupling capacitors
169MHz LNA inputs
169MHz PA outputs
Refer to ADF7030-1 Hardware Reference Manual, datasheet and 169MHz ADF eval board
ADF7030-1 PA1 matching
Refer to ADF7030-1 Hardware Reference Manual table 6 and figure 10
ADF7030-1 PA1harmonic filter
Refer to ADF7030-1 Hardware Reference Manual table 6 and figure 10
ADF7030-1 LNA matching
Refer to ADF7030-1 Hardware Reference Manual table 10 and figure 11
TCXO 26MHz
ECS-TXO-32CSMV-260-AN-TR
CUSTOMER: ALCIOM INTERNAL
PROJECT: Wiz'Up
DESIGN: Reference design
SHEET: RF RX + ANTENNA
REFERENCE: AL/SG/2012-014
DATE: 29/03/2021
REV: 1G
PAGE: 5/5
BY: SG

6.3 Bill of materials

Category	Quantity	References	Value	fab	Ref Fab	PCB Package
Capacitors	19	C1,C5,C12-C21,C28-C29,C86,C89-C91,C95	100nF			0201
Capacitors	1	C2	470nF			0201
Capacitors	7	C3,C10,C39,C99,C101,C111,C114	2.2nF			0201
Capacitors	4	C4,C6,C8,C118	DNI			0201
Capacitors	3	C7,C30,C110	2.2nF			0402
Capacitors	1	C11	1.2nF			0201
Capacitors	5	C22,C84-C85,C100,C119	12pF			0201
Capacitors	3	C23,C52,C112	1uF			0201
Capacitors	1	C27	DNI			0402
Capacitors	1	C33	10nF			0201
Capacitors	3	C70,C75,C81	10uF			0402
Capacitors	2	C87-C88	10pF			0201
Capacitors	1	C93	33pF			0201
Capacitors	2	C94,C98	27pF			0201
Capacitors	1	C97	15pF			0201
Capacitors	3	C102-C104	82pF			0201
Capacitors	1	C105	22pF			0402
Capacitors	1	C106	15pF			0402
Capacitors	1	C108	82pF			0402
Capacitors	1	C109	27pF			0402
Capacitors	1	C113	4.7uF			0402
Capacitors	3	C115-C117	100pF			0201
Resistors	1	R1	OR			0201
Resistors	5	R2,R4,R6-R7,R17	DNI			0201
Resistors	4	R3,R5,R86,R94	100k			0201
Resistors	1	R8	220R			0201
Resistors	2	R13,R87	50R			0201
Resistors	5	R18,R20-R23	470k			0201
Resistors	1	R24	22R			0201
Resistors	2	R95-R96	1k			0201
Resistors	1	R97	10k			0402
Integrated Circuits	1	U1	STM32L451CEU6	STMicroelectronics	STM32L451CEU6	UFQFPN48 7X7MM 0P5
Integrated Circuits	1	U2	ADF7030-1	ANALOG DEVICES	ADF7030-1BCPZN	ADF7030PKG
Integrated Circuits	2	U3,U6	MIC94090YC6-TR	Microchip	MIC94090YC6-TR	SC70
Integrated Circuits	1	U4	ECS-TXO-32CSMV-260-AN-TR	ECS Inc.	ECS-TXO-32CSMV-260-AN-TR	ECSTXO3225250TR
Integrated Circuits	1	U5	CAT24M01HU5I-GT3	ON Semiconductor	CAT24M01HU5I-GT3	UDFN8 3X2MM 0P5
Integrated Circuits	1	U7	MCP1810T-25I_J8A	Microchip	MCP1810T-25I/J8A	SON50P200X200X90-9N
Integrated Circuits	1	U8	SKY66121-11	SKYWORKS		4X4MM
Diodes	1	D5	SUPPR ESD BIDIR 15V 0.1PF	PANASONIC	EZAEG3A50AV	0603
Miscellaneous	1	J1	DNI (CONN-SIL2)			2PIN_EDGE_100TH_DB
Miscellaneous	1	J2	DNI (TRANS 10 DIL)			10PIN_EDGE_100TH_DB
Miscellaneous	1	J4	DNI (TRANS 14 DIL)			14PIN_EDGE_100TH_DB
Miscellaneous	1	J5	CONN_MHF4	Taoglas	RECE.20449.001E-01	MHF4_RF_CONN
Miscellaneous	2	L1,L16	12nH			0402
Miscellaneous	5	L2,L15,L18,L27-L28	FERRITE			0402
Miscellaneous	1	L5	470nH			0402
Miscellaneous	2	L10,L24	27nH			0402
Miscellaneous	2	L11-L12	82nH			0402
Miscellaneous	2	L13,L20	47nH			0402
Miscellaneous	1	L14	15nH			0402
Miscellaneous	2	L17,L19	56nH			0201
Miscellaneous	1	L21	5.6nH			0402
Miscellaneous	1	L23	7.5nH			0402
Miscellaneous	1	L25	2.7nH			0402
Miscellaneous	1	L26	10nH			0402
Miscellaneous	1	S1	DNI (SHIELD PROVISION)			SHIELD 35X20MM
Miscellaneous	9	TP1-TP4,TP6-TP10	TEST POINT			TEST_POINT_SMALL
Miscellaneous	1	X2	ABS06-32.768KHZ-1-T	Abracon	ABS06-32.768KHZ-1-T	XTAL_2X1.2MM
Miscellaneous	1	X3	QUARTZ 8MHz	ECS	ECS-80-12-33-JGN-TR	ABM8AIG25000MHZ122ZT3

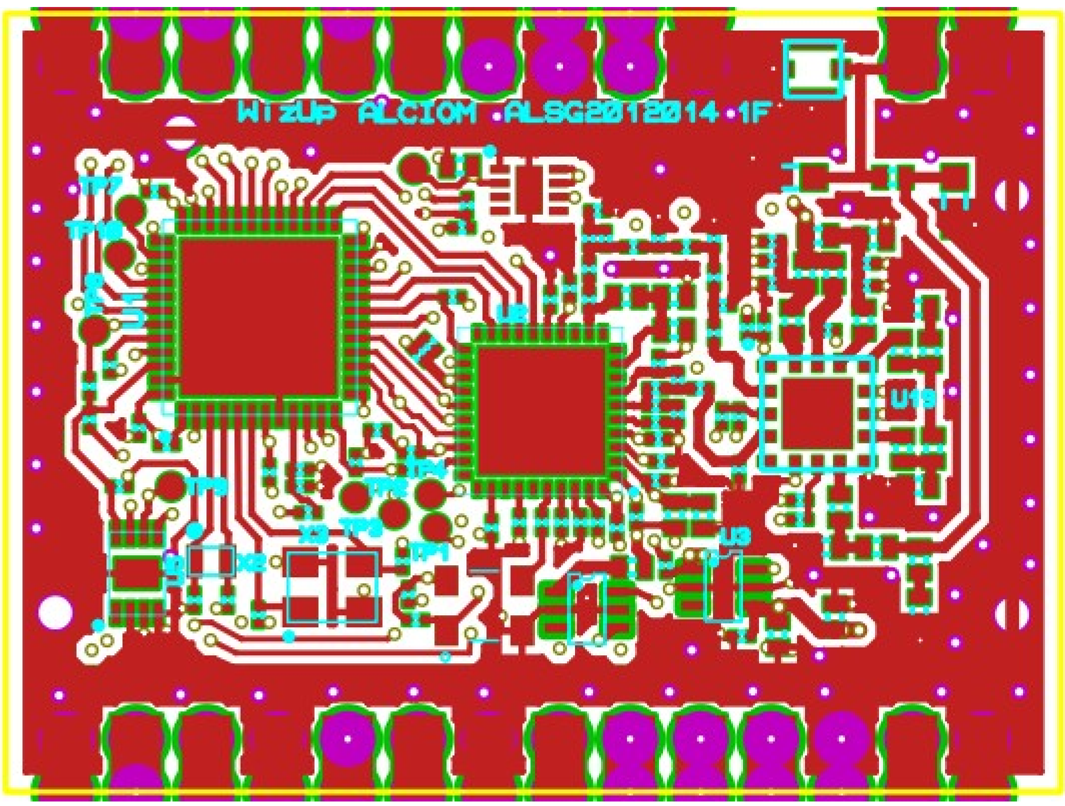
Warning : Parts on the RF path are critical in terms of performance and should be selected for a resonnance frequency significantly above 169MHz.

6.4 Layout

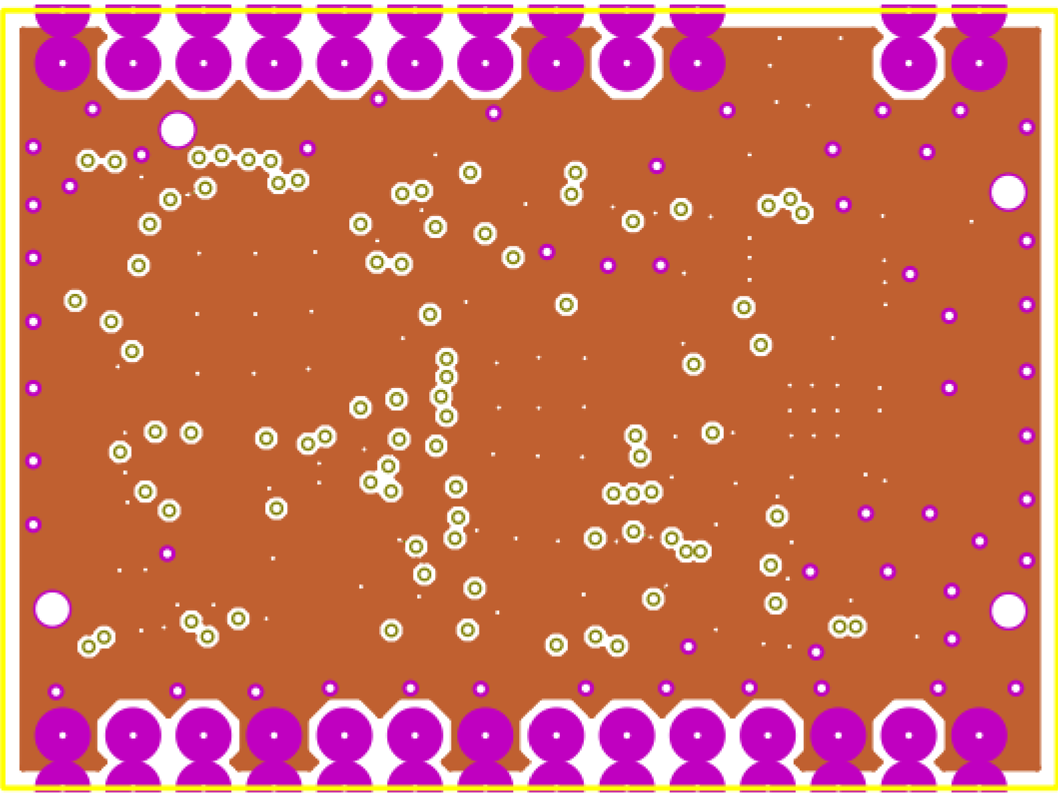


ID	Name	Type	Material	Thickness	Dielectric
TR	Top Resist	Surface	Resist	0.01mm	3.50
TOP	Top Copper	Signal	Copper	0.018mm	
		Prepreg	FR4	0.36mm	4.80
I1	Inner 1	Signal	Copper	0.035mm	
		Core	FR4	0.71mm	4.80
I2	Inner 2	Signal	Copper	0.035mm	
		Prepreg	FR4	0.36mm	4.80
BOT	Bottom Copper	Signal	Copper	0.018mm	
BR	Bottom Resist	Surface	Resist	0.01mm	3.50

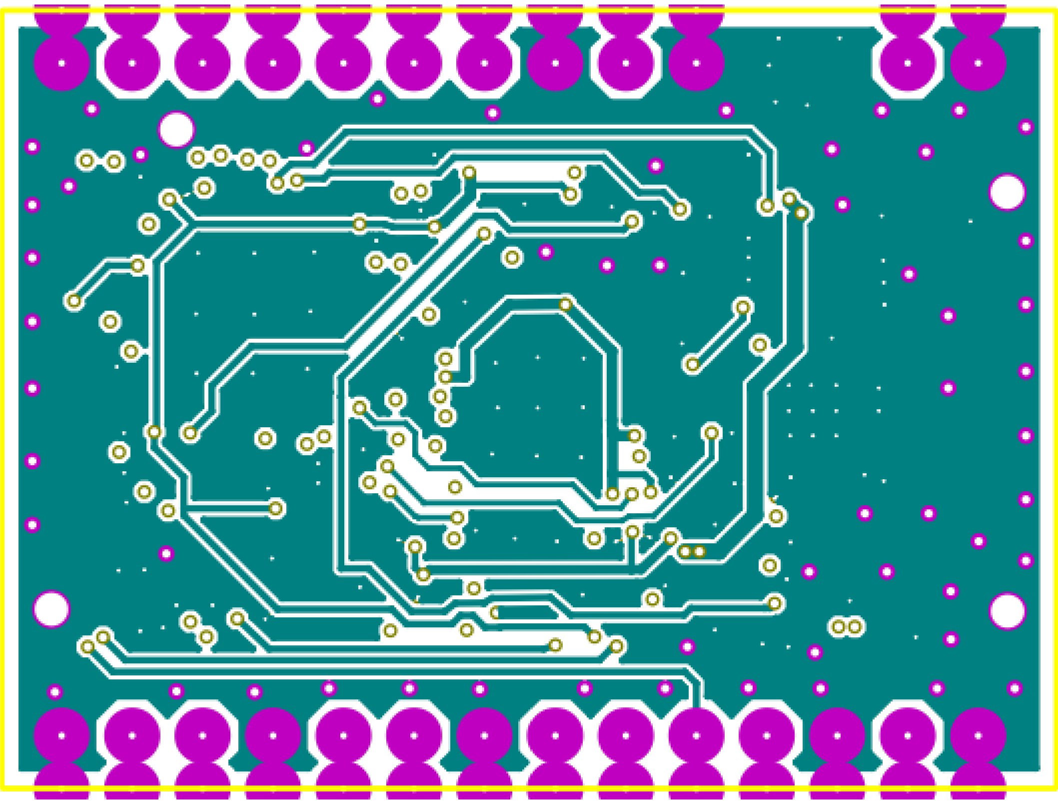
Top :



Inner 1 :



Inner 2 :



Bottom :