

UM235x

User manual

Getting started with STEVAL-25R3916B

Introduction

STEVAL-25R3916B is a ready-to-use development kit to evaluate the features and functionality in reader/writer, peer-to-peer and card emulation modes of the high-performance NFC universal device ST25R3916B for contactless applications.

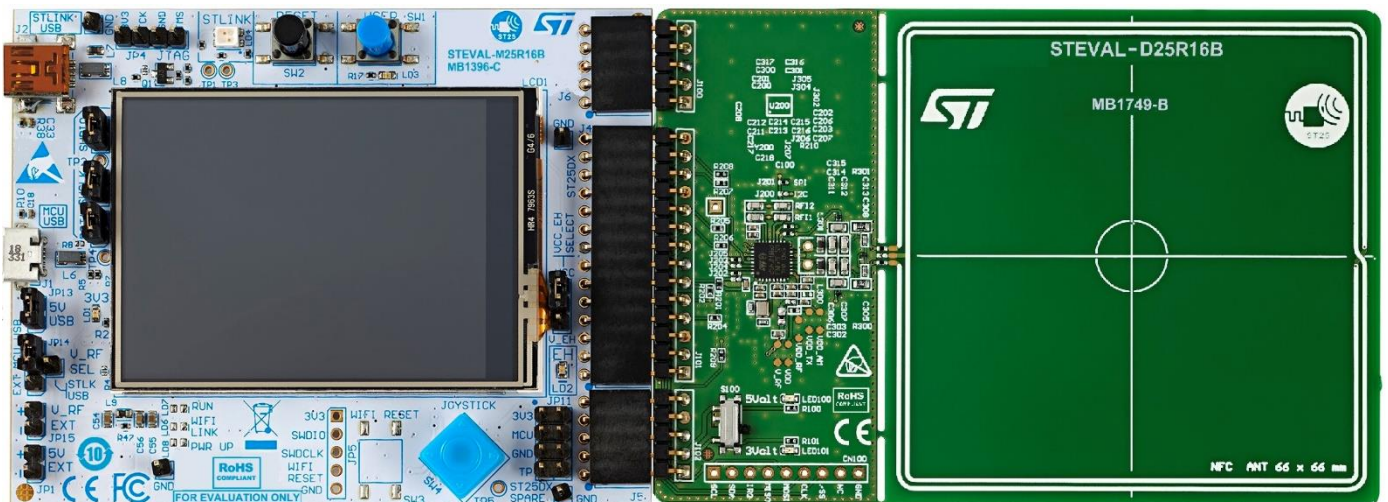
The kit is composed of two boards:

- MB1396 a microprocessor motherboard, which includes a complement of hardware and software tools enabling the use the full STM32 Nucleo ecosystem. The board is powered through USB connectors.
- MB1749 a daughter board, which embeds the ST25R3916B device and an antenna etched on the PCB with its tuning circuit.

The communication link between the two boards is the SPI bus and the processor card provides the power. Specific data lines complete the pin connector assignment shared between cards.

A variety of demonstrations can be performed with this kit, which allows the users to develop and test their applications.

The MB1396 and the MB1749 boards schematics, BOM, Gerber files, drivers and firmware are available on the STMicroelectronics website www.st.com.



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1 Features

- ISO 18092 (NFCIP-1) active and passive initiator and target modes
- NFC Forum NFC-A, NFC-B, NFC-F and NFC-V reader
- ISO 14443A, ISO 14443B and ISO15693 reader
- FeliCa™ reader
- Support of all five NFC Forum Tag types in reader mode
- NFC Forum Type 3 tag (NFC-F) host card emulation
- NFC Forum Type 4A tag (NFC-A) host card emulation
- Stream modes to implement other standard and custom protocols
- Integrated capacitive sensing system for low power detection of tag presence
- Integrated inductive sensing system for low power detection of tag presence using phase or amplitude measurement
- High output power
- User selectable and automatic gain control
- Serial peripheral interface (SPI) up to 10 Mb/s
- I2C with up to 400 kbit/s in Fast-mode, 1 Mb/s in Fast-mode Plus
- Automatic antenna tuning (AAT) via variable capacitor

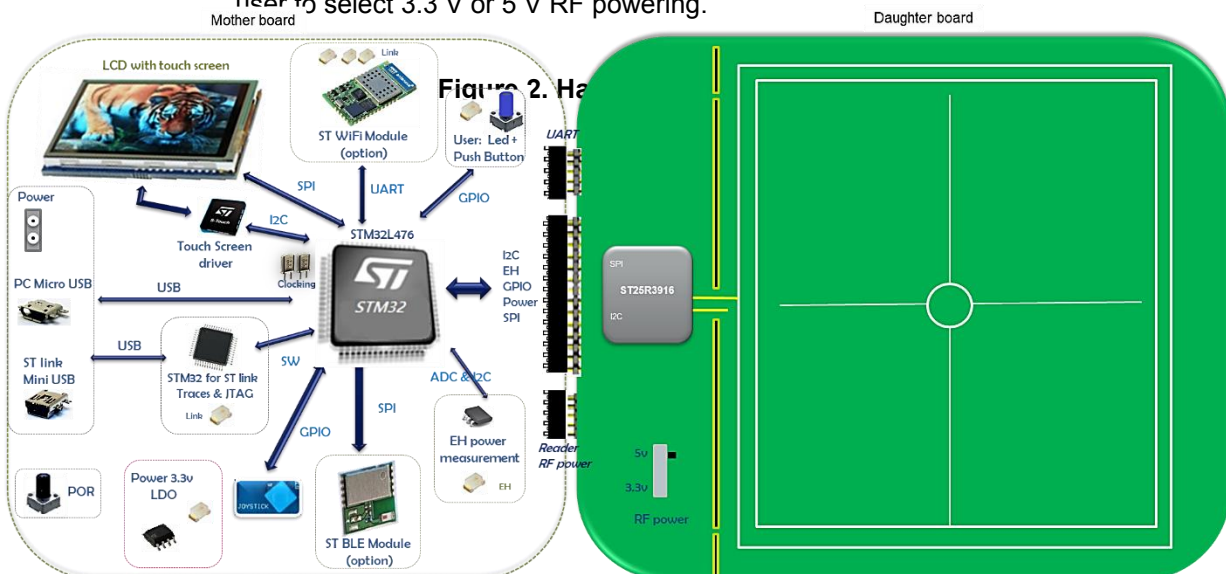
2 Description

The STEVAL-25R3916B kit allows the user to evaluate the features and capabilities of the ST25R devices, a series of high-performance HF readers.

The kit comes with application notes, software applications, drivers, BOM (bill of materials), board schematics, Gerber files and firmware schematics. All these documents can be downloaded from www.st.com, they help the user to reduce the design efforts.

The kit is composed of two boards:

1. The MB1396 is a microprocessor motherboard embedding a 32-bit microcontroller of the STM32L476 line, based on Arm^{®(a)} Cortex[®]-M4 high-performance CPU with FPU.
The MB1396 is powered through the USB bus. It includes:
 - an ST-LINK in-circuit debugger and programmer for STM32 microcontrollers
 - a 2.4" TFT LCD with touch screen capability
 - LEDs
 - push buttons (reset and user)
 - a mini-USB debug connector
 - a user-dedicated micro-USB connector.
 - features for ST NFC TAG
2. The MB1749 is a daughter board, which embeds the ST25R3916B, an antenna etched on the PCB and its tuning circuit. A switch allows the user to select 3.3 V or 5 V RF powering.



a. Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

3 Quick start

3.1 Getting started in standalone mode

The motherboard and the daughter board must be connected together.

The jumper configuration when the kit is delivered is the default one.

The kit is powered (like a PC) by the micro-USB bus via a cable connected to the power source.

It should be used on a clean and non-flammable surface

The unit must be supplied by a safety extra low voltage (SELV) limited power source through the USB port, the source must not exceed 60 V_{DC} / 8A / 100VA

When powered up, the microcontroller starts the firmware, which is already downloaded in the Flash memory.

This makes it possible to demonstrate the different capabilities of the ST25R3916B.

- Reader and writer
- Card emulation
- Peer to peer
- Automatic antenna tuning
- USB mode (see [Section 3.2](#))

There is no need for modifications or configurations to run the demonstration. Refer to the firmware's user manual available on STMicroelectronics website to get more details.

3.2 Getting started with USB mode

Connect the discovery kit to a PC using a micro USB cable. The USB port of the PC must be capable of delivering at least 250 mA at 5 Volt.

It should be used on a clean and non-flammable surface

To control the board, download the software from the dedicated page on www.st.com and install it. Further information on how to operate the software and the GUI that can be used to control the board can be found in User Manual "STEVAL-25R3916B kit user manual", available on www.st.com.

3.3 System requirements

- Micro USB cable
- USB port, capable of delivering at least 400 mA at 5 V (2W)
- Unit must be supplied by a safety extra low voltage (SELV) limited power source through the USB port
- For embedded ST link and STM32 ecosystem development usage a mini USB cable is required

4 MB1396 hardware

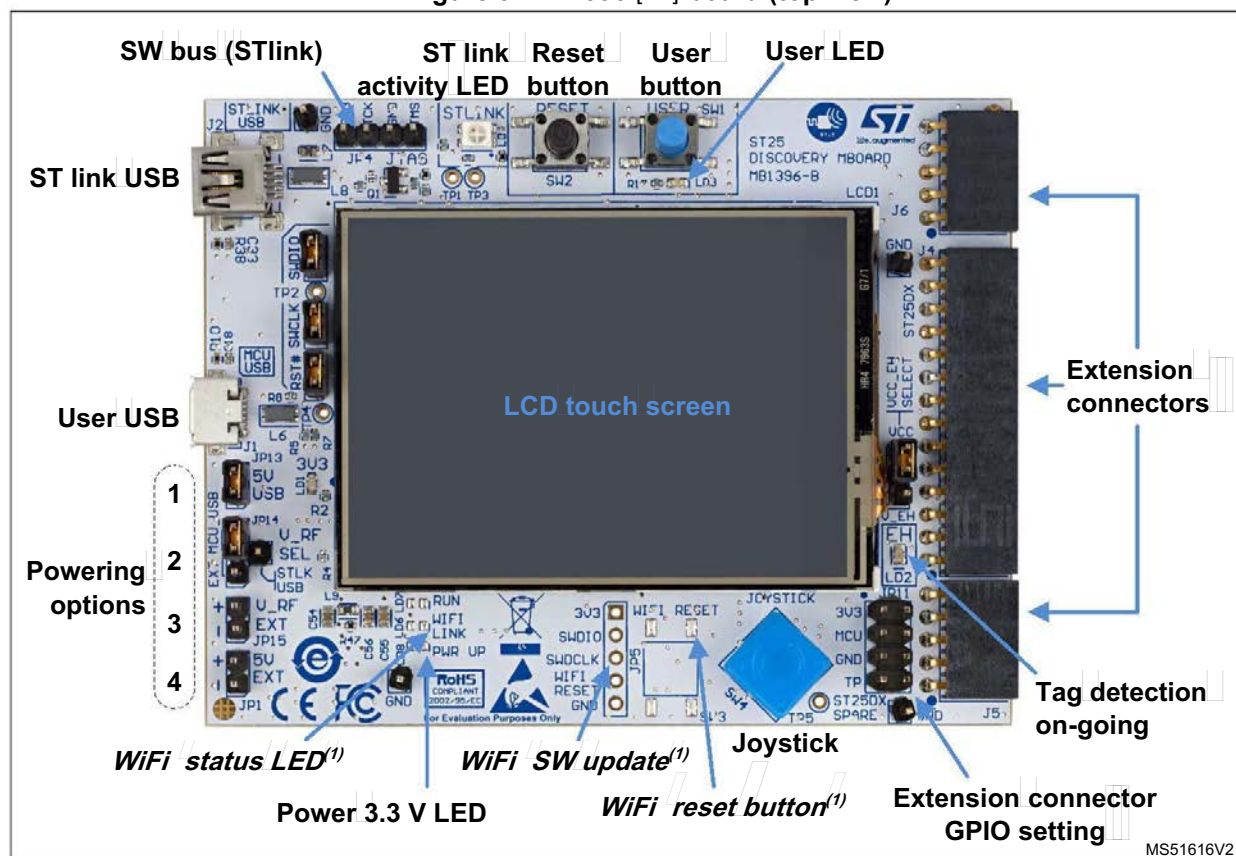
The PCB (printed circuit board) of the motherboard is usually connected via USB to the PC. The embedded firmware controls the STM32 MCU that operates the ST25R3916B via the extension connectors.

Both boards are powered by the 5 V supply of the USB bus. An LDO converts this voltage down to 3.3 V to supply the microcontroller and the ST25R3916B. The extension board is provided with both 3.3 and 5 V supplies, it is possible to select one of them.

A green LED close to the motherboard micro-USB plug indicates when the board is powered.

4.1 MB1396 board layout

Figure 3. MB1396 [-B] board (top view)



1. Available only on dedicated demonstration only edition.

Figure 4. MB1396 [-B] board (bottom view)

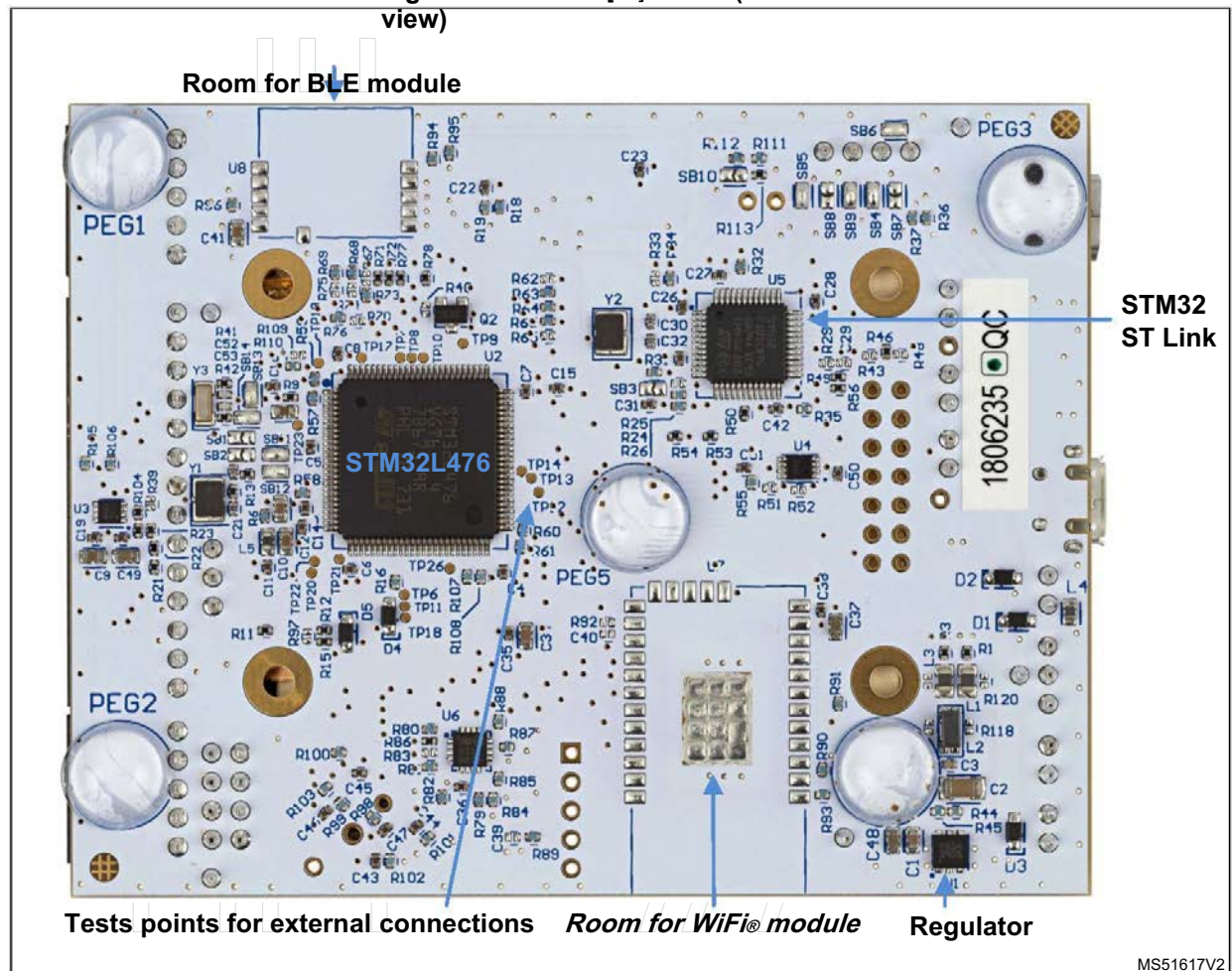


Table 1. Powering options

Reference	Connector	Position	Description
1	JP13	Closed 1-2	Card powered by USB
2	JP14	Closed 2-3	Card powered by micro USB
3	JP15	Open	ST25R3916B board powering, special feature
4	JP16	Open	Card powered by an external source

4.2 MB1396 jumper default configuration

This section details the MB1396 jumpers default configuration (recommended setting), set at kit delivery. With these parameters the USB micro connector provides the kit powering.

Figure 5. MB1396 default configuration

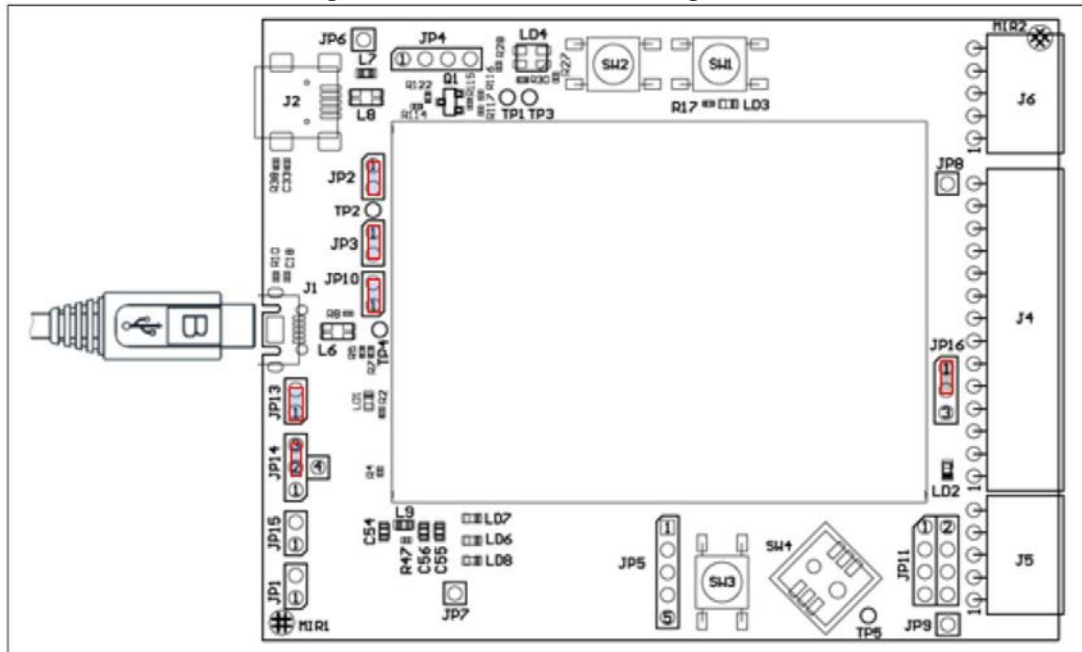


Table 2. Jumpers configuration

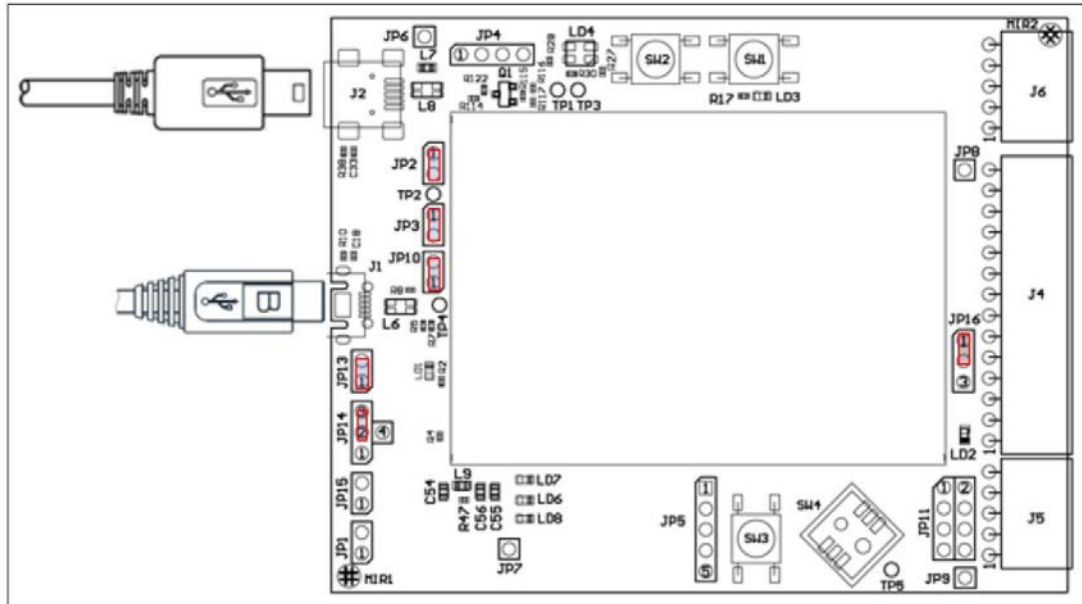
Connector	Position	Description
JP2	Closed 1-2	ST link UART debug features
JP3		
JP10		
JP13		
JP14	Closed 2-3	Card Powered by micro USB
JP16	Closed 1-2	Board powering special feature

4.3 MB1396 software development configuration

This section describes the MB1396 software development configuration and the USB connection when the embedded ST link is used.

The J1 USB micro connector provides the ST23R3916B powering, the J2 USB mini provides the link for the data exchange between the board and the computer.

Figure 6. MB1396 SW development configuration



5 MB1749 hardware

5.1 ST25R3916B

The ST25R3916B is directly connected to the filtered 5 V USB supply. There are additional supply filtering components placed close to the NFC/HF reader IC.

During layout all decoupling capacitors have been placed as close as possible to the ST25R3916B chip.

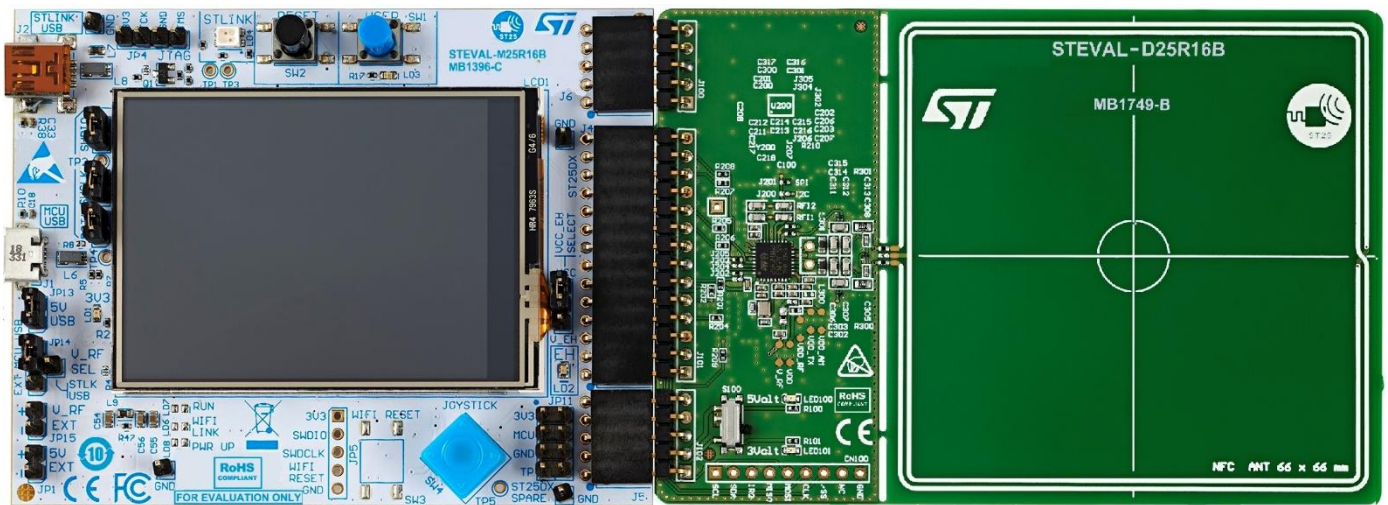
For SPI cross-connecting another reader PCB, serial resistors can be removed and CN100 used.

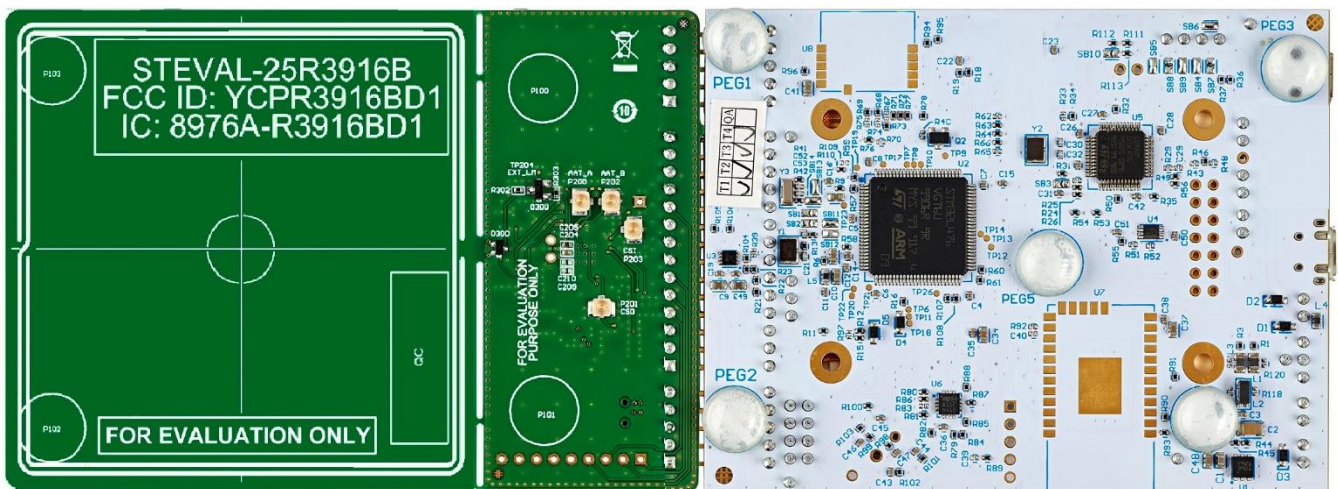
By default, the SPI is the firmware and hardware access bus. The I2C bus can be used instead by changing J200, J201, J202, J203, J204 and J205.

J206 makes it possible to bypass the internal V_{DD_RF} / V_{DD_AM} regulators when an output current higher than 350 mA needs to be supported.

5.2 Antenna and matching network components

This board contains the matching network and the automatic antenna tuning capacitors based on varicap.





6 Schematics

This section contains the schematics for the two boards:

- those for the MB1396 MCU motherboard (figures 9 to 18) include the microcontroller needed to operate the NFC reader IC
- the MB1749 ST25R3916B daughter board (figures 19 to 21) is connected to the ST25_Discovery_Mboard motherboard.

Figure 9. MB1396 - Overview

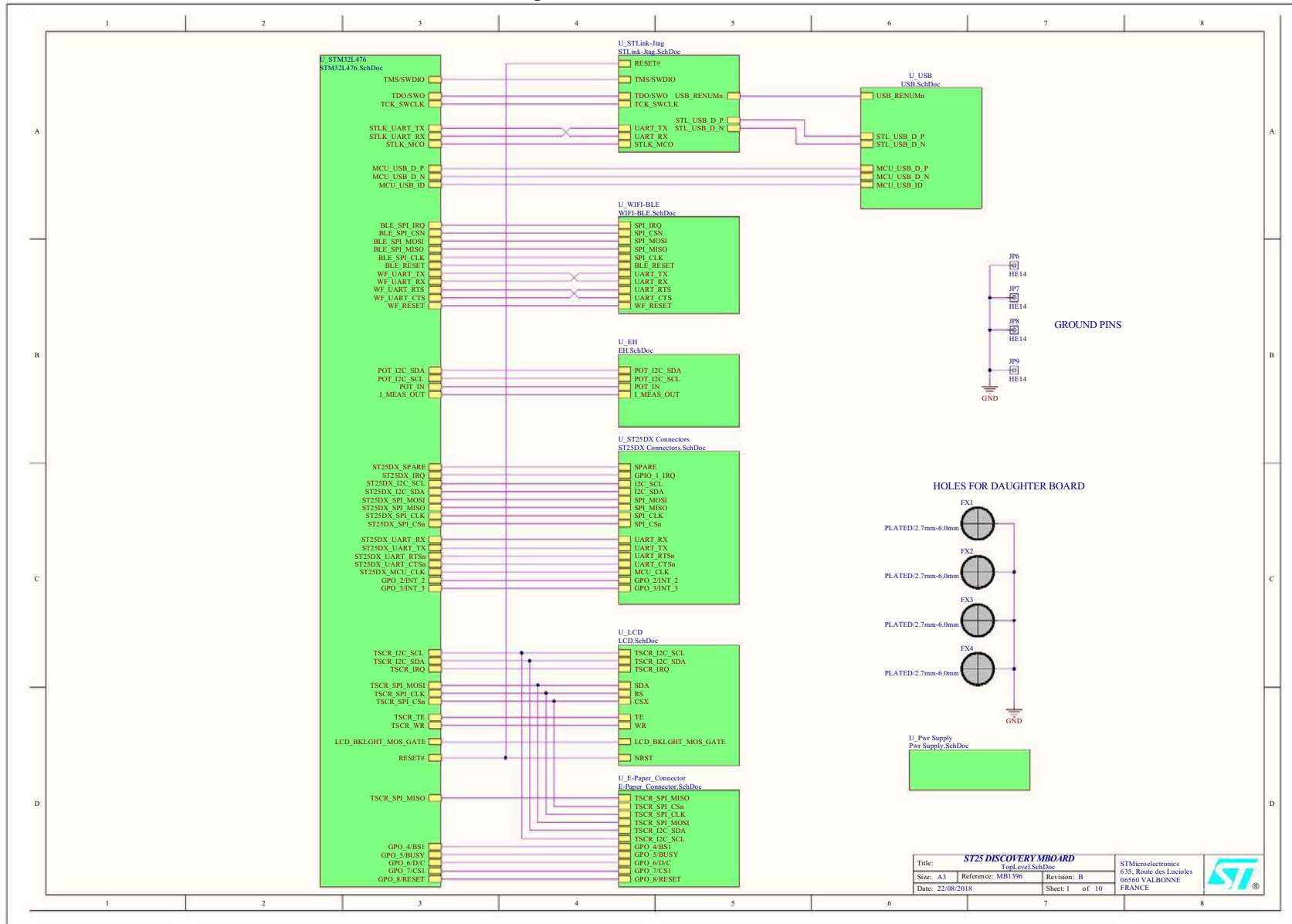


Figure 10. MB1396 - Power

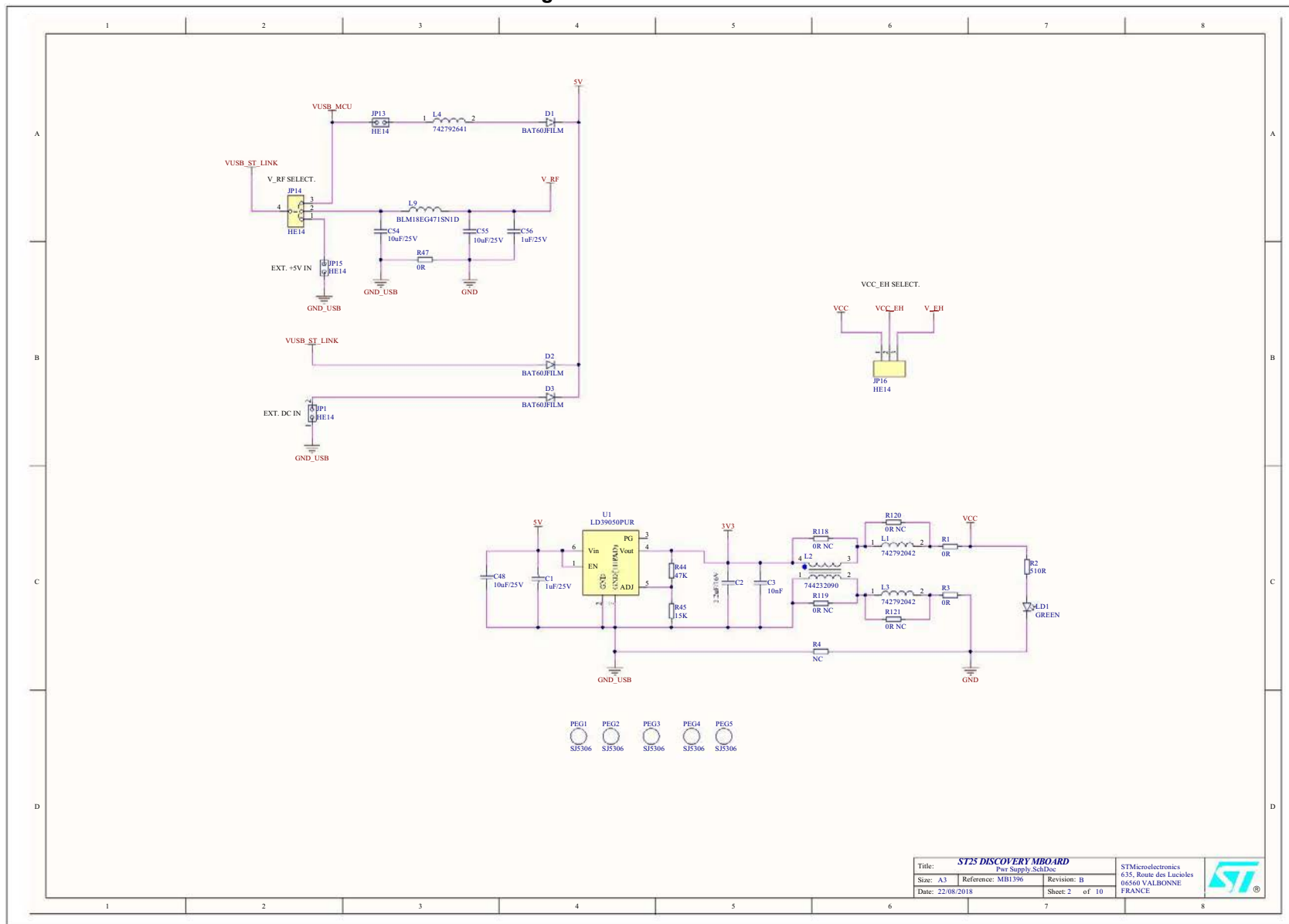


Figure 11. MB1396 - MCU

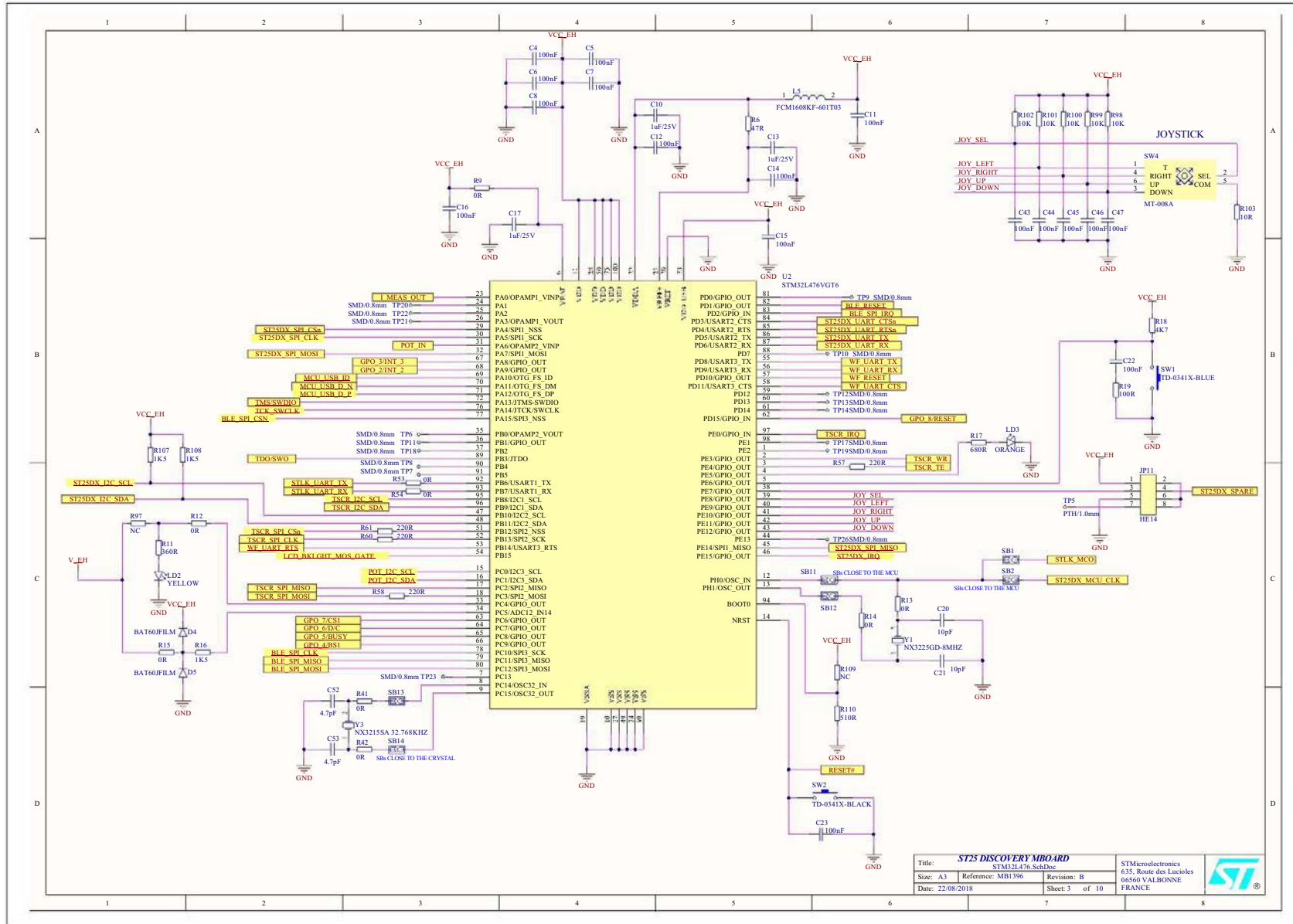
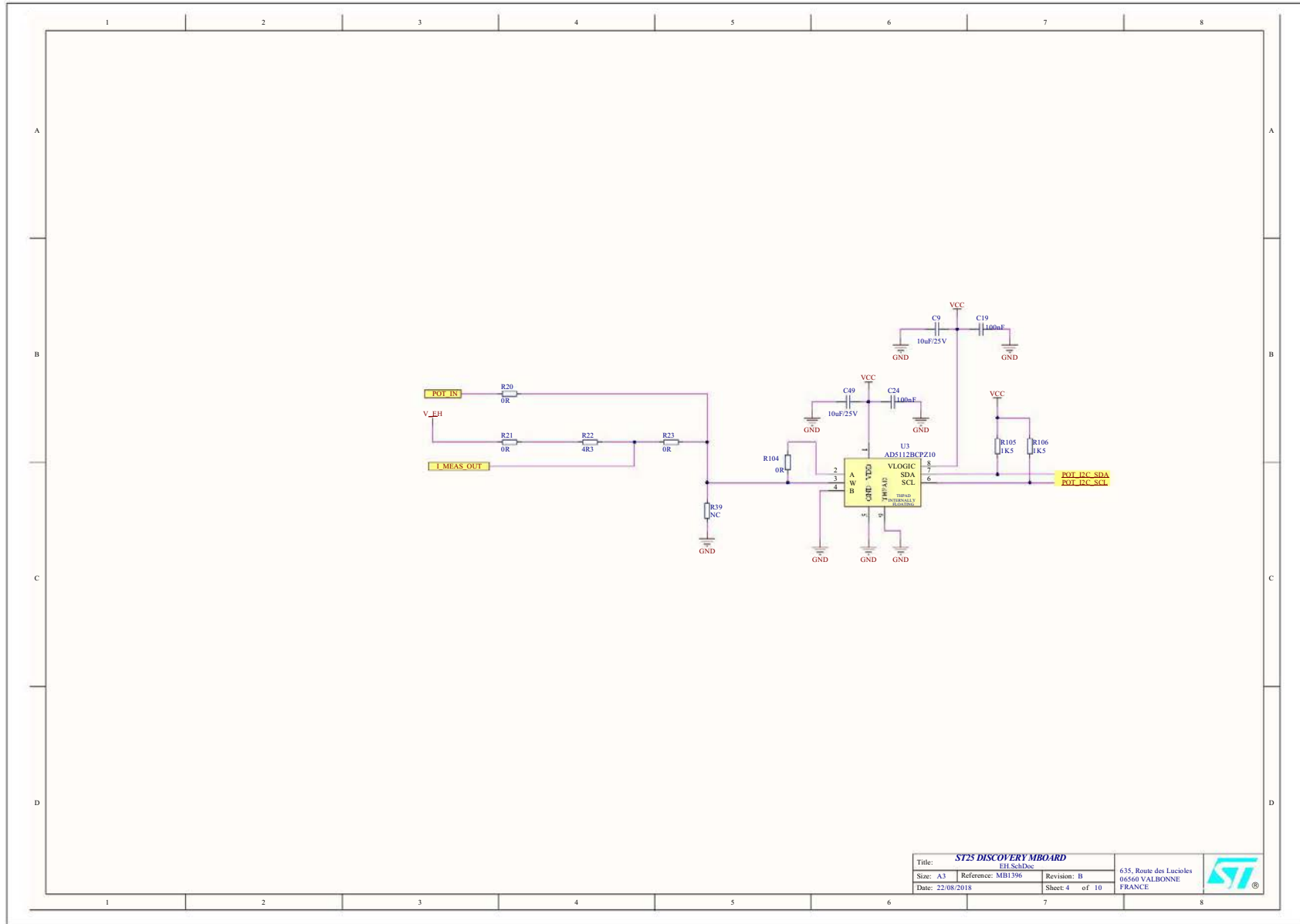


Figure 12. MB1396 - Energy harvesting measurement



Title: ST25 DISCOVERY MBOARD			
Size: A3	Reference: MB1396	Revision: B	635, Route des Lucioles
Date: 22/08/2018	Sheet: 4	of 10	06560 VALBONNE
			FRANCE



Figure 13. MB1396 - ST Link - JTAG

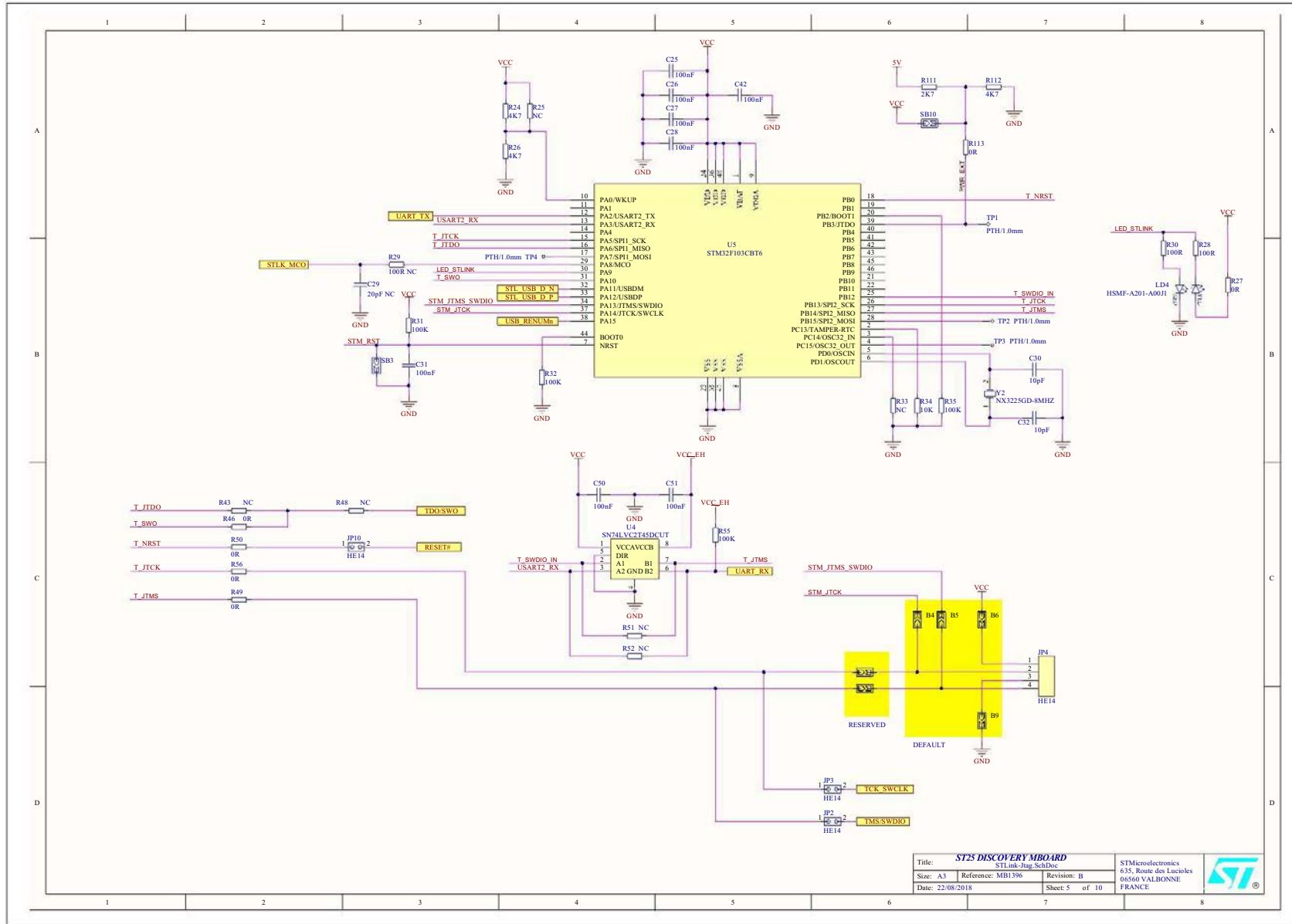
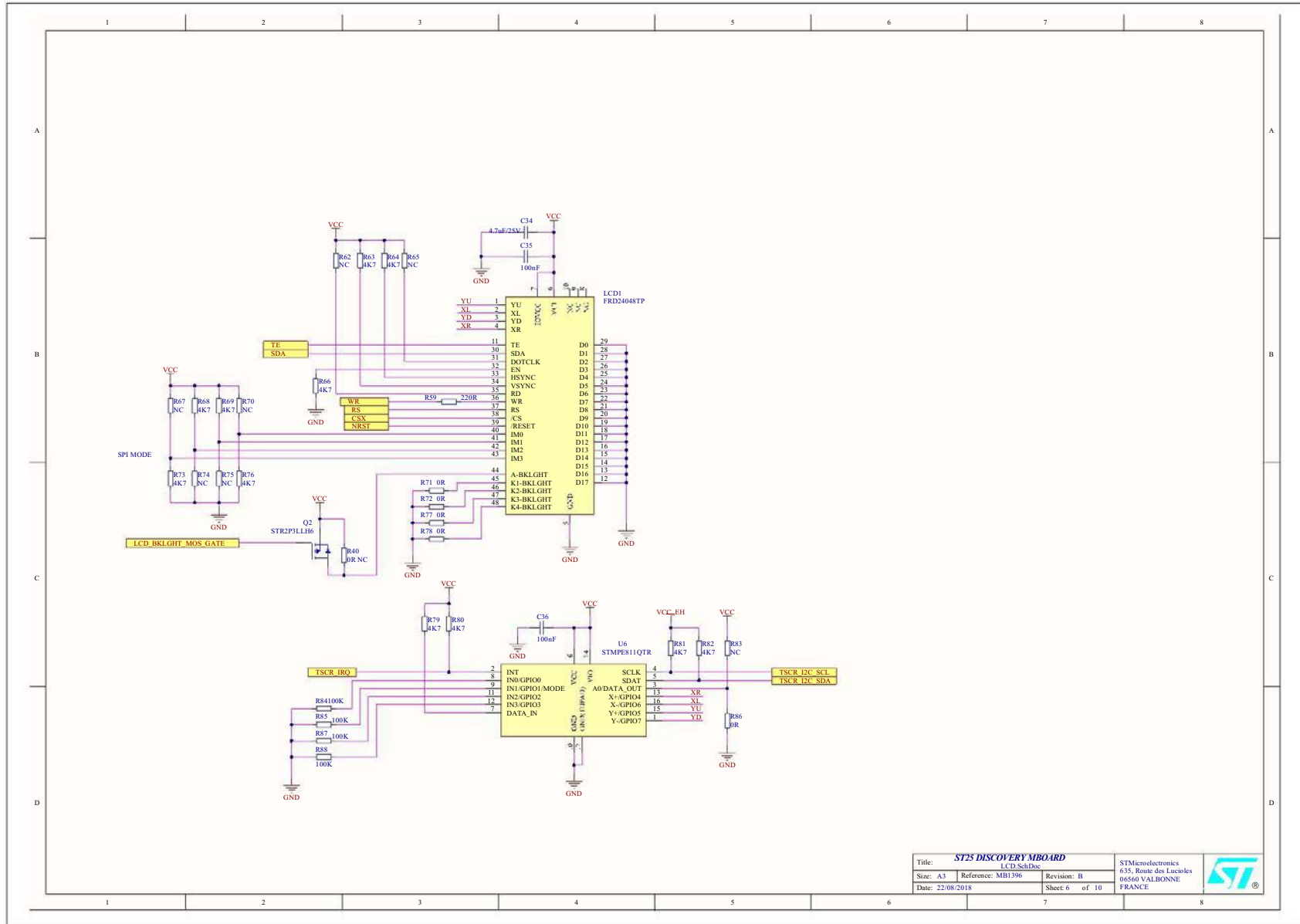


Figure 14. MB1396 - LCD



Title: ST25 DISCOVERY MBOARD		STMicroelectronics	
LCD.SchDoc		635, Route des Lucioles	
Size: A3	Reference: MB1396	Revision: B	06500 VALBONNE
Date: 22/08/2018		Sheet: 6 of 10	FRANCE



Figure 15. MB1396 - BLE and WiFi® modules

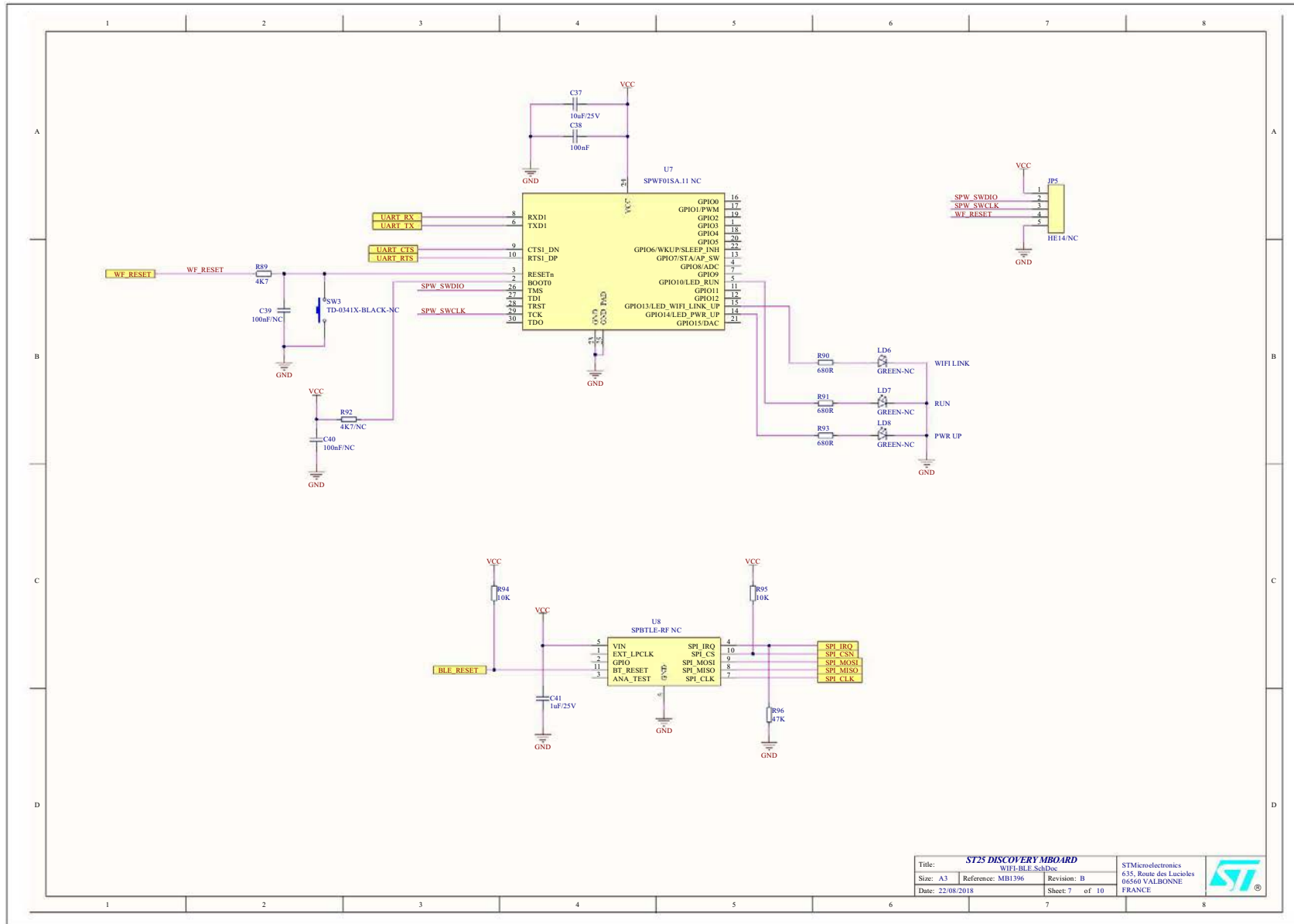
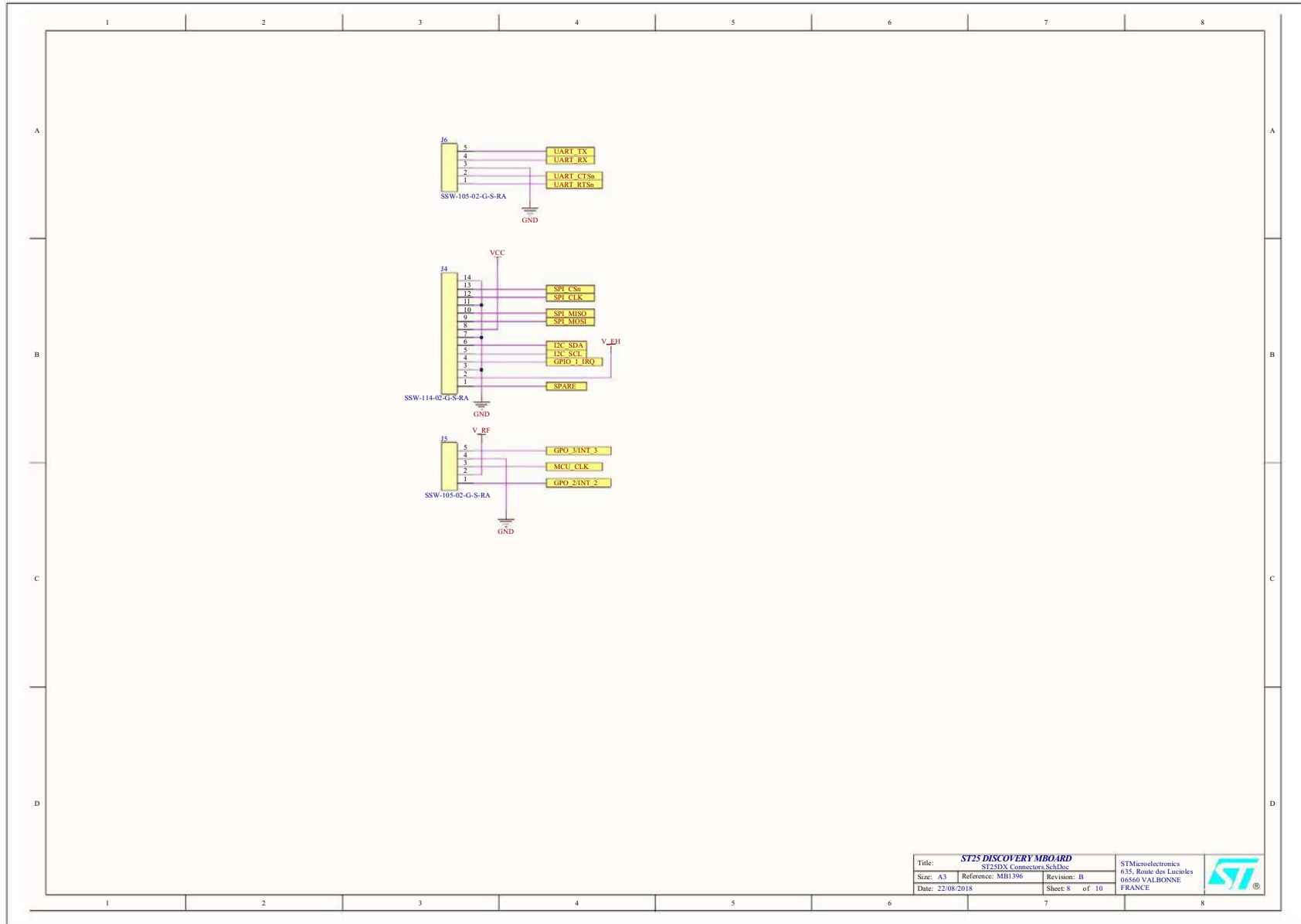


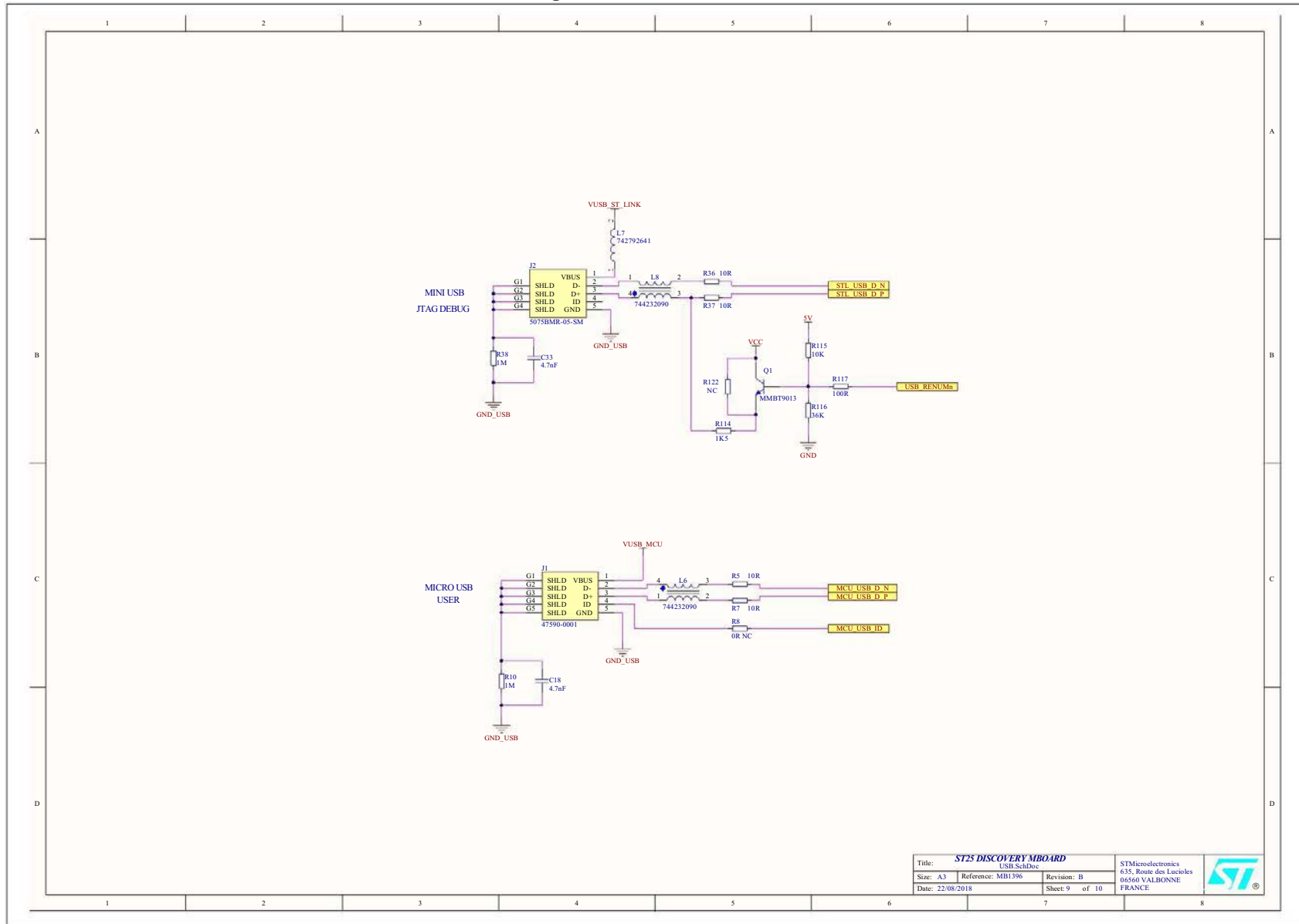
Figure 16. MB1396 - Connectors



Title: ST25 DISCOVERY MBOARD			
ST25DX Connectors SchDoc			
Size: A3	Reference: MB1396	Revision: B	STMicroelectronics
Date: 22/08/2018	Sheet: 8	of 10	635, Route des Lucioles 06560 VALBONNE FRANCE

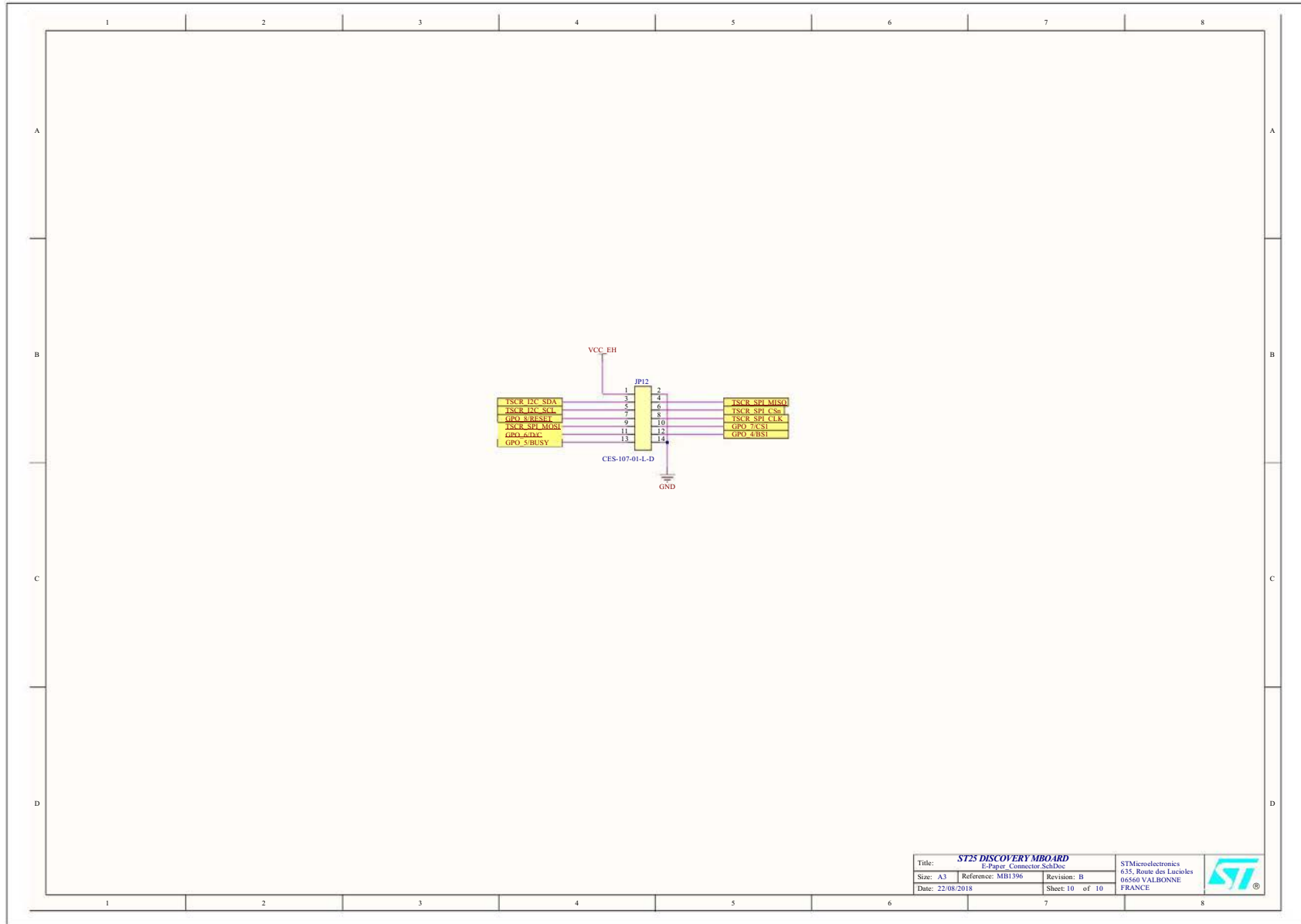


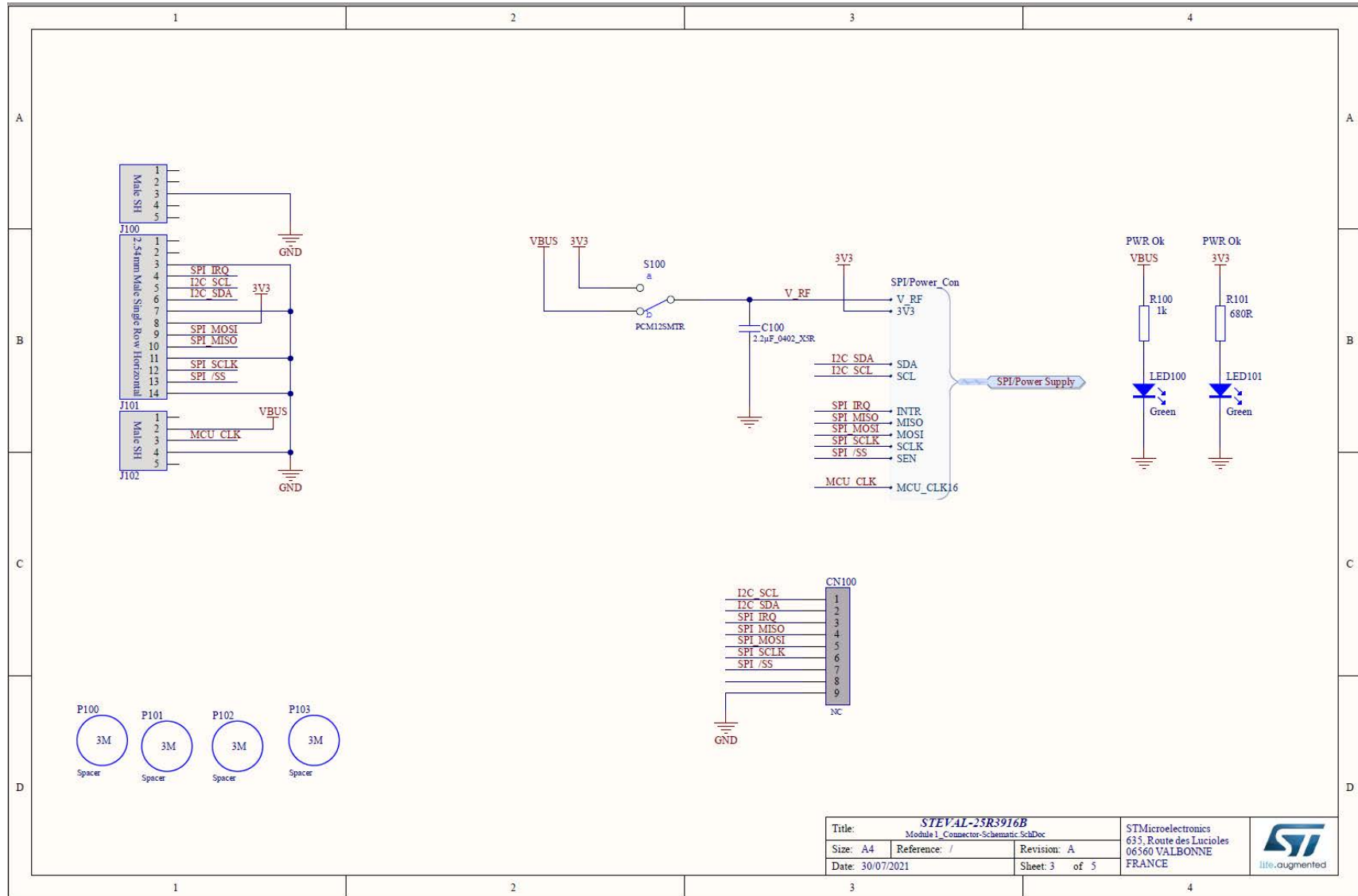
Figure 17. MB1396 - USB



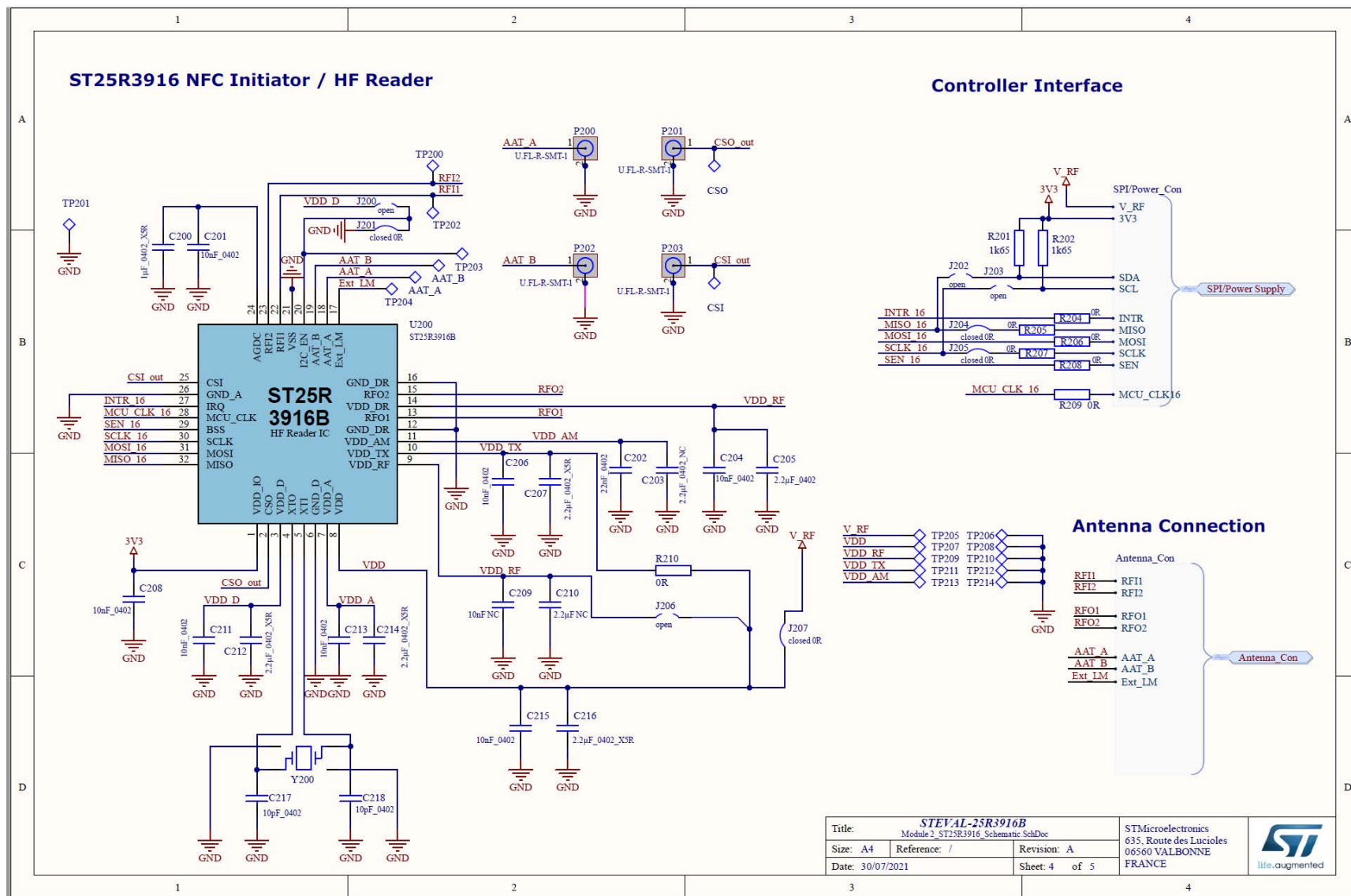
Title: ST25 DISCOVERY MBOARD			STMicroelectronics 635, Route des Lucioles 06560 VALBONNE FRANCE	
USB.SchDoc				
Size: A3	Reference: MB1396	Revision: B		
Date: 22/08/2018	Sheet: 9 of 10			

Figure 18. MB1396 - Epaper connector

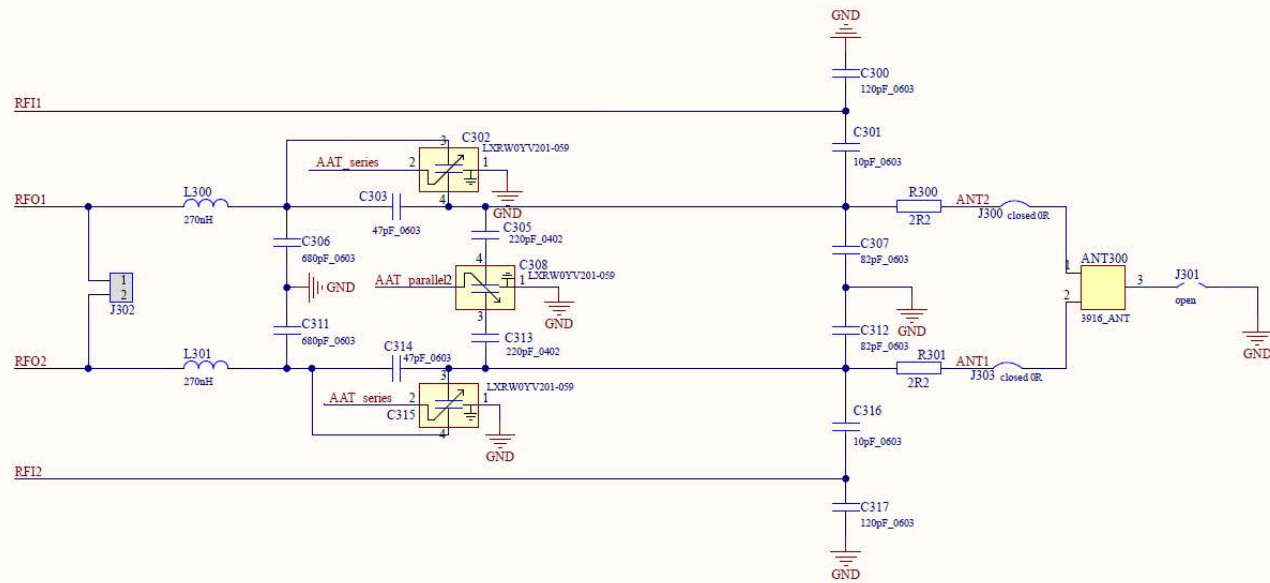




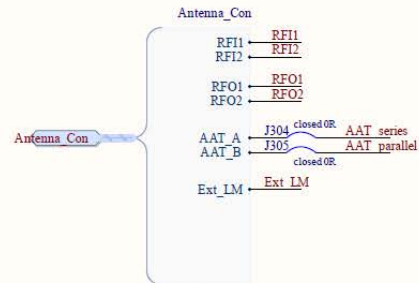
Title: STEVAL-23R3916B			 STMicroelectronics 635, Route des Lucioles 06560 VALBONNE FRANCE life.augmented
Module 1_Connector-Schematic.SchDoc			
Size: A4	Reference: /	Revision: A	
Date: 30/07/2021	Sheet: 3 of 5		



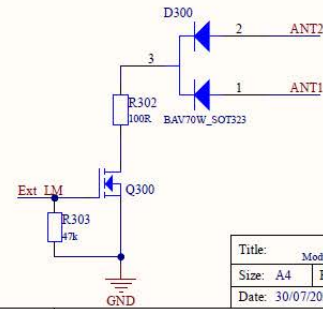
Antenna Circuit incl. EMI Filter and Matching



Antenna Connection



External Load Modulation Circuit



Title: STEVAL-25R3916B			STMicroelectronics 635, Route des Lucioles 06560 VALBONNE FRANCE	 life.augmented
Module 3_Matching_and_Antenna Schematic SchDoc				
Size: A4	Reference: /	Revision: A		
Date: 30/07/2021	Sheet: 5 of 5			

7 Federal Communications Commission (FCC) and Industry Canada (IC) compliance statements

7.1 FCC Compliance Statement

7.1.1 Part 15.19

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.

NOTE: The grantee is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. Such modifications could void the user's authority to operate the equipment

7.1.2 Part 15.21

Any changes or modifications to this equipment not expressly approved by STMicroelectronics may cause harmful interference and void the user's authority to operate this equipment.

7.1.3 FCC ID

FCC ID: YCPR3916BD1

7.2 Formal notices required by the Industry Canada ("IC")

7.2.1 Compliance Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

7.2.2 Declaration de Conformité

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement

7.2.3 IC ID

IC ID: 8976A-R3916BD1

NOTE: The grantee is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. Such modifications could void the user's authority to operate the equipment.

8

Revision history

Date	Revision	
March 2022	Rev 0.2	

Table 3. Document revision history



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