TN0076
Technical note

Improving PCB traceability with RFID technology

Benefits of the RFID technology

The RFID technology is successfully being used in a variety of applications such as mass transit ticketing, library asset management, logistics, anti-counterfeiting, e-passport and contactless banking.

It is also the right solution for improving traceability, supply chain visibility, counterfeiting prevention, and easing the scanning process.

The key benefits of RFID lie in a non line-of-sight, rewrite capability. Moreover, the RFID tags do not need any battery to operate, which makes their lifetime and cost attractive.

Most electronics designers who know the technology understand that they can turn their application into an RFID reader by either using an OEM reader module or a reader IC such as STMicroelectronics' CRX14. This gives them the capability of reading RFID tags.

However, few know that they actually can add the RFID tag function to their application by designing the RFID chip and the antenna directly on the printed-circuit board (PCB). Each PCB is then identified with a so-called UID, which is a factory-programmed-and-locked unique identifier that follows the ISO 15963 numbering standard.

RFID tag ICs also come with different user memory sizes, usually EEPROM memory. They can be used as means of storing and tracking many types of information:

- bill of material
- board revision
- firmware version
- schematics and layout file information
- documentation link
- date code
- manufacturing plant
- manufacturing flow
- key process characteristics
- end product type
- warranty/return information
- repair and upgrade history
- customer information
- anti-tamper information

Thanks to the EEPROM and the RFID technologies, this information can be programmed and updated throughout the entire manufacturing process and beyond. In this way, you can keep track of what happens to a PCB from its manufacturing to the end of its life. If the board is going to be refurbished and upgraded, you will know it.

Moreover, this information can be encrypted by the reader before programming so the data stored in the tag are useless to anybody else who might be reading it. Most RFID tag ICs also come with several data protection schemes to help protect their contents.

When it comes to implementation, RFID chips are available from STMicroelectronics in a soldering-friendly package such as UFDFPN8 (MLP8).

As far as the antenna is concerned, designers would replicate what RFID antenna designers do. To some extent, the inlay process is a very simple, one-layer, thin-flex PCB process where the antenna is etched off. STMicroelectronics application note AN2866 provides insight for designing and validating an RFID antenna.

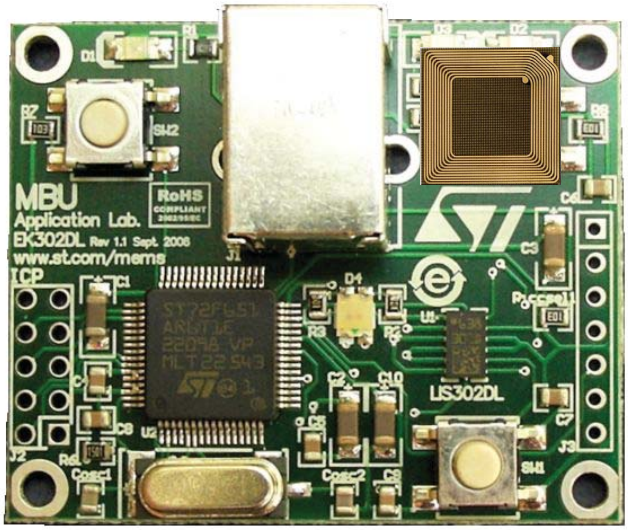
You can design three types of antenna: on-board, off-board and daughterboard antennas.

Antenna types

On-board antennas

Figure 1 shows an on-board antenna example. The pros and cons are then summarized.

Figure 1. On-board antenna



Pros

- Integrated and compact solution
- No connector, better reliability

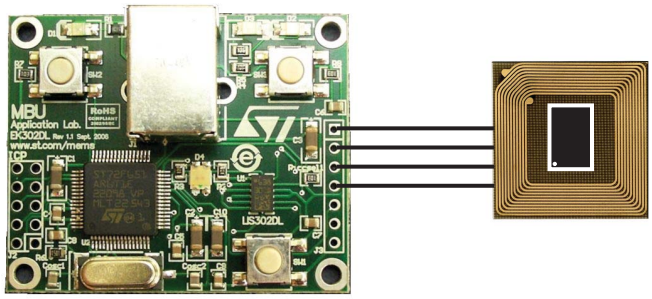
Cons

- Less space available on the PCB for a large antenna. Read range may then be smaller
- More sophisticated PCB design to avoid interference with the RF signal

Off-board antenna

Figure 2 shows an off-board antenna example. The pros and cons are then summarized.

Figure 2. Off-board antenna



Pros

- Antenna may be placed closer to the outside of the device
- Larger antenna may be designed, possibly leading to better read ranges

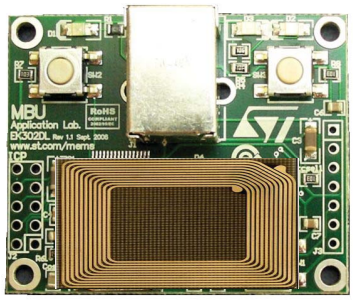
Cons

- Impedance matching, and connections plus wires make the design optimization more critical

Daughterboard antenna

Figure 3 shows a daughterboard antenna example. The pros and cons are then summarized.

Figure 3. Daughterboard antenna



Pros

- Accommodates designs with space constraints

Cons

- Impedance matching and connections make the design optimization more critical
- Because there may be very little space between the antenna and the board, the read ranges may be limited

STMicroelectronics' RFID products

STMicroelectronics offers a wide range of RFID tag ICs that covers the HF (13.56 MHz) and UHF (800-950 MHz) frequency bands and offers a user memory whose capacity goes from a few hundreds to several tens of thousands of bits.

The LR (long-range) series, based on the ISO 15693 standard, and the SR (short-range) series, based on the ISO 14443-B standard, both operate at 13.56 MHz. LR and SR devices are particularly well suited to PCB traceability applications because they:

- offer well contained read ranges
- allow a simple and straightforward antenna design
- are used in many industries
- are interoperable with a wide range of readers

STMicroelectronics' RFID products are ideal for PCB traceability applications owing to the combination of key features:

- best-in-class read ranges
- high-reliability and -endurance memory
- availability in different capacitance values for a wide choice of antenna sizes
- availability in different forms, including UFDFPN8 (MLP8)
- wide range of memory sizes

Revision history

Table 1. Document revision history

Date	Revision	Changes
25-Mar-2009	1	Initial release.