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RFID Systems

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FORM-FACTOR CONSIDERATIONS FOR EMBEDDED SYSTEM RFID READERS

WHAT PHYSICAL SPECIFICATIONS PLAY A ROLE IN INTEGRATING CARD READERS?

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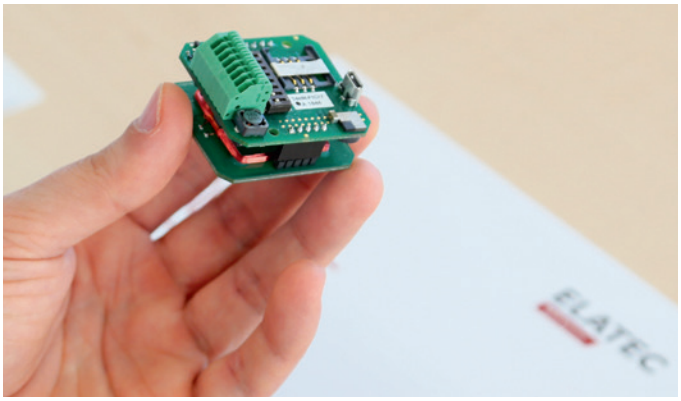
One key aspect of hardware design is choosing an appropriate form factor for your product. In today's world, form factor not only defines your product's size and shape but also includes its aesthetic appeal. While size and shape are important, another aspect that is prominent when dealing with RFID card readers (including NFC and BLE mobile credential readers) is the reader's location within the end device and the size of the RF antenna. This article focuses on some key considerations relating to form factor and other physical specifications that play a role in integrating card readers.

The considerations are:

INTEGRATED VS. EXTERNAL ANTENNA

When a device that hosts an RFID reader module is being designed, the module is often part of a larger system and behaves as a peripheral. It seldom happens that the RFID module is a perfect fit for the product being designed. This can result in the location of the RFID module not being ideal for user interaction. For instance, the host or motherboard might be in a central area of the product, and running a long wire or connector to the card reader for communication might not be an option.

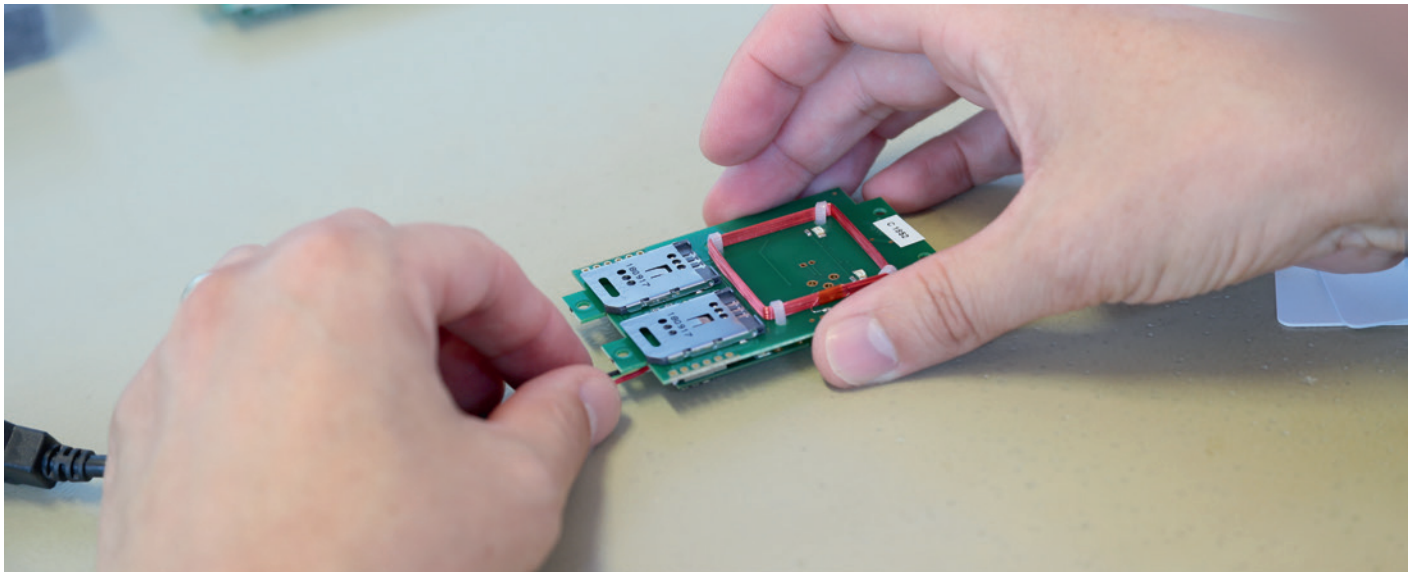
In such a case, if a card reader with integrated antennas is used, then the distance between the surface of the product (where users usually interact) and the reader will not be optimal. This can lead to read-range issues, resulting in a substandard user experience. The solution would be to use an external antenna with the card reader. The reader should be able to support external antenna connections that alleviate problems associated with the reader's location near the surface.



MODULES VS. FINISHED READERS

There is always an option available between an RFID engine or module and a fully finished reader. RFID modules are electronic boards that require hardware integration and are not plug-and-play devices. They contain the pin configuration or connectors necessary to interact with the host board and to interface with the antennas. Fully finished card readers, on the other hand, are ready to interface with the host, requiring little or no hardware integration, and they have antennas already integrated.

Card reader manufacturers understand and appreciate that not all finished products may meet the technical specifications of an end user or its target market. There may be shortcomings in the areas pertaining to, but not limited to, the size of the antenna (read range), voltage requirement, form factor, communication interface, etc. Hence, one can take advantage of RFID modules that are essentially RF engines comprising the hardware, software and other necessary interfaces required to read and transfer RFID data to the host.



In many cases, OEMs and systems integrators do not want to invest resources in designing an RFID engine that processes various technologies available worldwide. Their end goal is to focus on their product line, and not to develop an RFID reader from scratch. For example, due to stringent specifications enforced by an end customer, a finished card reader might not be capable of meeting its form-factor and transponder read range expectations. In such a scenario, the OEM could choose an RFID module that meets the user's form-factor requirements and a separate antenna to fulfill the read-range expectation.

Although the above solution is convenient, the costs involved may vary. One of the most important differences between an RFID module and a finished reader is the availability of certifications. If the RFID module lacks integrated antennas, it will not carry radio certifications. If an OEM or systems integrator chooses to move ahead with an RFID module, it must bear the cost of, and often protracted timeframes for, radio certifications, or else contract it for a non-recurring engineering (NRE) fee. For this reason, evaluating the choice between an RFID module and a finished reader becomes highly crucial.

SIZE VS. PERFORMANCE

As electronic hardware continues to shrink in size following Moore's law and other related patterns, users are more inclined to choose a smaller form-factor-based product. Although small form-factor card readers are typically beneficial in terms of ease of integration, there is a need to thoroughly evaluate the performance that you expect. In connection with RFID card readers, a smaller form factor would also mean a smaller diameter or circumference of the RF antenna, which means the amount of energy transferred to the transponder is less. This attribute directly affects read range. For instance, a transponder that could have been read by a larger

antenna from about 4 inches away can now only be read at 2 inches by a smaller antenna.

That being said, the antenna design and the RF front end of the card readers greatly influence the amount of energy transmitted, thus affecting the read range. For example, two readers identical in antenna circumference may not propagate the same amount of energy if the antennas are designed differently (e.g.: symmetrical vs. asymmetrical) or if the RF front end is much more efficient.

In addition to this, present-day transponders (RFID credentials) have a lower energy requirement that is reducing the need for larger antenna circumference. With advancements in transponder design, static ID detection and memory operations are much faster and can happen over comparatively long distances. This enables users to find a tradeoff between selecting a reader based on desired physical specifications and doing so based on performance.

AVAILABILITY OF ONBOARD CONNECTORS, HEADERS AND MOUNTING OPTIONS FOR EASE OF INTEGRATION

There is a need to connect hardware devices to establish appropriate communications. Although there are an increasing number of wireless interfaces, such as BLE, that can be used for communication between devices, the most reliable means of communication are wired protocols. For ease of integration between electronic components and, in this case, between a card reader and a host, the availability of onboard connectors is necessary.

These connectors help to establish a point-to-point or point-to-multipoint communication with the requirement of little or no hardware or mechanical integration on the OEM's side. The use of standard connectors also enables OEMs to source their counterparts readily, avoiding the need for custom development. Of course, it isn't possible to provide onboard connectors for every hardware communication interface, and in such a scenario it is helpful if the device has through-hole pins or headers that can be provided which correspond to the pin configuration present on the PCB.

Additionally, mounting options go a long way toward supporting the mechanical integration or installation of the card reader within a product. They not only bolster the installation of the card reader, but also appeal aesthetically. For example, imagine a scenario in which a multifunction printer (MFP) adds support to a card reader. If there are options such as embedding the reader within a plastic enclosure inside the MFP, or the availability of holes to mount the reader on the MFP, it not only strengthens the install and ensures safety, but also adds to the aesthetic appeal.

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