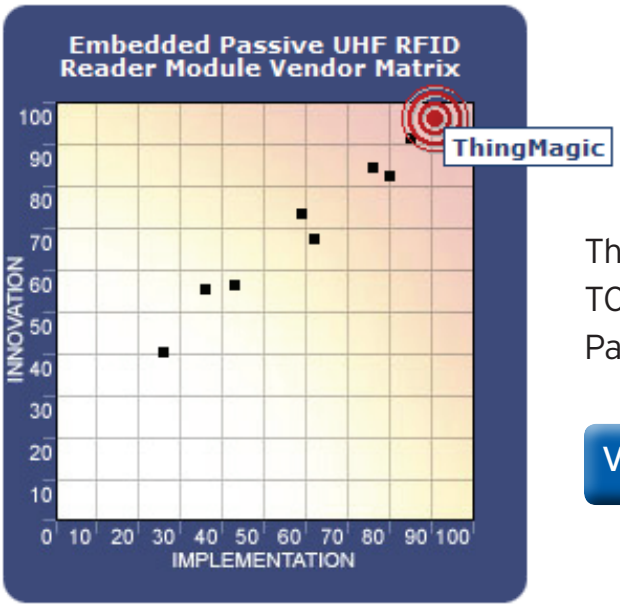
ThingMagic
A DIVISION OF TRIMBLE

10 Criteria for Selecting an RFID Reader Module



ThingMagic has been ranked in the overall TOP position of the ABI Research Embedded Passive UHF Reader Module Vendor Matrix!

Visit www.thingmagic.com to read more.

Introduction

Its time to reshape the way we think about RFID. With the small size and high performance of embedded RFID modules, the market has evolved from providing one-size-fits-all readers to form factors that can be used in just about any application. This advancement allows customers to move beyond limited, siloed deployments of RFID toward integrating the technology into a great number of mobile and stationary devices and with the enterprise infrastructure. Customers can now focus on data generated by an RFID-enabled product or system and determine how it can best be applied to their business processes. The key point is that the technology itself is no longer a barrier to entry.

So, if you are an original equipment manufacturer or solution developer considering bringing an RFID-enabled solution to market, how should you get started? How do you choose what approach is best for your business and your customers' businesses? There are several options to consider.

1. Build an RFID reader using discrete components

While this process provides the flexibility of designing to your own specifications, you must source all of the components and own the design, development, test and certification processes. This process is complex, time consuming and expensive.

2. Build an RFID reader using an RFID reader chip and a reference design

Using an RFID reader chip and reference design can save some time, but you still need to have a deep understanding of RFID protocols and take on significant development, test, and certification resource and cost burdens.

3. Build an RFID reader using an RFID module

For most applications, there are considerable advantages to starting the development process with an RFID module. By using an RFID module, you are selecting a product that has been designed to meet market needs. And, RF performance, optimization, and certification for regional use have already been addressed, resulting in significant time-to-market and cost savings.

ThingMagic's family of embeddable RFID modules allow OEM customers to seamlessly incorporate RFID into handhelds, printers, manufacturing lines, vehicles, and more. Our entire line of RFID modules and finished RFID readers are supported by the same application programming interface, providing a common platform to speed development and time-to-market of highly complementary RFID-enabled solutions. These products represent significant advancements in performance, utility, hardware, and software features that allow our customers to add RFID to a growing number of connected enterprise applications.

Through development kits and universal software tools and interfaces, we are lowering the barriers to RFID technology adoption.

10 Criteria for Selecting an RFID Reader Module

1. RF Power Output

The RF power output level (and antenna) will determine the distance at which tags can be powered up. If you cannot power-up a tag, you cannot read it.

2. RF Receive Sensitivity

Technically, it is much more difficult to build a sensitive tag than a sensitive reader, so the reader receiver should be sensitive enough that if the tag is successfully powered-up, the reader can decode the signal returned from the tag.

Be very careful about trusting published receive sensitivity numbers. Because the reader transmits and receives on the same channel, the biggest cause of low receive sensitivity is the inability of the reader to reject reflections of its own raw carrier (from poorly-matched internal components, antenna connectors, the antenna itself, and metallic objects near the antenna), which can mask the desired reflected signal from the tag. Vendors often measure the receive sensitivity either while not transmitting, or at the lowest supported transmit level, which can lead to very erroneous calculations of how far tags can be read. Modules that feature "self-jamming cancellation" will achieve best receive sensitivity in real-world environments.

3. DC Power Consumption

If the application is an AC-powered reader, the DC power consumption of the module will be of little concern, but many modules are used in battery-powered readers and printers where power consumption is critical. As such, key features to look for are:

- Power consumed while transmitting at maximum RF output power levels
- Ability to save power by transmitting at less than the maximum RF power level

If the module is used in a battery-powered application, the power consumed when the reader is not actively transmitting may be more important than the power consumed when it is transmitting. Depending on how often the reader is actively looking for and communicating with tags, consider:

- Power consumed while idle (i.e. just ready to transmit or just ceased transmission)
- Sleep-mode options
- How sleep mode is activated (timer? Explicit command? Control pin?) and how it is exited
- How quickly can a module in sleep mode can be ready to transmit (this will often determine how much of the time the module can be allowed to remain in Sleep mode).

4. Module Size

As RFID is considered for a greater number of products and solutions, the size of the RFID module becomes a more critical factor. Solution developers may benefit from working with a vendor that offers several modules of differing sizes and capabilities, allowing for the development of highly complementary connected enterprise applications.

Some applications require modules to have a maximum size, usually if the reader needs to have a small form factor or if UHF RFID is being added to a reader that was not originally designed to support this technology and limited space is available to accommodate the module. Module size, however, should also be viewed within the context of performance. Sacrificing performance for size typically does not pay off.

5. Number of RF Ports

One RF port is sufficient for many applications, but there are many applications where more than one port is required:

- SMA – allows the module port to be pushed through a hole in the enclosure and used directly
- MMCX – small edge connector that can be disconnected and connected repeatedly, but needs a cable to connect it to the readers bulkhead connector or to an internal antenna
- U.FL – small connector that can be anywhere on the module and unique because it protrudes vertically from the board; It cannot be repeatedly re-connected and supports only a small RF cable, so the bulkhead connector or antenna must be located fairly near to the module

6. RF, Power and Control Physical Interfaces

Module RF interfaces are of three types:

- SMA – allows the module port to be pushed through a hole in the enclosure and used directly
- MMCX – small edge connector that can be disconnected and connected repeatedly, but needs a cable to connect it to the readers bulkhead connector or to an internal antenna
- U.FL – small connector that can be anywhere on the module and unique because it protrudes vertically from the board; It cannot be repeatedly re-connected and supports only a small RF cable, so the bulkhead connector or antenna must be located fairly near to the module

Power/data connectors come in four types

- Common external connector: Such as a micro USB connector, which could be accessed through a hole in the reader enclosure
- Multi-pin cable connector: Requires a mating connector to be plugged into it; Provides the most flexibility for locating the motherboard connector relative to the module's connector
- Ribbon-cable connector: Does not require a mating connector – the connector has a locking mechanism so a ribbon cable with exposed contacts on both ends is used between the module and motherboard; For best results, the motherboard connector must be aligned with the module connector (although ribbon cables can be folded to accommodate an offset
- Board-to-board connector: The connector on the module plugs directly into the connector on the motherboard without an interconnecting cable; This is often used to achieve the lowest profile, but can make heat sinking difficult as it is difficult to mount the module on a heat sink and to the motherboard simultaneously.

7. Heat Dissipation

UHF RFID readers dissipate heat when transmitting. The maximum amount of time the reader can transmit is often related to the maximum ambient temperature inside the reader and the ability of the module to dissipate its heat to the reader's enclosure. A heat sink of some sort will be needed to conduct the heat from the components on the board to the enclosure.

8. Support for Optional, and Custom, Gen2 Commands

To gauge whether the module is future-proofed, look to see whether the vendor has kept up with recent features introduced in Gen2 tags. If the module vendor is using stock off-the-shelf firmware from the Gen2 reader chipset vendor, and therefore do not have the ability or desire to update the firmware, then these features will often be lacking.

9. Availability of an API That Supports Planned Host Applications

Time-to-market will be significantly decreased if the programs that control the reader can interface with the modules at a program level and do not have to explicitly deal with low-level tasks such as:

- Establishing and tearing down communication channels to the module
- Assembling command packets, which often involve calculating a cyclic redundancy check (CRC)
- Interpreting responses and error messages

Solution developers may benefit from working with vendors that offer a common software interface across their product families as this can speed time-to-market market and reduce development cost.

10. Global (or multi-regional) Compliance

Certifying an RFID reader for global or multi-regional operation requires strict and ongoing compliance. By using an RFID module that has been certified, solution developers are starting with a product that has been designed to meet market needs and that has been fully tested and approved for regional use, reducing time to market and overall development costs.

FCC Modular Certification: The FCC requires that RFID equipment be certified either at the module level or the reader level. If the module can be certified alone, then it can be used in multiple readers without the need to certify each reader individually.

In order to be able to be submitted for FCC approval, a module must contain its own DC power conditioning circuitry to ensure that noise on the DC power input line cannot become RF noise that is radiated out the antenna. If this power conditioning does not exist, the FCC will insist that the entire reader be tested to ensure that it does not put noise on the DC power lines to the module.

ThingMagic Market Leading UHF RFID Reader Modules

M6e Reader Module

2.7 in L by 1.7 in W by 0.3 in H. Near to long read range (over 30 feet).
Offers world leading performance, form factor, and time-to-market advantages.
Provides 4 ports and will operate to a level of +31.5 dBm. Designed to the performance standards of full size readers, but is small and efficient enough to be used in mobile applications.

M6e-Micro Reader Module

1.6 in L x 1.0 in W x 0.16 in H. Near to long read range (over 30 feet).
Provides 2 ports and will operate to a level of +30 dBm. Add high-performance RFID to printers, hand held devices and scanners, RFID readers and portals, point of sales devices, mobile device accessories, and more.

M5e Reader Module

3.23 in L by 2.13 in W by 0.2 in H. Near to long read range (over 30 feet).
Ideal for adding read/write capabilities to a wide range of devices, from high speed label printers, to inline testing solutions, to fixed and mobile readers in a variety of form factors.

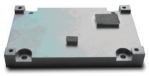
M5e-Compact Reader Module

2.2 in L x 1.4 in W x 0.2 in H. Near to medium read range (12 inches to over 13 feet).
Ideal for applications where small size and low power consumption are essential. It can be used in hand-helds, mobile printers, and any device that trends towards size because of desire to miniaturize.

M5e Module Accessories

4 Port Multiplexer allows one M5e module to support up to 8 ports ; compatible with M5e antenna detection and search algorithms

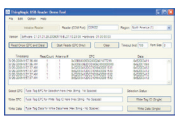
Power / Interface board converts the M5e serial interface to high speed USB and conditions incoming DC power to support in-vehicle or AC powered applications



M5e heatsink allows use of the M5e module in environments where continuous reading or high ambient temperatures are required

ThingMagic Developers Kit and Mercury API

MercuryDevKit contains all the components necessary to begin reading and writing RFID tags using a ThingMagic RFID Reader Module



ThingMagic modules come with a variety of easy-to-use development tools. The ThingMagic MercuryAPI provides a common platform to develop highly complementary RFID enabled products. Our Web UI offers intuitive configuration screens and tag data displays and the ThingMagic Universal Reader Assistant can be used to initialize readers and select application specific performance settings.

For more information, visit www.thingmagic.com.
To purchase ThingMagic products, please email salesteam@thingmagic.com or call 1-866-833-4069 (International callers dial +1 617-499-4090)

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