

Radio Frequency Identification (RFID) Vs Barcodes

Which one to choose? Which one is the better technology? Why choose one over the other?

Answer: It really depends on the application, and what you want to achieve.

Barcodes – in the retail market

In today's society, the barcode is still the dominant technology when it comes to the retail market. **Why?**

Cost is the only reason why it is the preferred technology because the cost involved in printing barcodes is so cheap that does not give RF tags a chance for retail applications. However, this is understandable since the cost of a barcode is relatively negligible, approximately the same cost as printing out a piece of paper on your printer. Also, it would be the logical solution when you have an item that is a few cents or a few dollars in price. It also makes perfect sense that it will be of no benefit to have the tag cost more than the product.

What are the benefits using Barcodes?

The barcode is simple and easy to apply. They can be made in either printed in small or large sizes and basically applied to any smooth or finished surface. However, the cost advantage is really the only true benefit that barcodes has to offer and it is only limited to a few market applications.

Barcodes are ideally used only to monitor items, such as their item number, location & price, and are registered within close proximity of the scanner. It is the cheapest and relatively quick method to scan objects through a register.

However, as with all technologies, there are also limiting factors that must be considered before deploying the technology.

Barcodes is governed and operational under the following conditions.

1. The barcode must be in the line of sight of the scanner.
2. The scanner must be within 4-8 inches of the scanner for a successful read.
3. Numerous items in an automated production line must be "precisely" controlled or scanned individually by a staff member, (such as check-out personnel).

Being only a line-of-sight technology, barcodes does not give any security capabilities. So theft of a product is not easy to detect or monitor. Also bar codes are easy to be duplicated and manipulated so that they can pass unsuspecting intruders or thieves.

What about RFID? – What's with all the hype?

RFID popularity is growing at an alarming rate, statistically shown as one of the top marketed products to date, as it provides a huge complimentary extension to what barcodes cannot offer.

Barcodes are ideal when it comes to the retail market, but what about everything else?

What are the applications that use RFID?

1. Supply Chain and Logistics
2. Security
3. Retail Automation
4. Vehicle Theft Protection
5. Livestock Identification
6. Document Tracking & Management
7. Proximity Identification & Access Control
8. Road Tolling
9. Car park Access

What are the benefits with RFID?

In essence, the possibilities of RFID are just about limitless. The applications mentioned above are just some of the very few yet main applications that they are involved in.

1. One of the main advantages that RFID has over barcodes is that it is not line-of-sight. Non-metallic objects between the view of the reader and tag has no influence on the read performance or functionality of the system.
2. The read distance is also a major advantage that RFID has to offer. Depending on the read distance you require, most technologies concentrate on the short distance applications (up to 2m). However, some technologies have been recorded to be capable of going as far as 30m read distance.
3. RFID offers very high security. Each tag is identified by a Unique Identification Number (UIN), which can be either factory or manually programmed and then password protected. The excellence of this tag is that the data on the chip that uses sophisticated algorithm techniques cannot be duplicated or manipulated. Hence making it the perfect tool for Secure Access Control and Vehicle Theft protection.
4. Some RFID technologies provide “anti-collision” capabilities, which is the ability to identify multiple tags within the vicinity of the reader. This has been an increasingly popular need for items that need to be either tracked or identified within a large population of tags. The most popular use of this function is document tracking and management, particularly library books, CDs, DVDs or any other confidential material that needs to be controlled and organized.
5. The very first use of the technology was to identify livestock. The benefits of these transponders are that they are also able to be implanted within the animal and still be read successfully. This also gave the idea to some others that the technology was also suitable for underwater applications. Either to track particular underwater pipes or monitor the research of marine life.
6. There are many products are moving in and out from a warehouse. But the duty to scan each product as it comes in or out? This can be a laborious and time consuming task. The opportunity to have an automated system using RFID can make the process a whole lot streamlined and avoids the bottlenecks in the process.
7. Stocktaking is the most frustrating times of the year in a warehouse with a lot of product. If a RFID system is employed, the time to count items will be a whole lot quicker, simpler and the chances of human error is dramatically reduced. Let’s face it, no matter how many times you count it there is always still something missing or out of place.

Why is RFID more expensive?

The make up of a RFID transponder is a little more complicated than a set of printed lines (or bars) like with barcodes.

RFID consists of:

- an antenna,
- a capacitor,
- a smart chip,
- and some tags also have a battery.

So it is not really hard to understand why it is more expensive. Much thought has gone into the process to reduce the cost in order to gain the competitive advantage, but the material, labour and manufacturing costs can only be driven down to a certain extent.

The price of RFID equipment and tags is a substantial jump, but as the old saying goes “you pay for what you get”. On the same token, where RFID cannot compete with barcodes on price the benefits of RFID certainly out perform the advantages that barcodes unfortunately can never offer.

How many technologies are there with RFID?

At present, there are basically 5 technologies that are available to the Australian market. They are frequency bandwidth dependant and they are as follows:

1. 125 kHz (LF-Low Frequency)
2. 134.2 kHz (LF-Low Frequency)

3. 13.56 MHz (HF-High Frequency)
4. 2.45GHz (Microwave Frequency)
5. 5.8 GHz (Microwave Frequency)

There is also a selection of passive and active transponders (also called “tags”).

- Passive meaning that there is no battery and generally the read distance suffers. (LF & HF)
- Active tags have an inbuilt battery that assists with the read distance performance. (Microwave)

Passive tags are generally made for the Low & High Frequency technologies. These tags are a lot cheaper due to the battery-less design. However, with the active tags, you are paying up to ~20x the amount, but again you are able to achieve ~10x read distance.

The active tags are made for the microwave frequency technology and the reader associated with the microwave equipment is also very expensive. The microwave technology is a very sophisticated design for very specific needs (eg. road tolling), but when extra read distance is required then there is also a price associated with the need.

But, I heard about a 900 MHz UHF passive tag system that has a 2-3m read range..?

There is also another technology that is available that customers usually ask us about, but unfortunately it is not feasible to be used here in Australia. This technology operates in the UHF – Ultra High Frequency band from 900-926MHz. It looks and operates the much the same way as the 13.56MHz technology.

This technology is available in the US, but the reason why it is not feasible here for Australians is because the output power levels allowed. In the US they are allowed up to 4W, which successfully gives them a 3m read range.

Unfortunately for Australia and NZ, we are only allowed up to a maximum output power limit of 1W, which brings us back down to the 1m read range. This is the same as what you can already achieve with the 13.56MHz equipment. There has been a lot of debate and struggle to increase this output power level with the ACA – Australian Communications Authority but it is highly unlikely that this will ever eventuate.

In addition, our local telecommunication carrier providers (Telstra & Optus) have bought the right to frequencies on either side of <918 and >926MHz frequencies, and if anything they will eventually squeeze and buy out this remaining frequency range so that there will be no use or even allowance for this technology to be here at all.

In essence, it is too much of a high risk to use this technology here. So that is why we have never introduced this technology here as there are no added benefits to do so.

What does Electro-Com have to offer?

Electro-Com is a professional engineering firm that has over 10 years RFID experience, keeping ahead of the competition and up to date with new technologies available on the market. Electro-Com is a highly reputable company that understands what is going to be the most beneficial and feasible technology for Asia Pacific region and its customers with highly trained technical support and excellent product quality.

Electro-Com is the sole distributor of Texas Instruments for Australia and New Zealand and they are able to provide the following technologies from Texas Instruments (TI-RFID):

- 134.2kHz Low Frequency
- 13.56MHz High Frequency

Low Frequency 134.2 kHz

Texas Instruments (TI-RFID) initialised its foothold into the RFID market by introducing its 134.2 kHz (Series 2000) range of RFID equipment which was the first technology available to the market from TI-RFID. This technology was first introduced for livestock identification. It was (and still is being) used to identify sheep, cattle, pigs and any other farm animal needed to be tagged.

This technology uses passive tags that are available in the following forms:

- 23mm and 32mm Glass Capsules (water-proof)
- Keyring transponders
- 30mm and 85mm Disk Transponders
- 120mm Cylinder Transponder
- 12mm Wedge Transponders
- Mount on Metal Transponders
- Proximity/Vicinity Access Card Transponder

High Frequency 13.56 MHz

The 13.56MHz (Series 6000) from TI-RFID technology uses Smart Label technology. These smart labels (inlays) are cheapest form of passive tags available. The tags inlays themselves are very cheap and TI-RFID has four sizes available:

- square
- small rectangular
- large rectangular
- thin rectangular

The issue with these inlays is that they once they are applied into another form (i.e. sticker or card) the costs of these tags substantially increase. These tags are not able to be applied directly onto a metal surface as the antenna on the inlay will be detuned.

However, the added benefits of this technology are:

- The readers have “anti-collision” capability, which means that the reader is able to read up to 50 tags per second simultaneously within the vicinity of the reader antenna.
- The TI-RFID Tag-it HF-I inlays have 2kb (made up of 64addresses x 32blocks) of user programmable memory.

TI-RFID have just released its latest range of Access Control “Vicinity” HF equipment. This equipment is a contact-less system used for very high security access control into apartments, buildings, offices, homes, and even for the used of hardware, such as computers and other peripherals.

In addition, TI has also introduced a new range of HF tags that is now available to the consumer:

- “Vicinity” (or Proximity) Access Control Cards – punchable with magnetic stripe
- Keyfob (keyring) tags
- Laundry Tags

Microwave Frequency 2.45 GHz

Electro-Com has also adopted a 2.45GHz technology as part of its microwave range. This technology was introduced to Electro-Com by Balogh as part of their HyperX range.

Electro-Com now has the microwave readers available to achieve read ranges from 0.5m up to 10m. Although the tags have got batteries in them, they are called “semi-passive” since the battery is only included to assist the memory functions, whereas with an active tag, the battery is used also used to improve the signal strength of the tag to achieve greater read distances.

The tags available are:

- Access Control / Vicinity Card – can be also used for windscreen mount for cars and trucks.
- Industrial Type – for industrial & outdoor use and can also be mounted on metal.

Depending on the application, Electro-Com can assist with the application even when the technology is not from TI-RFID. Electro-Com has been able to assist even when a customer has asked for guidance and support with a 125 kHz technology. We are more than happy to help you as Electro-Com has now released



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a new range of blank Smart CDs and DVDs for the use of highly confidential and controlled documents using 125 kHz technology. If you want to know more, ask us about it by calling us on 1300 130 806.

To conclude, the decision whether to use barcodes or RFID solely depends on the application and feasibility of what you hope and set to achieve. Whatever technology you choose run it through Electro-Com with over 10 years technical experience in RFID, guide and assist you with that final decision.

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About Electro-Com (Australia) Pty Ltd

Electro-Com is Australian owned and operated company located in Melbourne, Australia. Electro-Com has been supplying radio frequency identification readers and tags to markets such as animal identification, access control and logistics management and is a leading supplier of Electro-mechanical components, control products, electrical switchgear and electronic enclosures. For more information visit the company's website at www.electrocom.com.au.

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