RFID FAQs

General FAQs

1. What is Radio Frequency Identification (RFID)?

Radio frequency identification (RFID) technology uses wireless radio communications to uniquely identify objects or people, and is one of the fastest growing automatic data collection (ADC) technologies.

RFID creates an automatic way to collect information about a product, place, time or transaction quickly, easily and without human error. It provides a contactless data link, without need for line of sight, for example articles inside a cardboard box, or concerns about harsh or dirty environments that restrict other auto ID technologies such as bar codes.

In addition, RFID is more than just an ID code, it can be used as a data carrier, with information being written and updated to the tag on the fly.

2. What does a complete RFID system consist of?

Included in an RFID system are a number of components including tags, handheld or stationary readers, antennas, and system software. A reader comprises of a transmitter, receiver, control module and communication functions, sometimes called a transceiver in radio terms for it to link to a controlling PC.

The transponders or tags are used to identify objects, which can be uniquely programmed with information about the objects. Readers should have an attached antenna, which is used to transmit and receive the radio frequency signal. Each reader is accompanied with PC compatible software that allows the user to read and program tags. Serial communications RS232 or RS422/485 are required.

3. What operating systems are compatible with your reader software?

The S2 utility is compatible with Windows 95, 98, and NT. Tag-it™ Navigator is compatible with Windows 95 and 98 only.

S2000 (Low Frequency) FAQs

1. What do the LEDs on the S2000 mean?

The red LED flashes when the reader turns on its transmitter to power a tag; the green LED indicates a successful read of a tag and the yellow LED indicates noise above a configured ‘base level’. As this level is adjustable, this LED is not a reliable indicator of absolute noise.

2. Can I detect multiple tags at the same time?

No. The reader will probably lock onto the strongest tag (FM signal capture) and ignore the others.

3. What factors control the read range of a tag?

The range of a tag is influenced by:

- **The size of a tag’s antenna**
  The larger the tag’s antenna, the stronger the response and the better the tag can be detected above the back ground noise.
- **The size of the reader’s antenna**
  A larger reader antenna increases the read range but in a noisy environment may have a worse signal-to-noise ratio and cause the reading distance to go down
- **Environmental noise**
  The tag has to have a 6 dB stronger signal so that the reader can be discriminated from the background noise. As noise increases the tag has to move closer and closer to the reader’s antenna to be detected.
- **The reader output power**
  Increasing the reader output power normally makes little difference because the limiting factor is the strength of the tag’s response and once the on-board capacitor is fully charged, extra power makes no effect.

4. What are sources of environmental noise?

If you suspect you are getting a reduction in read range because of environmental noise you should check:

- Computer monitor interference
- Interference from switch mode power supplies
- Common mode noise
- Unsuppressed electrical motors

5. What can cause a reduction in read distance?

There are a number of factors that influence the reading range of any system. These include environmental noise and the influence of metal.

Environmental
If there is environmental electrical noise (RFI) in the vicinity of the reader's antenna, then some reduction in the reading performance may result. This RFI could be caused by:

- Other transmitters in the location
- Inverters on drives and motors
- Noise associated with the power supply, especially if switch mode supplies are used.
- Common mode noise

To prevent reader transmitters mutually affecting one-another, some method of synchronization should be implemented. Changing the orientation of the antenna or shielding the antenna is often an effective method against radiated noise but for conducted noise such as that associated with power supplies, filtering, BALUNs or opto-isolators may be required.

Metal
When metal is close to the tag or reader antenna, that antenna is no-longer matched to the correct frequency. Re-tuning will restore some of the performance but energy is still absorbed by the metal—the best solution is to remove the metal.

6. What is the write range of a tag?
The write range of a tag varies with the type of tag and is between 40% and 80% of the read range.

7. Can the Service Port of the RI-STU-MB6A be used to connect and configure this reader using the S2_Util software?
The Service Port is a software emulation of an RS-232 channel and was used in conjunction with the 'Tiris Reader Manager' utility. Unfortunately, this was a DOS program and wouldn't run on later Windows operating systems. When the 'S2_Util' program was developed, support of the Service Port was dropped. For customers who need to configure the RI-STU-MB6A, we recommend using an RS-232 to RS-422 converter (S2_Util cannot be used to configure a reader using the RS-485 interface)

8. What is the read-cycle of the S2000 Reader?
The S2000's complete read cycle is made up of:

[Sync-time + Charge-time + Response-time + Housekeeping-time + Delay]

Synch-time depends on how the reader's synchronization is configured; the Charge-time is configurable (default is 50 ms); the Response time is typically 17 ms but will vary slightly depending on the number of '1's versus the number of '0's in the response; the Housekeeping-time is typically 3 ms but slightly longer whenever a tag is read; and the Delay is by default 0 ms but again is configurable.

Wireless synchronized (Default).
In this mode the Synch-time is variable and changes between 1 ms and 70 ms. It is typically:

[20 ms + 50 ms + 17 ms + 4 ms + 0 ms] = 91 ms]

But in environments where noise might be interpreted as another reader:

[70 ms + 50 ms + 17 ms + 4 ms + 0 ms] = 151 ms

Master/Slave synchronization (Without acknowledgement).
In this mode the Sync-time is zero and represents the fastest reading cycle.

[0 ms + 50 ms + 17 ms + 4 ms + 0 ms] = 71 ms

9. Can I get the reader to recognize particular tags and set an output?
There is no direct connection between recognizing tags and setting outputs. If you need to establish this relationship it must be done via the controlling computer recognizing a tag number and instructing the reader to set an output. If you don't care about the tag number and just want to set an output whenever a tag is read, then the O/C output on ST32 can used.

10. Can I RESET the reader over the interface?
The ASCII protocol does not have a RESET command but the Tiris Bus Protocol does (0x5F).

Both readers can be suspended and re-started by implementing DST/DTR on the RS-232 interface and setting the appropriate jumpers. Note: Only the 5-wire connector on the S251B can be used.

11. What is the difference between the RI-STU-MB2/6A-02 and RI-STU-MB2/6A-03.
The firmware changed from v1.40 to v1.50. Version 1.40 was incorrectly outputting the format of ISO11785 Animal Identification conformant tags. An extra "0" was being inserted – this is now removed.

The Manufacturers register is at: http://www.icar.org/pages/manufacturer_codes.htm
The country codes can be found at: http://userpage.chemie.fu-berlin.de/diverse/doc/ISO_3166.html

The same change was also made to the S210B reader (RI-STU-S21B) whose firmware went from v1.01 to v1.10

12. Can I upgrade my earlier S2000 reader to the latest firmware version?
Early S2000 readers used an EEPROM that became obsolete and the socket was changed. These readers cannot be upgraded. We do not sell the EEPROMS but for later readers (Firmware v 1.32 or later), you may be able to get a third party to copy the EEPROM. The EEPROM is ATMEL AT27C512R.

Tag-it™ FAQs

1. What can cause a reduction in read distance?

There are a number of factors that can influence the reading range of any RFID system. They include the influences of metal, the attenuation caused by the signals passing through different materials, environmental noise and interference.

Metal

Metal close to an antenna, or a large mass of metal (relative to the antenna size) passing an antenna, can alter the matching of the antenna's characteristics to that of the reader. Re-tuning of the antenna in-situ normally reduces this problem.

Signal attenuation

As the frequency of a tagging system rises, the ability of the radio waves to penetrate different materials decreases. At Tag-it™'s frequency (13.56 MHz) this reduction is much less than at UHF and microwave frequencies. It is not an issue at the LF (134.2 kHz) frequency.

Environmental

If there is environmental electrical noise (RFI) in the location of the Antenna system, some reduction in the read performance may result. This RFI could be caused by:

1. Other transmitters in the location
2. Inverters on drives and motors
3. Electrical noise generated by moving equipment such as conveyors
4. Noise associated with the power supply, especially Switched Mode Power Supplies.

Shielding the antenna is often an effective way to reduce or overcome such issues. This has benefits because it not only stops the RFI but it also stops any interference generated by the Reader affecting other equipment. The shield also stops transponders (XP), which are not in the read zone from being read. A shield also allows higher power levels to be used and still keep within the regulatory limits.

Antenna systems built around a conveyor belt or a tilt tray sortation system may suffer noise from the following causes:

1. If there are metal rollers within the antenna system then these can modulate the signal. In this case you should replace them with plastic rollers.
2. Ensure that the conveyor and tilt tray systems are completely grounded (earth bonded). Conveyors and tilt-tray systems are made from metal sections, which are bolted together and use linear motors to drive them. Unfortunately, at the connecting points the metal is painted which does not give a good earth bonding. So ensure that you remove the paint from the metal and earth bond the metal work which passes through the antenna system.

How can you reduce the read range? Normally everyone wants maximum read range, but the quickest way to achieve a reduced range is to turn the RF power down. Having done this, you must check that you have not created any read holes.

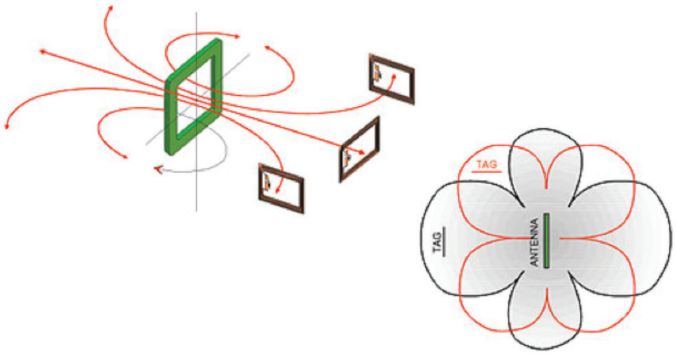
2. What is a reading hole and what are possible causes?

Reading holes are areas within the field of an antenna where no reading is possible and can occur close to an antenna because of:

1. The orientation of the tag to the antenna
2. The tag is de-tuned by the antenna
3. The antenna Q is too high

Orientation

Because of the physics, the RF field does not couple equally with the tag in all locations. It is possible for a tag to be close to the antenna in some orientations and still not be read.



De-tuning

It is possible for mutual de-tuning to occur, when the size of the tag's antenna is of similar size to the reader's antenna. This could occur with an antenna designed for a printer. A partial solution is to re-tune reading antenna. This is more of a problem with the high Q antennas of RFID system's LF antennas.

Q too high

Another cause of reading holes is due to the fact that the Q factor of the antenna is too high (> 40). The Q factor can be reduced by using a resistor soldered across the tuning capacitor. A loaded Q factor of between 30 to 40 is needed usually to ensure that you get a complete reading from the center of the antenna to its extremity.

3. What is the maximum read-range?

There is no single answer to this question as it depends on:

1. Reader antenna size
2. Tag antenna(s) size
3. Reader RF power (legal limitations)
4. Environmental noise
5. Reading mode

With the large inlay (RI-I12-110A-00) you can achieve over 1 meter (40 inches) with opposing antennas. As a conservative rule, for a single antenna, the reading distance will be around the same as the smallest dimension, so a 400mm x 500mm antenna will be capable of reading 400mm. Readings from a single large antenna of much greater than 800mm, (all conditions optimum) should not be expected.

4. What is the minimum separation between tags?

There is no minimum separation between tags. Using the SID (anti-collision algorithm), multiple tags close to the antenna can be readily identified but if they are at the extreme reading range, they will require some separation (5 cm) to prevent mutual de-tuning. If individual tags are passing an antenna, some separation will need to be maintained if the anti-collision algorithm is not being used. The separation is related to the size of the reading zone and should be sufficient that only one tag is in the field at one time.

5. How many tags can be identified?

Using anti-collision techniques, there is theoretically no limit to the number of tags that could be inventoried at one time. Although, in the real world this is dependant on a number of factors:

1. The size of the reader's antenna
2. RF Power
3. How closely packed the tags are
4. How long you are prepared to wait for the data

It requires a strong RF field for simultaneous identification, as tightly packed tags can 'soak up' the power and possibly de-tune each other if they are too close together. Smaller antennas have stronger RF fields close to the antenna, whereas a larger antenna, capable of reading more tags, and may have a less dense RF field.

Using simultaneous identification, around 30 tags/ sec can be inventoried. If you wish to read extra data, the time required will increase, e.g. to inventory 20 tags and return one page of information from each, takes 1 second.

Without simultaneous ID, up to 60 individual tags can be read in one second.

6. What is the S6000 communication speed?

The communication speed between Host processor and reader is 19,200 baud.

7. What is the maximum antenna size?

There are 3 limiting factors to be considered:

- Legislation
- Matching difficulties
- Performance degradation

Legislation

The larger the antenna, the greater the signal strength will be at a distance from the antenna. You have to keep the antenna sizes down, if you wish to operate legally without screening.

Matching

An antenna is a resonating circuit having resistance, i nductance and capacitance. To make the antenna resonate is a balancing act between the inductive and capacitive reactances. As the antenna size increases, the inductance also increases and you can reach a point where matching such antennas become very difficult, as it requires very small values of capacitance to complete the balance.

Performance degradation

When antennas get too large, the RF field weakens and operations such as anti-collision reading and writing become difficult. Larger antennas also have a worse signal to noise ratio. Once antennas exceed 900mm x 900mm, the performance may decrease.

8. What is the maximum allowed field strength?

The regulations in which the system will have to meet will vary in different parts of the world and the country of use. The two main regional standards are:

- ETSI 300 330 and 300 683 (Europe & associated countries)
- US FCC CFR47 Part 15 (USA and associated regions)

If we just look at maximum RF power at 13.56 MHz, the two limits are:

- 38dBμA/m @ 10m (USA)
- 42dBμA/m @ 10m (Europe)

9. How can I determine the inductance of an antenna?

You can do this in 3 main ways:

1. Using inductance-measuring equipment at 13.56 MHz
   This is the most accurate but will not be an option for most people because of the cost of the equipment.
2. Using an LCR meter
   These are relatively inexpensive but as they measure typically at a frequency of 1 kHz, are not as accurate.
3. Calculating the inductance
   This is the least accurate. Most formulas are based around multiple winding circular antennas but TI's "ADU.exe" program is accurate enough for most rectangular designs.

10. How can I avoid coupling between antennas?

In multi-antenna systems you will always get some mutual coupling between antennas but this can be minimized by ensuring they are exactly 90° to each other and by 'nulling-out'. 'Nulling-out' antennas minimizes the mutual coupling effects and is done by attaching one antenna to an oscilloscope, so that the induced voltage can be read whilst the other antenna connected as normal but with the transmitter on 100%. Moving the antenna to the null position can reduce the induced voltage.

11. What are possible noise sources?

Power supplies e.g. inverters, switched mode power supplies; electric motors, VDU's, other transmitters.

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