

Testing Observations

ASSIGNMENT #2 – RFID READER
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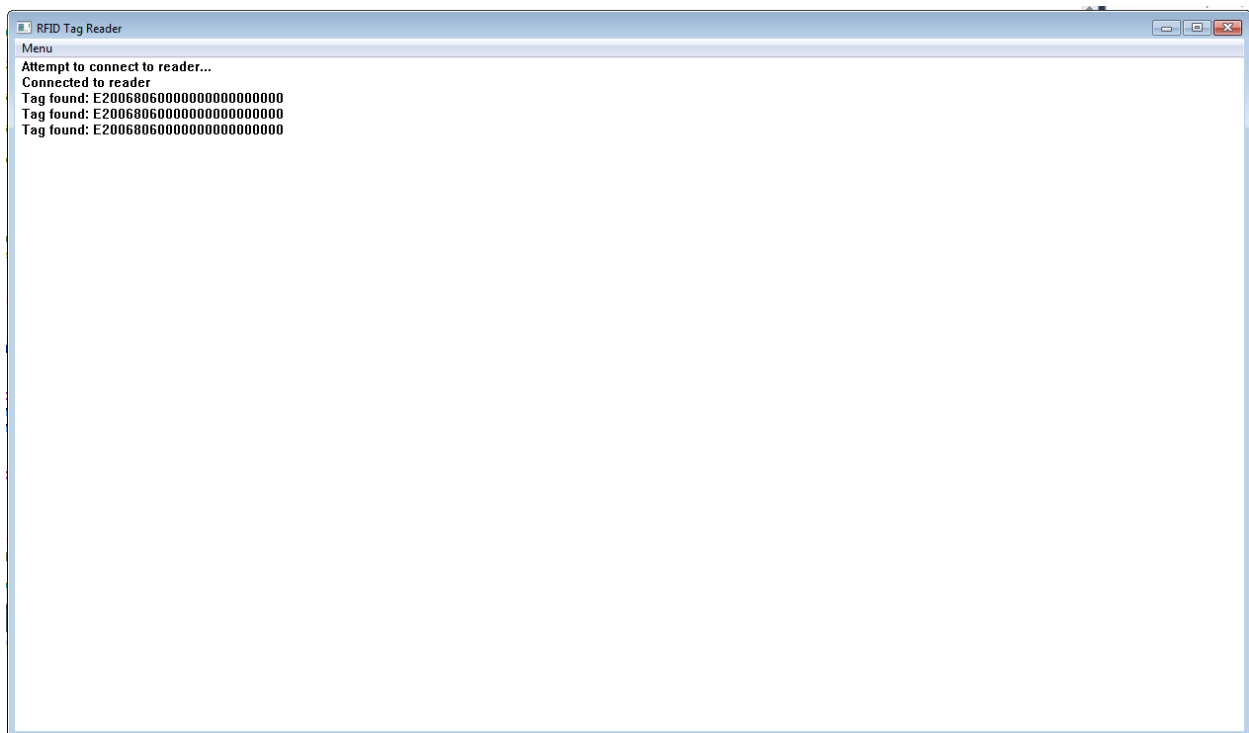
RFID Reader

Working Tag reading software distributed by Data Commies

Observations

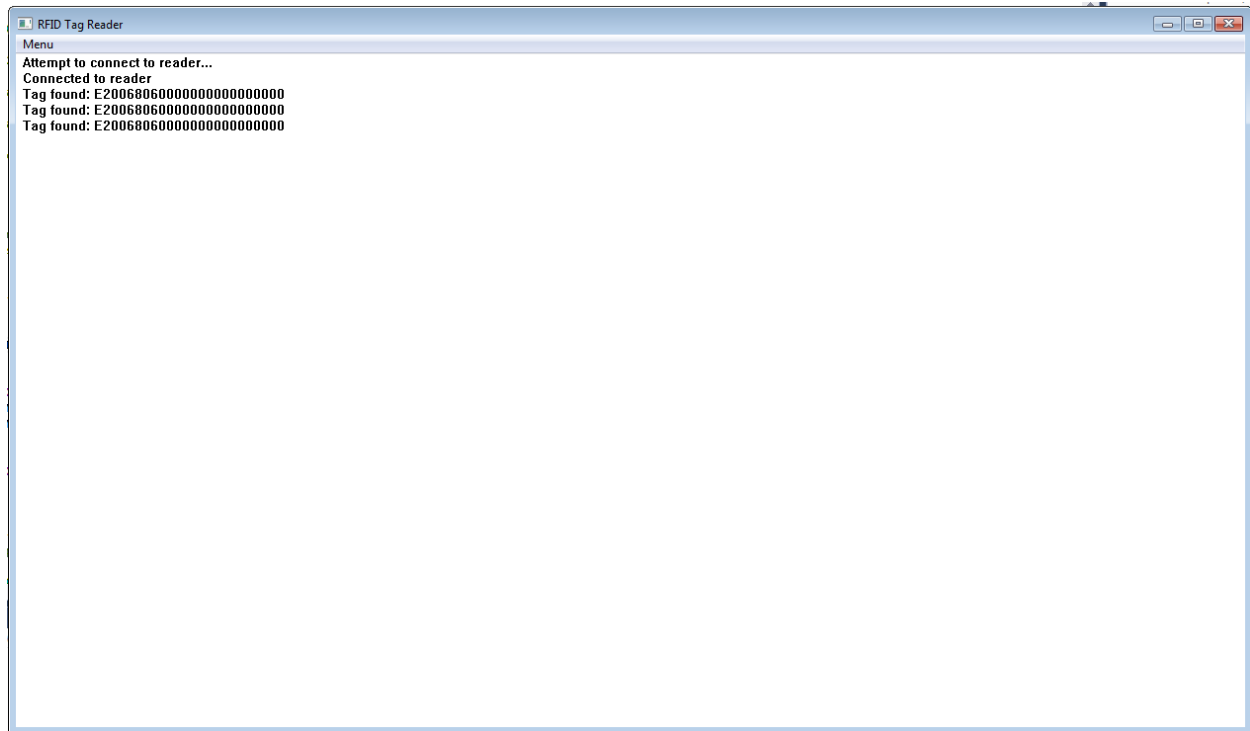
Single Tags – Placing tags up against the reader

- The RFID Reader had no issue reading the tag regardless of the size.
- Four separate tags were tested and they all experienced no issues.
- The Reader consistently read the tag and experienced no flickering or delay.



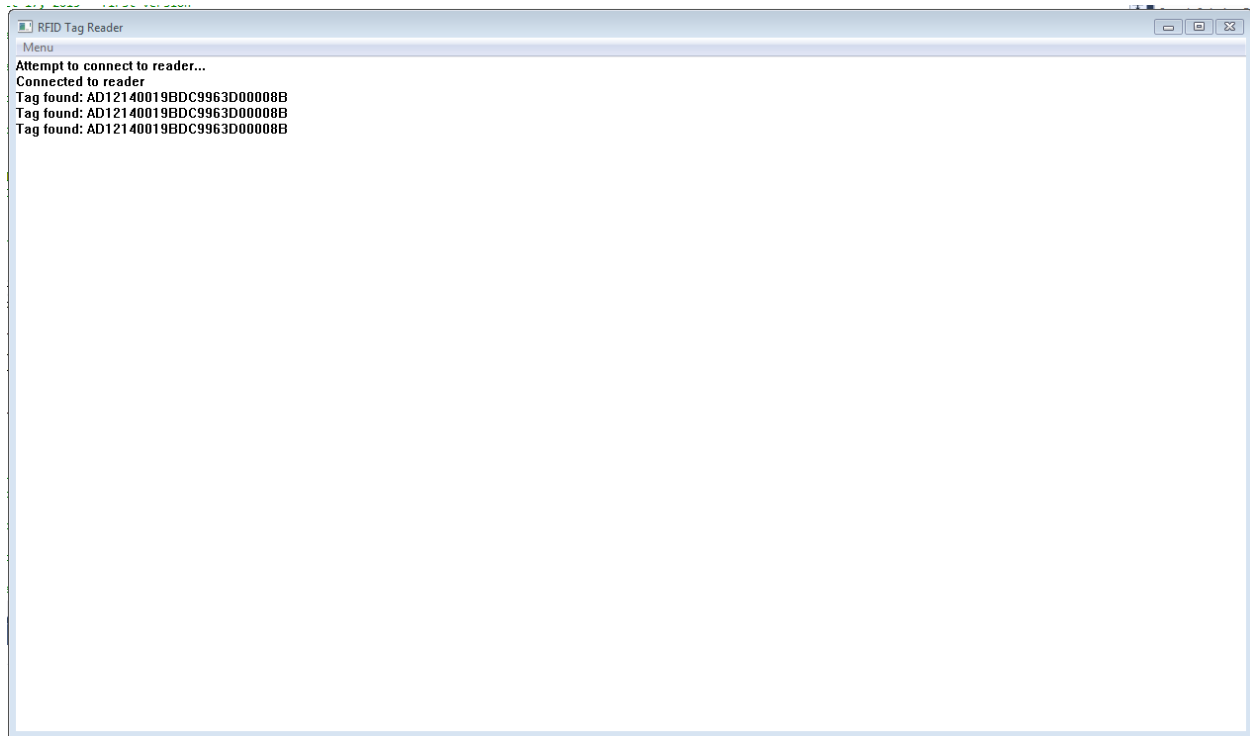
Single Tags – Changing the distance (Small Tag).

- We changed the distance from next to the machine to 15cm where it stopped reading the tag at all.
- The best range for reading appeared to be at 7cm away from the reader.
- From our observations, we noticed that the maximum reading range for a single small tag is 14cm. Any farther and the tag would not read at all. When the tag was read at maximum range, the tag's name flickered approximately every second on the screen.
- The maximum observable reading range is approximately 14cm. The "dead zone" for reading a small tag is 15cm.



Single Tags – Changing the distance (Large Tag)

- We changed the distance from next to the machine to 25cm where it stopped reading the tag at all.
- The best range for reading appeared to be at 7cm away from the reader.
- For larger version of the tag, we noticed that the reading range increased to around 23cm. We believe this is because of the surface area of the tag was able to receive more of the reader's transmission waves compared to the smaller tags.
- The reader flickered approximately every second on the screen when it was at its maximum reading range.
- The maximum observable reading range is approximately 23cm. The "dead zone" for reading a large tag is 25cm.



Single Tag – Ultra High Frequency tag

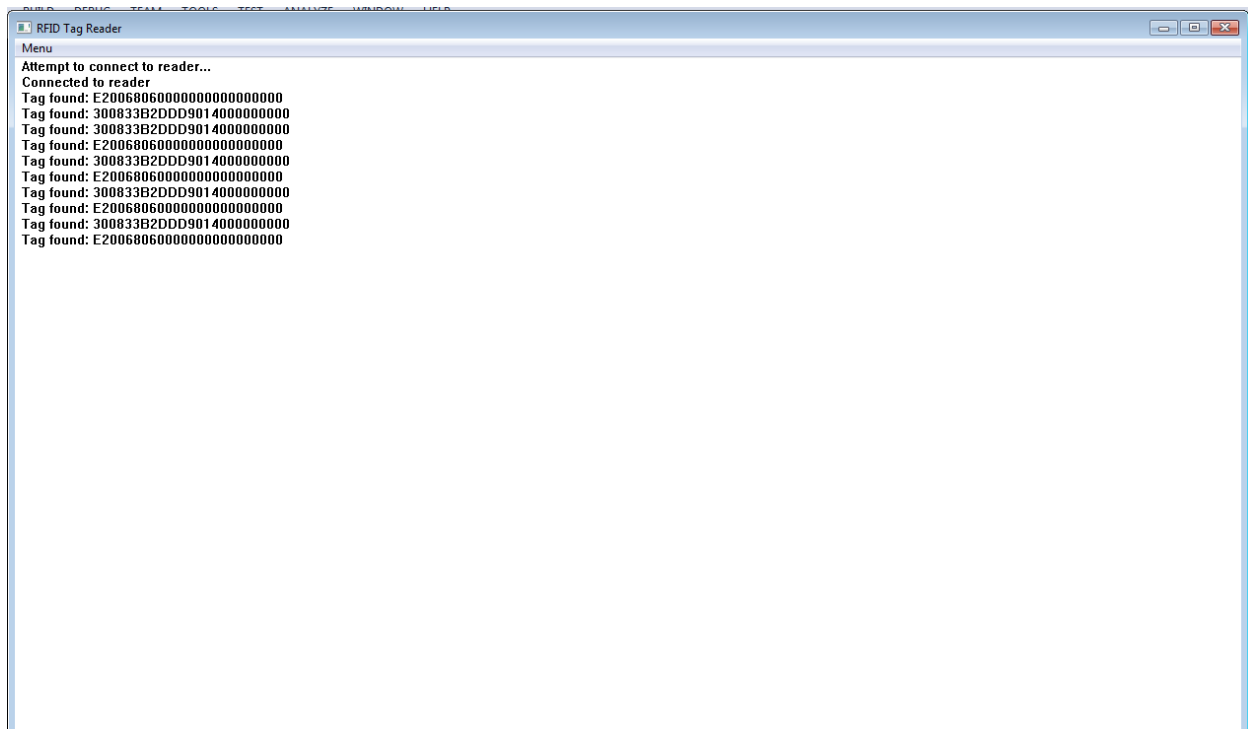
- We attempted to scan the UHF tag but the reader was unable to read the tag at all no matter what the distance was.
- We have come to the conclusion that Ultra High Frequency tags are unable to be read with this reader device.

Single Tag Conclusion:

The smaller tags have a smaller range of effectiveness compared to the larger tags but both tags have an optimal range of 7cm away from the reader. The small tags have a maximum range of 14cm while the large tags have a maximum of 23cm.

Two Tags - Placing tags up against the reader

- The reader had two small tags placed on opposite ends of the reader.
- When scanning, it seems only one tag is able to be read even though there are two tags there.
- We made a note that when placing the tags in the beginning near the reader. The two tags were able to be read, but when both tags were close together, there were issues reading BOTH tags at the same time.
- It appears that one tag seems to cancel the other out regardless of their position. Having one tag larger than the other doesn't seem to have this issue.
- Moving both tags 3cm away from the reader allowed the tag to read two small tags however two smaller immediately next to the machine causes read issues.



Two Tags – One tag 7cm close to Reader/ One small tag with change of distance

- One small tag was placed immediately next to the machine however the other tag had its placement continuously moved for this experiment. Replacing the size of tag (that was close to the reader) to a larger one made no observable difference in read distances.
- The tag closest to the reader had absolutely no issue being read throughout this experiment.
- The reading range of the second tag appears to be 20cm (longer distance than initially observed from single tag reading).
- The second tag's maximum reading range is approximately 20cm. The second tag's "dead zone" appears to be 21cm.

Two Tags – One tag 7cm close to Reader/ One large tag with change of distance

- One small tag was placed immediately next to the machine however the other tag had its placement continuously moved for this experiment. Replacing the size of tag (that was close to the reader) to a larger one made no observable difference in read distances.
- The reading distance of a larger tag seems to drop off 25cm. Similar to the single tag reading for a large tag experiment.
- The second tag's maximum reading range is approximately 23cm. The second tag's "dead zone" appears to be 25cm.

Two Tag Conclusion

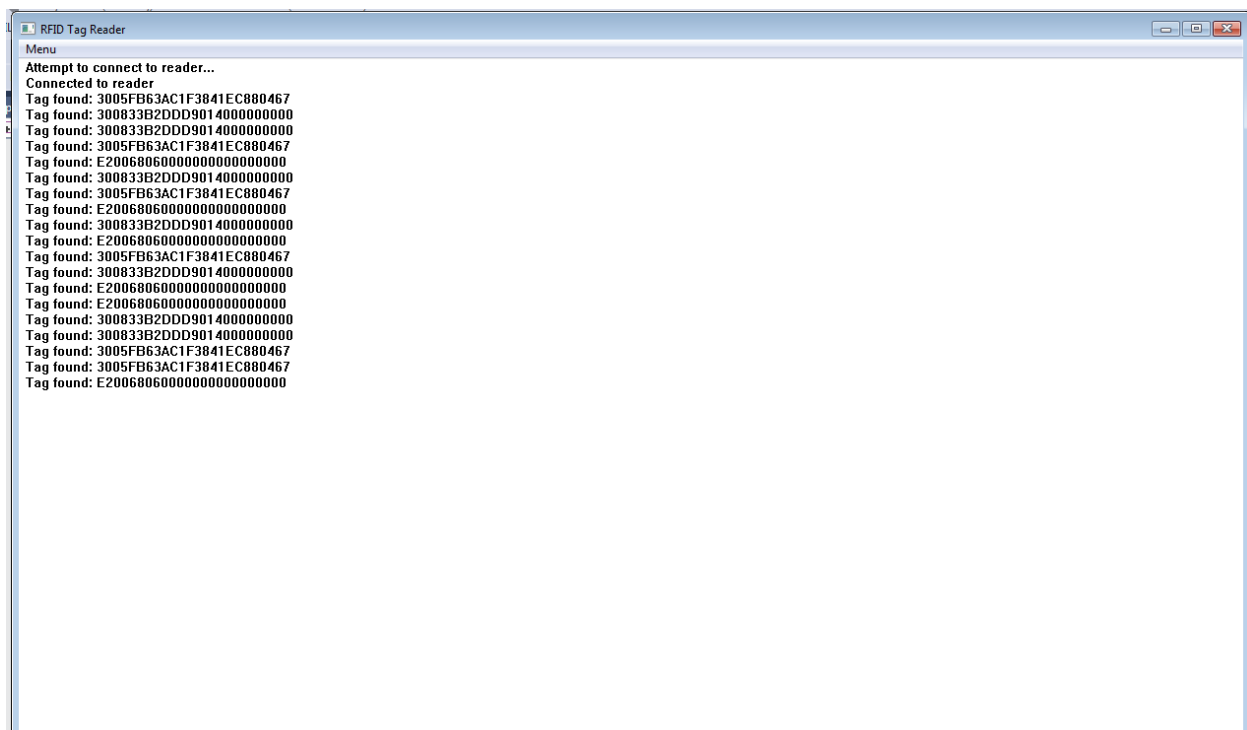
The smaller tags seem to receive boost of their effective range when another tag was at the opposite end of the reader (compared to their single read range). The larger tags did not receive a noticeable boost unfortunately. The optimal reading distance for two tags is 7cm at opposite ends of the reader regardless of size.

The maximum reading distance for a small tag (when another tag is at the opposite of the RFID reader) is 20cm.

The maximum reading distance for a large tag is 23cm.

Three Tags – One 7cm close to Reader/ Two tags with a change of distance:

- The first tag that was 7cm close to the reader had no issue reading.
- The second tag, when the third tag was nearby on the same side, had an issue reading the second and third tag.
- The third tag had the most trouble being read; moving the position seemed to cause troubles to the second tag or first tag whenever it was close.
- Whenever movement occurs to either the second or third tag, reading seems to be able to be the tag's data occasionally from either 1cm away or 7cm away.
- With lack of movement, only the first tag (unaffected by the third tag) gets read consistently.
- Placing the third tag initially at 7cm away from the reader. However placing the tag right next to the machine caused a lot more difficult than initially than the 7cm position we gave it.
- Initially when testing we had trouble reading the three tags when they were at rest. Only having one consistent tag being read while either the second or the third (rarely both) were being displayed).
- After a few minutes of inactivity, it seems that the two tags are being displayed consistently with the third one being shown every five seconds.



Three Tags Conclusion

Only the tag that is close to the reader and yet, farthest away from the third tag seems to read properly. The two tags that are close to each other seem to override each other's transmission output to the reader. Large tags are read more efficiently compared to smaller tags.

Movement appears to play a role in how tags return their data.

Movement had repeatedly good reading of two tags with the third tag appearing every 3 seconds.

Lack of movement had only one tag reading consistently only either the second or the third tag would display approximately 5sec. The chances of all three showing at once were very rare.

Four and Five Tags – Distance variation for each tag

- We initially organized 4 tags, and later 5 tags, 7cm close to the reader.
- All tags were spread out evenly away from each other in the beginning.
- In both of those tests, only the tag marginally closest was being displayed consistently meanwhile the other tags displayed in a random manner.
- We had difficulty getting a screenshot for four tags in a single window and had to repeat the test three times to ensure all tags were present in the window at one time.
- The experiment with five tags failed because we were unable to display five tags on the window at the same time. We repeated this experiment five times and changing the size of the window did not make a difference.
- Another technique we tried was varying the distance:
 - *1st tag at 4cm,*
 - *2nd tag at 7cm,*
 - *3rd tag at 10cm,*
 - *4th tag (our large size tag) at 12cm.*
- The results (taken over approximately 3 seconds) we expected matched our observations where the tag read rate was best with the 1st tag with the read rate losing its efficiency with each farther tag.
- The 3rd closest tag and the 4th closest tag shared the same read rate but we believe this may be due to the large size of the 4th tag.
- Final results (refer to the screenshot for a visual representation):
 - 1st closest tag: Best read rate having occasional times where it was the only tag being read 15 times in the screenshot below.
 - 2nd closest tag: 2nd best read rate with 10 times
 - 3rd closest tag: Tied for worst read rate, 4 times total.
 - 4th closest tag (large size): Tied for worst read rate, 4 times total.



Four and Five Tags Conclusion:

Four tags is the hypothetical maximum for reading tags properly. Five tags is possible to be read but we were unable to produce any successful tests that had five tags on screen all at once.

Due to the RFID tags interrupting each other's return signal, we are unable to pinpoint a consistent maximum reading distance. Regardless, our best estimate is 12cm.

It is not recommended to scan any more than three tags because of the sheer randomness of scanning!