

Appendix A: RFID Testing

* Note: Confidential information is redacted.

RFID Signal Strength Testing Results



Testing Procedure

Hardware:

- Antenna fixture: Stack discs to change ring height (25 total heights tested)
 - Small discs (S0-S4)
 - ~ [REDACTED]
 - Large discs (L0-L5)
 - [REDACTED]
- RFID Reader

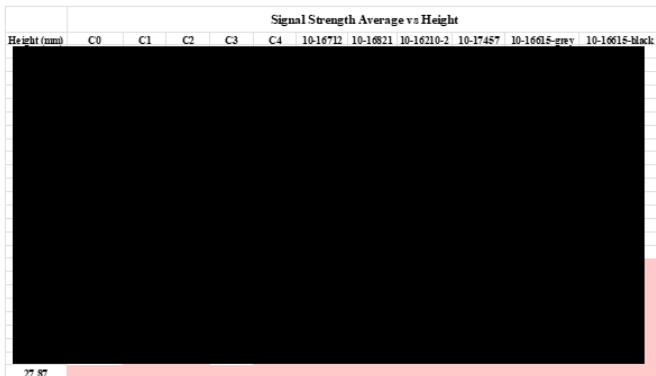


Software:

- The RFID reading program loops through a user input range of heights. For each height, it will read the ring 20 times. It will store each read as a separate row in the data view, as well as one row of "analyzed" data for every 20 readings (each height).
- Manually change the height and click read. Repeat for each ring/height.

Record 20 readings of each height:	Height (mm)
No discs	[REDACTED]
S0	[REDACTED]
S0+S1	[REDACTED]
S0+S1+S2	[REDACTED]
S0+S1+S2+S3	[REDACTED]
L0	[REDACTED]
L0+S0	[REDACTED]
L0+S0+S1	[REDACTED]
L0+S0+S1+S2	[REDACTED]
L0+S0+S1+S2+S3	[REDACTED]
L0+L1	[REDACTED]
L0+L1+S0	[REDACTED]
L0+L1+S0+S1	[REDACTED]
L0+L1+S0+S1+S2	[REDACTED]
L0+L1+S0+S1+S2+S3	[REDACTED]
L0+L1+L2	[REDACTED]
L0+L1+L2+S0	[REDACTED]
L0+L1+L2+S0+S1	[REDACTED]
L0+L1+L2+S0+S1+S2	[REDACTED]
L0+L1+L2+S0+S1+S2+S3	[REDACTED]
L0+L1+L2+L3	[REDACTED]
L0+L1+L2+L3+S0	[REDACTED]
L0+L1+L2+L3+S0+S1+S2	[REDACTED]
L0+L1+L2+L3+S0+S1+S2+S3	[REDACTED]

Data: Breakdown



Control Rings:

- 5 rings tested
- 2500 total readings stored (20 reads per height, per ring, 25 total heights)

Test Rings:

- 6 rings tested
- 3000 total readings stored (20 reads per height, per ring, 25 total heights)

Raw Data Stored:

- Test height
- Signal strength
- Ring information

Analyzed Data Stored:

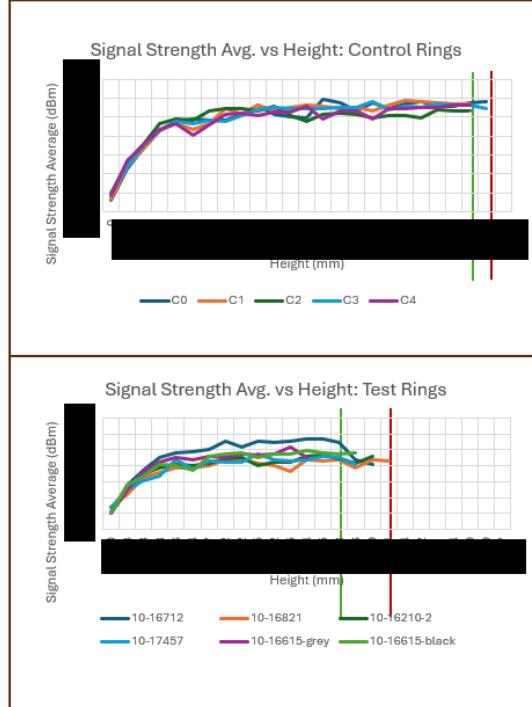
- One row per ring, per height:
 - Average signal strength
 - Standard dev.
 - Max & Min strength
 - Range

Results

	Control	Test
Earliest Point of Failure (mm)	[REDACTED]	[REDACTED]
Furthest Read (mm)	[REDACTED]	[REDACTED]
Max Height for 100% Success Rate (mm)	[REDACTED]	[REDACTED]

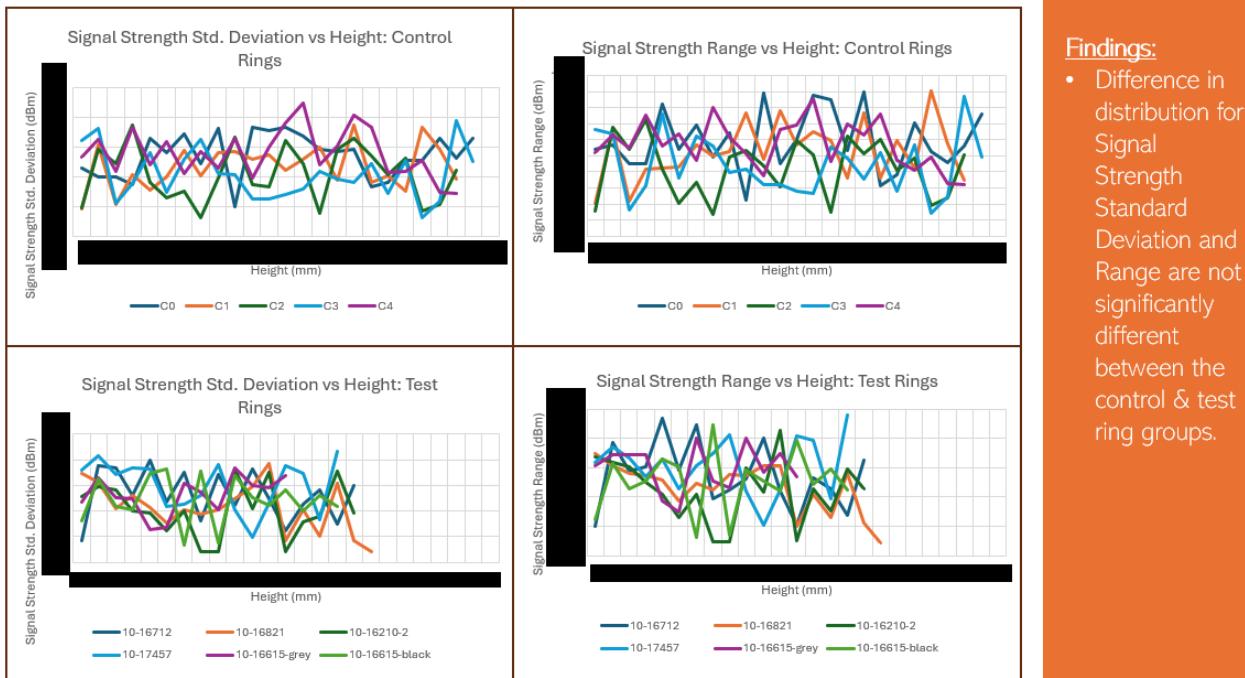
Key Findings:

- All of the test (RMA) rings stop reading much lower/closer to the RFID reader. There is a [REDACTED] mm difference between the maximum height each group had a 100% success rate at reading.



Furthest Read

Max Height for 100% Success Rate



Findings:

- Difference in distribution for Signal Strength Standard Deviation and Range are not significantly different between the control & test ring groups.