Supplementary Material for "Paper Title..."

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Abstract

This supplementary document provides comprehensive mathematical proofs, detailed simulation settings, and additional experimental results that support the main claims of the paper.

■ Contents

■ S.1.   Detailed Derivations

This section presents the derivation of the optimal frame length. By minimizing the collision probability, we can derive the condition for maximum throughput.

■ S.2.   Additional Experiments

■ S.2.1.   Throughput Analysis

We further analyze the system throughput under different tag densities.

S.2.1.1. Impact of Velocity

The tag velocity introduces Doppler shifts, which may affect the decoding performance. However, our results show that our protocol remains robust up to 5 m/s.

Table S1. Detailed Simulation Parameters (Full Width)

Parameter	Value	Unit	Description
Tag Population	100 – 1000	-	Number of tags in SOA
Clock Drift	0.4%	-	Maximum oscillator deviation
Bit Rate	40 – 640	kbps	Adaptive link speed