

Novel Adaptive Sliding Window Algorithm Reducing Latency for Multi-Tag Chipless RFID Systems

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The main contribution of this work is to introduce a novel technique for reducing the *latency* of multi-tag Frequency Coded (FC) chipless RFID systems, which is defined as the time required for the reader to identify the tagged objects within the same interrogation zone. The frequency scanning methodology, windowing and notch detection are the three main processing blocks that significantly affect the overall system latency.

Since the notch bandwidth increases with frequency as shown in Figure 2 ($W_2 > W_1$), the idea of adaptive window size is created and applied. Therefore, Adaptive Sliding Window (ASW) algorithm is proposed to reduce the scanning time and overall system latency accordingly. The operating frequency spectrum is divided into two main parts, preamble bandwidth and coding bandwidth. The former is responsible for representing the tag existence and the frequency allocations of tags coding bits as described in (M. El-Hadidy, A. El-Aawamry, A. Fawky, M. Khaliel and T. Kaiser, "A Novel Collision Avoidance MAC Protocol for Multi-Tag UWB Chipless RFID Systems Based on Notch Position Modulation", EuCAP'2015). The ASW algorithm starts with scanning the preamble bandwidth with fixed window size and then scans the rest of band according to the estimated frequency position with an adapted window size.

Five protocol based chipless RFID tags with the corresponding RCS shown in Figure 2 are designed depending on slot ring resonators shape using CST MWS EM simulator and exported to the MATLAB to apply the proposed ASW technique. Figure 1 shows the comparison between different scanning methodologies and the proposed ASW algorithm which illustrates a significant reduction at system latency.

In the full paper, a mathematical framework for the ASW algorithm will be described and real-world implementation using Software Defined Radio (SDR) platform will be used to calculate the overall system latency including the hardware limitations.

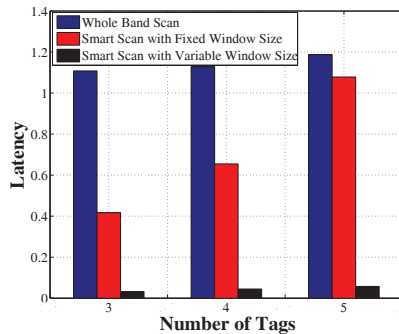


Figure 1: Latency comparison for different scanning algorithms.

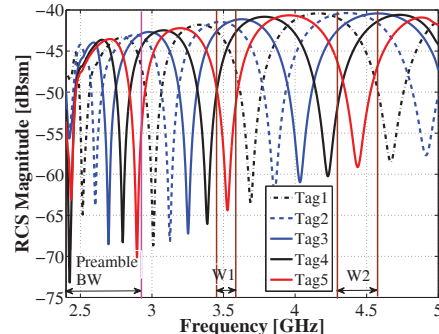


Figure 2: RCS magnitude for the protocol based chipless tag.