IEEE 802.11
Wireless Access Methods and Physical Layer Specifications

TITLE: Evaluating Sync and Framing Patterns Using a Correlator

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AUTHOR: Ed Geiger
Apple Computer
One Infinite Loop
Cupertino, CA 95014
edg@apple.com

Introduction

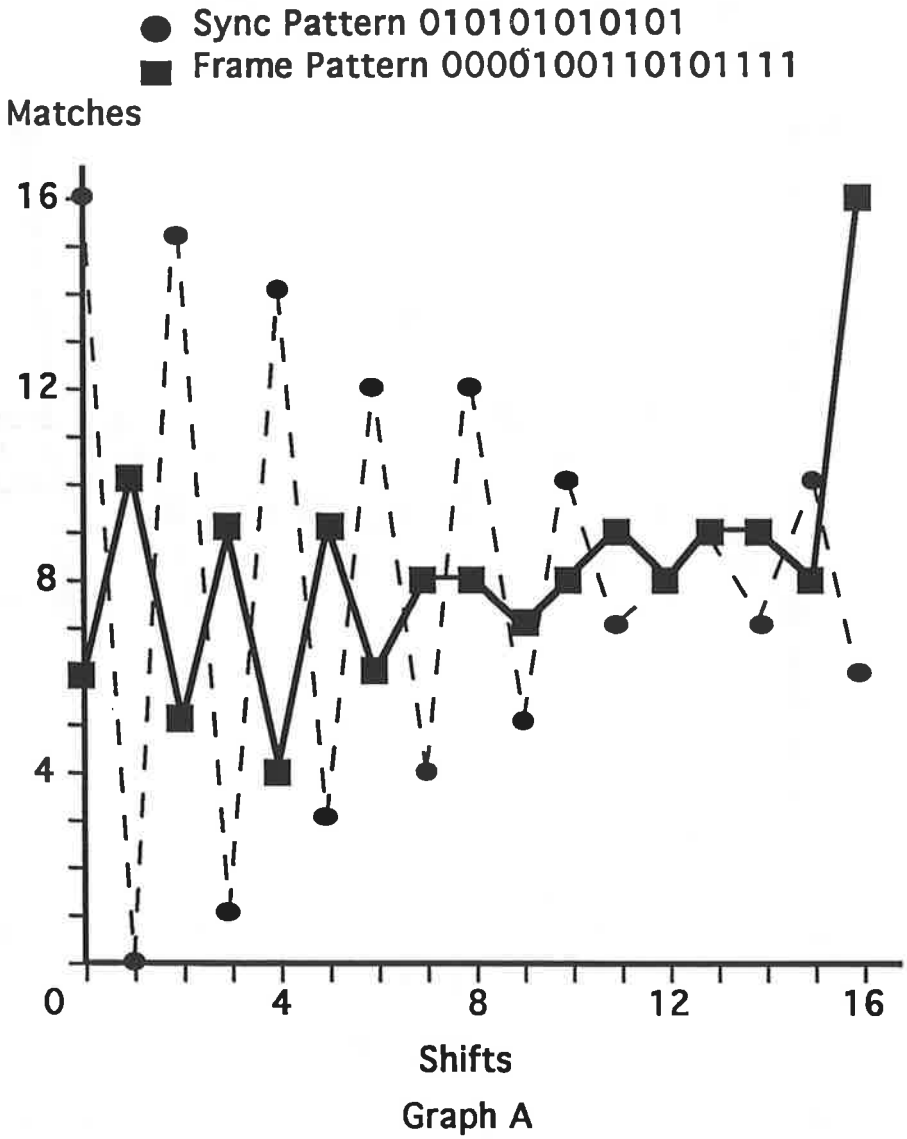
This paper is intended to provide information to the PHY Layer working group to assist in the design and development of a suitable sync and framing pattern for the Burst Preamble.

1.0 Introduction

Although there are many ways to build circuitry to do sync and frame symbol detection, one of the simplest ways is to build a correlator. A correlator can be constructed using a set of shift registers and comparators. As data is shifted through the set of shift registers, the contents of each register after every shift is compared with the corresponding bit values of the frame symbol. When the contents of each register matches the frame symbol exactly, frame is detected. A more sophisticated version of a correlator can be built which counts the number of registers that match instead of only looking for a complete match. This type of correlator can allow some error management instead of just a match or no match type response.

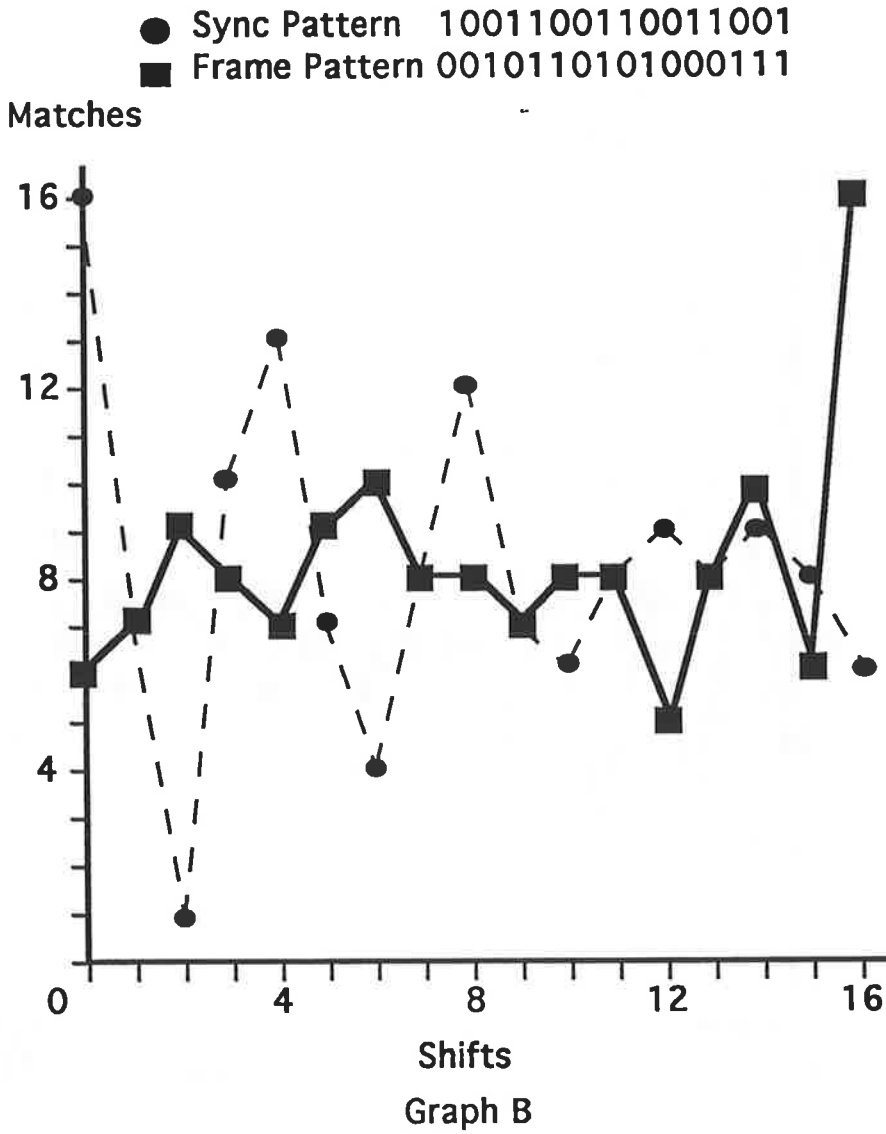
Using an Excel spreadsheet , I built a correlator which counts the number of matches. I thought it would be interesting to plot the results and possibly use them for topics of discussion in the next working group. My approach was to design a correlator for each of the three frame symbols we have been working with during the last couple of meetings and see how their results compare.

The test was to simply load each correlator with the sync pattern prior to N bits before the frame symbol of N length. I then plotted the number of matches between the sync symbol and the frame symbol as the sync symbol was shifted out of the correlator and the frame symbol shifted in. The following graphs record the results.



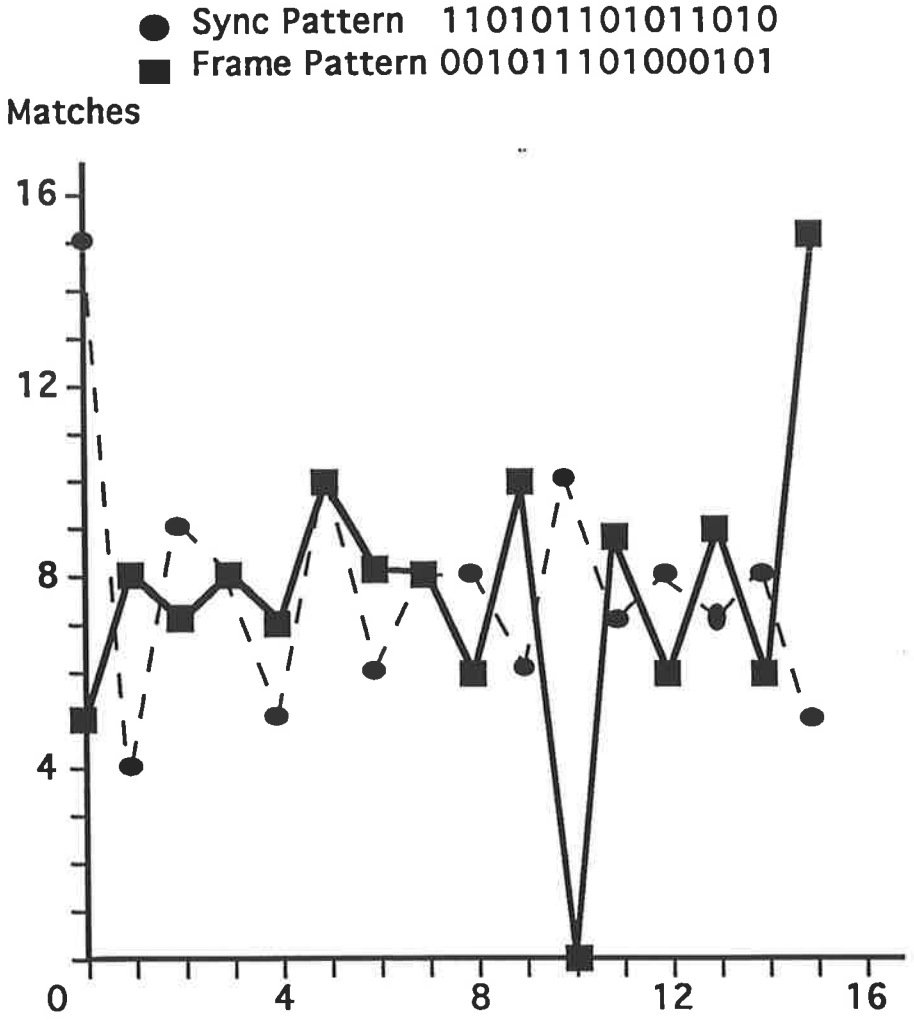
Graph A

Graph A shows the results of plotting the matches of the correlator using the sync and frame symbols proposed at the last meeting. At shift 1 the plot shows the dramatic swing as would be expected when shifting a pattern of 1's and 0's. As data is shifted through the correlator, one can see that the distance from a good frame (@16) to the next closest value 10 is 6 bits. It is disturbing that a 1 bit error in the frame field might cause the sync state machine to error.



Graph B

This plot shows one of the other sync patterns (1001) and frame symbols proposed at previous meetings. Once again, there appears to be a distance of 6 bits between the 16 bit match when the frame is detected and a 10 bit match which appears at two different places in the operation. The sync pattern in this plot quickly distances itself from a valid pattern and has a distance of at least 3 bits after a couple of shifts.



Graph C

This plot was done for the 11010 sync pattern and a 15 bit frame symbol. There is a shorter distance between the valid symbol (@15) and a couple of values of 10. The plot shows the best cross correlation between the sync symbol and the frame symbol of the three systems.