**Spectral Properties of Digital Signals.**

This subject has been on my longer-term program for the gigabit research project, but I will advance it because Alva is worried about if for the 400 mbit project right now.

The general question is this: what is the spectrum of a digital signal? You need to know this to know how much of it will get through a coax cable. And so on.

You might start with a simple square wave. You know it has a line spectrum that fits inside the usual sinc envelope. But then come many associated questions:

(a) how do you interpret the sinc shape?
(b) if 1's and 0's are random in some sense, what does the "average" spectrum look like?
(c) what is all this "raised cosine" business?
(d) what standard theory goes with this subject?
(e) Then we want to eventually get to the issue of Alva's automatic clock recovery. How is this thing going to really work? How deal with aligning spectral lines?
(f) what role does noise play in this problem?
(g) what is the effect of the scrambler on everything?

This is just my opening list of questions. There will be many more. As we well know, seeking the answer to one question creates 10 more questions, until the project stabilizes.