

binary) and 1023 ("1111111111"). These numbers are transmitted bit by bit, so each number needs 10 steps for transmission.

One way to do this is to phase-modulate a NOAA transmission directly into these bits. After demodulation in the receiver, and amplifying to TTL level, a low voltage means '0', a high voltage is a '1'. (**Fig. 1**)

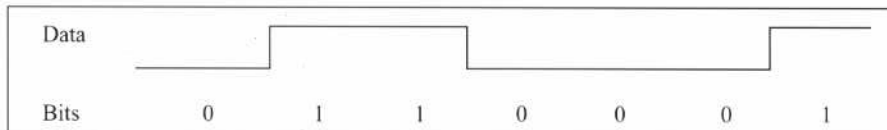


Fig.1 - Transmission of Digital Data

A problem with transmitting data in this way is that it is not obvious when a new bit is received, especially if there are long strings of successive zeros or ones. An extra difficulty is that the satellite is moving, causing Doppler shifts, so the data rate isn't constant. In other words, the "length" of one bit isn't always equal to that of the next. To solve this problem, the serial data stream has to be translated into a stream which doesn't contain long strings of zeros and ones. With C/HRPT and HRI this is done by means of the so-called "split phase" or Manchester encoding, a zero being translated into "01" before transmission, and a one into "10".

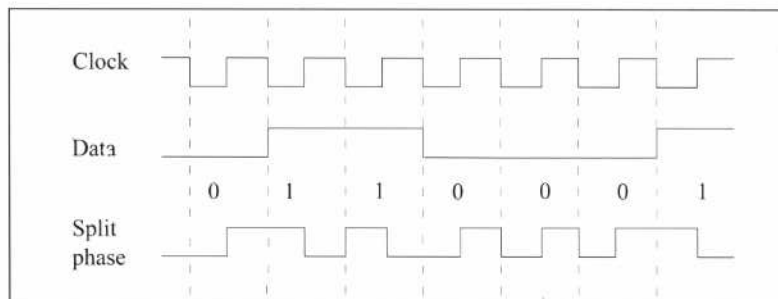


Fig.2 - Clock and data forming together the split-phase signal

Another way to look at this problem is that the decoder needs *two* signals to reconstruct the data, a marker stating "a new bit starts here", and the data itself. In the satellite, the marker is a square wave, a so-called "clock". The data modulates this clock in phase ("0" ==> 0 degrees, "1" ==> 180 degrees) the result is the same split-phase signal. (**Fig.2**)

In the decoder the two signals have to be separated from each other, as will be explained later.