1.0.0.0.1 FEC Algorithm (RS(255, 223))

The FEC code used for 10GBASE-PR links is a linear cyclic block code - the Reed-Solomon code (255, 223) over the Galois Field of GF(2^8) - a code operating on 8-bit symbols. The code encodes 223 information symbols and adds 32 parity symbols. The code is systematic, meaning that the information symbols are not disturbed in any way in the encoder and the parity symbols are added separately to each block.

The code is based on the generating polynomial

$$G(X)=\prod_{i=0}^{31}(X-\alpha^i)=A_{31}X^{31}+A_{30}X^{30}+\cdots+A_0X^0 \qquad (76\text{-x})$$

where:

α is equal to 0x02 and is a root of the binary primitive polynomial $x^8+x^4+x^3+x^2+1$,
A is a series representing the resulting polynomial coefficients of $G(X)$,
X corresponds to an 8-bit GF(2^8) symbol,
x corresponds to a bit within each value of X.

The parity calculation shall produce the same result as the shift register implementation shown in Figure 76-xx. Before calculation begins, the shift register shall be initialized to the value 0x00. The content of the shift register is transmitted without inversion.

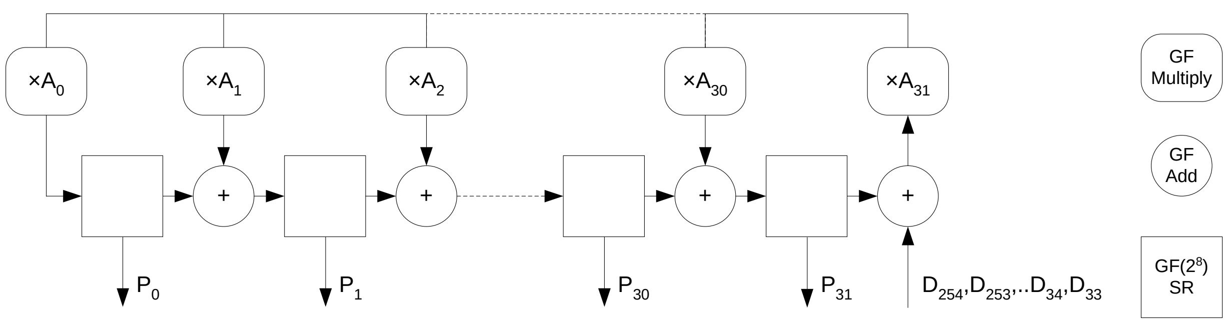

Figure 76-xx -- Circuit for generating FEC parity vector.

A FEC parity vector is presented by

$P(X) = D(X)$ **mod** $G(X)$,

where:

$D(X)$ is the data vector $D(X)=D_{222}X^{254}+D_{221}X^{253}+\ldots+D_0X^{32}$. D_{222} is the first data octet and D_0 is the last.
$P(X)$ is the parity vector $P(X)=P_{31}X^{31}+P_{30}X^{30}+\ldots+P_0X^0$. P_{31} is the first parity octet and P_0 is the last.

A data octet (d_7, d_6, ..., d_1, d_0) is identified with the element: $d_7\alpha^7+d_6\alpha^6+\ldots+d_1\alpha^1+d_0$ in GF(2^8), the finite field with 2^8 elements. The code has a correction capability of up to sixteen symbols.

Note - For the (255, 223) Reed-Solomon code, the symbol size equals one octet. The d_0 is identified as the LSB and d_7 is identified as the MSB for all octets in accordance with the conventions of 3.1.1. See Bit ordering shall be as illustrated in Figure 76–11.