



Description of the RS(239,255) code

May 13, 2003

Hoon Lee

**Electronics and Telecommunications
Research Institute(ETRI)**

65.2.2 Forward error correction code

The FEC code specification, properties and performance analysis are specified in the “ITU-T Recommendation G.975”.

The FEC code used is a linear Cyclic Block code - the Reed-Solomon code (255,239,8) over the Galois Field of $GF(2^8)$ - a non-binary code operating on 8-bit symbols. The code encodes 239 **information** symbols and adds 16 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 **generator polynomial of the code** is $G(x) = \prod_{i=0}^{15} (x - \alpha^i)$

where α is equal to 0x02 is a root of the binary primitive polynomial $x^8+x^4+x^3+x^2+1$.

A code word of the **Reed-Solomon code (255,239,8)** is presented by $D(x) + P(x) = G(x) * L(x)$ where:
 $D(x)$ is the **information** data vector - $D(x) = D_{238}X^{254} + \dots + D_0X^{16}$. D_{238} is the first data octet and D_0 is the last.
 $P(x)$ is the **parity** data vector - $P(x) = P_{15}X^{15} + \dots + P_0$. P_{15} is the first parity octet and P_0 is the last.
 $L(x)$ is the quotient vector.

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

Note that for the Reed Solomon code **(255,239,8)**, the symbol size equals one octet.