

RELATIONSHIP BETWEEN E_b/N_0 AND S/N

$$E_b = S/R = (E/t) / (B/t)$$

Where E_b is the Energy per Bit
 S is the Signal Power
 R is the Bit Rate

$$N_0 = N/W$$

Where N_0 is the Noise Spectral Density
 N is the Noise Power
 W is the Bandwidth

Hence,

$$E_b/N_0 = (S/R) / (N/W) = (S/R) \times (W/N)$$

And therefore,

$$\mathbf{E_b/N_0 = (S/N) \times (W/R)}$$

Where (S/N) is the Signal to Noise Ratio
 (W/R) is the Processing Gain
 E_b/N_0 is the ratio of energy per bit to the noise power spectral density. E_b/N_0 is the measure of signal to noise ratio for a digital communication system. It is measured at the input to the receiver and is used as the basic measure of how strong the signal is.

Reference:

1. CDMA Theory and Nortel Networks Product Design and Function, Student Guide, July 2000.
2. <http://www.sss-mag.com/ebn0.html>