Conversion from Packet Error Rate (PER) to Bit Error Rate (BER) by modelling CCK bit errors.

The 11 Mbps CCK implementation encodes a byte stream using 2^8 different out of 2^{16} symbols of 8 chips each.

Notations:
PER = Packet Error Rate
BER = Bit Error Rate
SER = Symbol Error Rate
N = Packet length in bytes
NS = Packet length in symbols

Assumptions:
1. An erroneously interpreted symbol will produce any of the other symbols with equal probability.
2. Symbol errors are considered to be independent of each other.
3. The 1 Mbps preamble and header are not CCK encoded and are assumed error-free. They are ignored in the discussion below.
4. One byte corresponds to one symbol exactly: NS=N.

From assumption 1 it follows that one erroneous symbol on average contains: (8 * 128)/(256-1) = 4.016 erroneous bits. From this it follows that:

(a) $BER = SER * (4.016/8\ chips) = SER * 0.502$

From assumption 2 the rate of errorless packets (1-PER) depends on the rate of errorless symbols (1-SER) in the following way:

(b) $(1-PER) = (1-SER)^{NS}$

or, using (a) and assumption 4:

(c) $PER = 1 - (1 - (1.992 * BER))^{N}$

For a BER of 1E-5 (as required for FCC approval), and a packet size of a 1000 bytes, this leads to a PER of 0.02 (which is 2%).

A PER of 8% corresponds with a BER of 4.2E-5.