

The following guidelines are provided here for optimizing your wireless system design for maximum range and reliability. Many tradeoffs must be considered when selecting an off the shelf encoder/decoder or designing custom software.

If your wireless design incorporates an off the shelf encoder/decoder combination, the only parameter that might vary is the data rate. As a rule, it is best to minimize the data rate as much as possible while balancing this with transmitter power consumption and system latency. Also select an encoder/decoder that has little or no overhead in terms of “1”s or “0”s. The optimal encoding format will have an average value for  $T_{on}$  and  $T_{off}$  equal to 50 percent. This condition places the data slicer threshold halfway between the peak signal level and the noise floor, which will provide the best performance.

If your wireless system incorporates microprocessors for encoding and decoding, some additional factors may be considered in the design of the data encoding scheme. The following is a list of items to consider when selecting the encoding format and decoding algorithm:

1. Transmitter power consumption.-To minimize average transmitter current use the shortest possible transmission interval. For high security applications, the decoder must recognize two or more consecutive words for validation. Design the transmitter such that it automatically stops transmitting regardless of whether the button is depressed.
2. Peak vs. Average Transmitted RF Power. –The FCC Part 15 regulations specifies average power levels which allows a higher than the limit peak power. This is true for the fundamental and harmonic radiated

power. To take advantage of this, the transmission must be less than 100 milliseconds and have the smallest number of bits possible. In other words, the average transmitted duty cycle over a millisecond interval should be minimized.

3. Decoder Tolerances. –The decoder algorithm should tolerate some amount of noise spikes within the data stream that might be received in some applications (i.e. ignition noise). Also, allowances should be made for pulse width distortion and jitter. Self-locking schemes are necessary when the data rate is not accurately controlled at the encoder or the clock in the decoder is not crystal controlled. Asynchronous transmission is acceptable for short words and will work for long words if the encoder and decoder clocks are accurate with respect to each other.