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Strategic Implementation of Wireless Technologies

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Why Wireless?

- Offers adopters significant strategic advantage in terms of:
 - Cost Savings
 - Engineering
 - Installation
 - Logistics
 - Dramatic improvement in the frequency and reliability of data

Key Drivers

- **Installation Savings**
- **Better Information**
- **Economies of Scale**
- **Operational Savings**
- **Safety**

Wireless Evaluation Criteria

- **RF Technology**
- **Security**
- **Interference Rejection**
- **Sensitivity**
- **Power Management**
- **Legacy System Integration**
- **Backwards Compatibility**

RF Technologies

- **Unlicensed vs. Licensed**
 - **Unlicensed**
 - In 1985, the FCC permitted use in the ISM Bands
 - (902-928MHz, 2.4-2.4835 GHz, 5.725-5.85 GHz)
 - Power levels up to 1 Watt
 - **Licensed**
 - VHF/UHF
 - Only operate within Licensed area

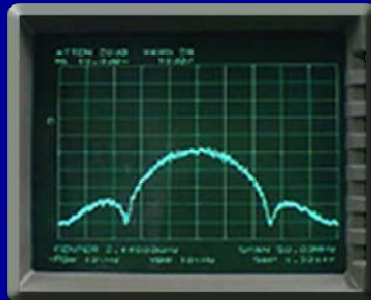
Unlicensed Spread Spectrum

- **Frequency Hopping Spread Spectrum (FHSS)**



Unlicensed Spread Spectrum

- Direct Sequence Spread Spectrum (DSSS)



Spread Spectrum Advantages

- No License Required
 - Not limited to a single geographic location nor has a defined term for use.
- Interference Rejection
 - Quickly hops pseudo-randomly through multiple channels, allocating a specific time slot and frequency for its transmission providing inherent immunity to interference.

FHSS Characteristics

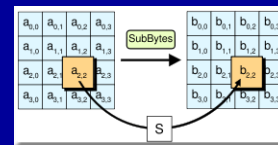
- Security

- Communication frequency changes rapidly

- FHSS appears to be short duration impulse noise to an unintended receiver.

- Advanced Encryption Standard (AES)

- 128 & 256 bit Encryption Keys



FHSS Characteristics

- Data Integrity

- Error Checking



- Uses Cyclic Redundancy Check, giving each packet a unique digital signature guaranteeing what is received is identical to what was sent

- As width of the CRC increases, so does the probability of error detection.

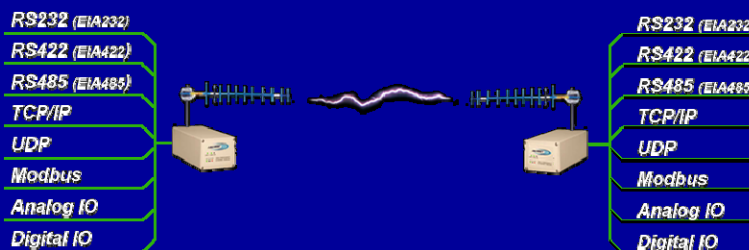
- » 8 Bit CRC – 99.6094%
- » 16 Bit CRC – 99.9985%
- » 32 Bit CRC – 99.9999%

FHSS Characteristics

- Sensitivity
 - Very Important as the more sensitive the receiver is, the weaker the transmitted signal can be
 - Sensitivity is expressed in terms of dB
 - *Example: a receive sensitivity of -110 dBm is better than a receive sensitivity of -107 dBm by 3 dB, or a factor of two. In other words, at a specified data rate, a receiver with a -110 dBm sensitivity can hear signals that are half as strong as a receiver with a -107 dBm receive sensitivity.*

FHSS Characteristics

- Flexibility
 - Operation of different protocols over the same communications layer



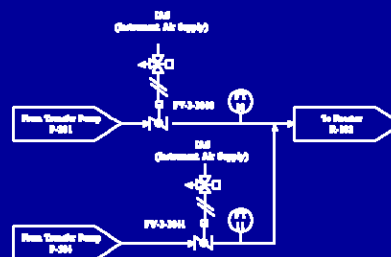
FHSS Characteristics

- **Temperature Range**
 - Reliable Operation within industrial temperature ranges (i.e. -40° to +75° C).
- **Operation in Hazardous Environments**
 - UL certification for Class 1, Division 2 environments permitting radio operation in the presence of flammable or explosive gases, fluids or vapors.

Applications

- **Wireless I/O**
 - **Conduit & Wire Replacement**
 - **Analog & Digital IO**

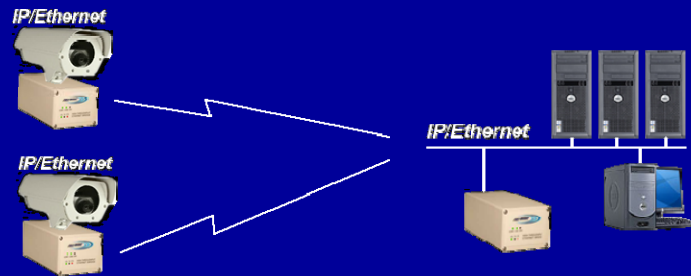
- Turn Pumps On/Off
- Actuation of Valves
- Remote transmitters



Applications

- **Security**

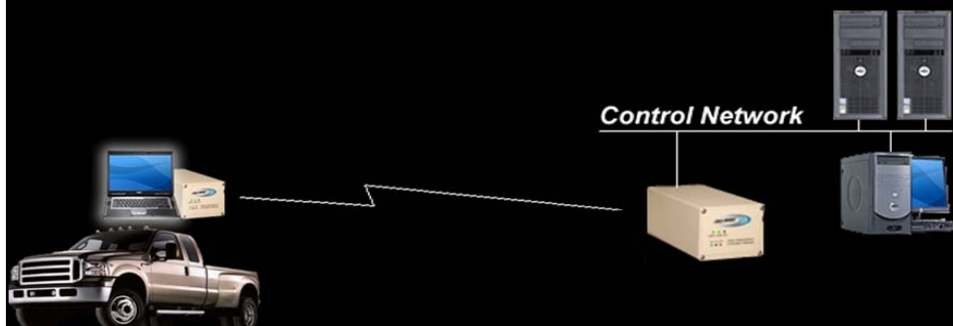
- Detect intrusions, control access, or perform video surveillance within facility.



Applications

- **Workforce Mobility**

- Allows mobile workers to access applications and perform jobs where they work.



Applications

- **Mobile Asset and Material Tracking**
 - Tracking asset location allows for better use of assets as well as regulatory compliance for the use, storage and transport of hazardous chemicals.



Applications

- **Integration of Technologies**
 - Integrate Wireless Sensor Networks with other technologies providing greater potential for widespread applications.



Closing

- **Information is Power.**
- **The ability to gather time-critical information, digest it and react to it is the key to continuously adapting to change with increasing reliability and profitability.**