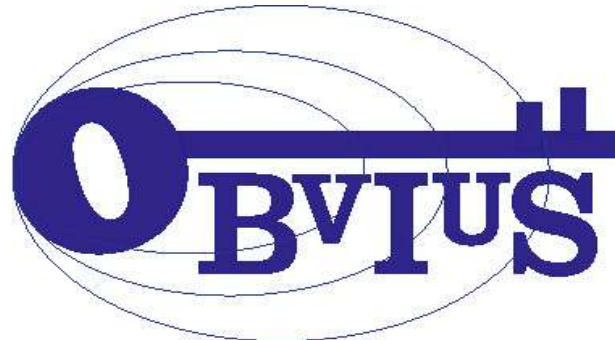


# Wireless metering overview

Obvius LLC  
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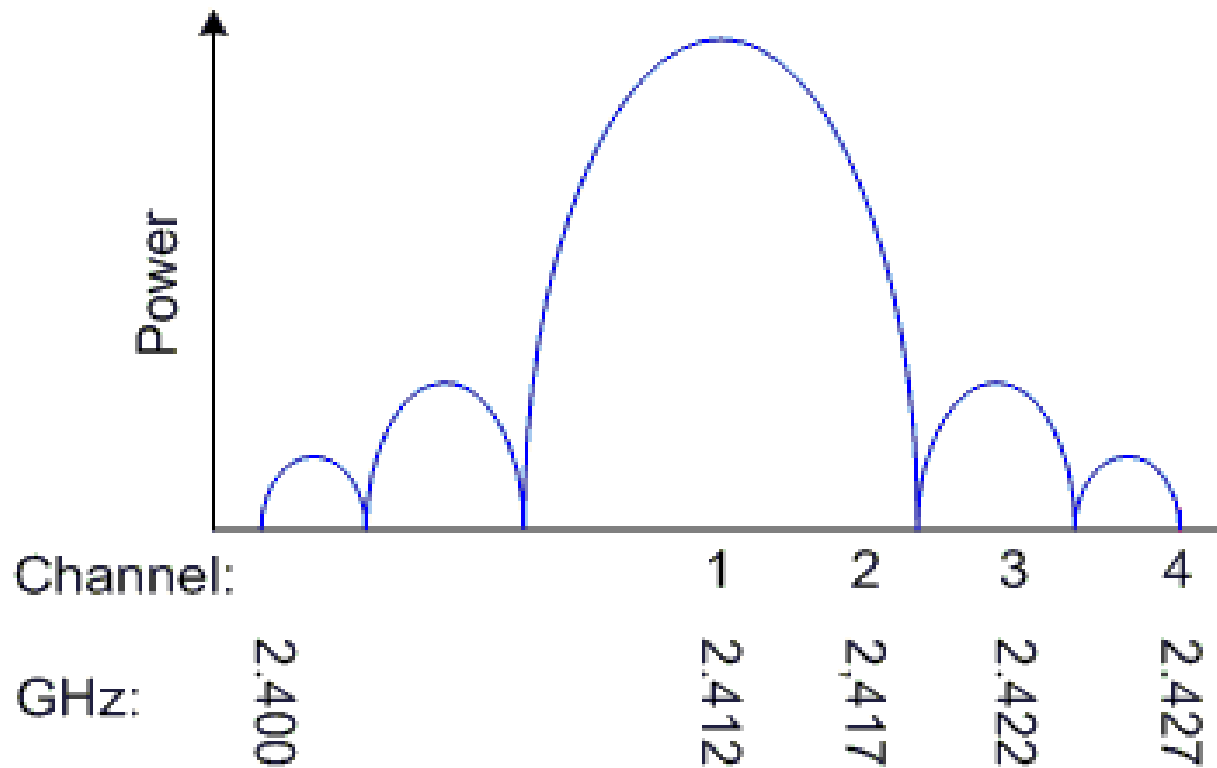
# Agenda

- Types of radios
  - Modulation
  - Frequencies
- ISM bands
- Radio configurations
- Applications
- Sample products

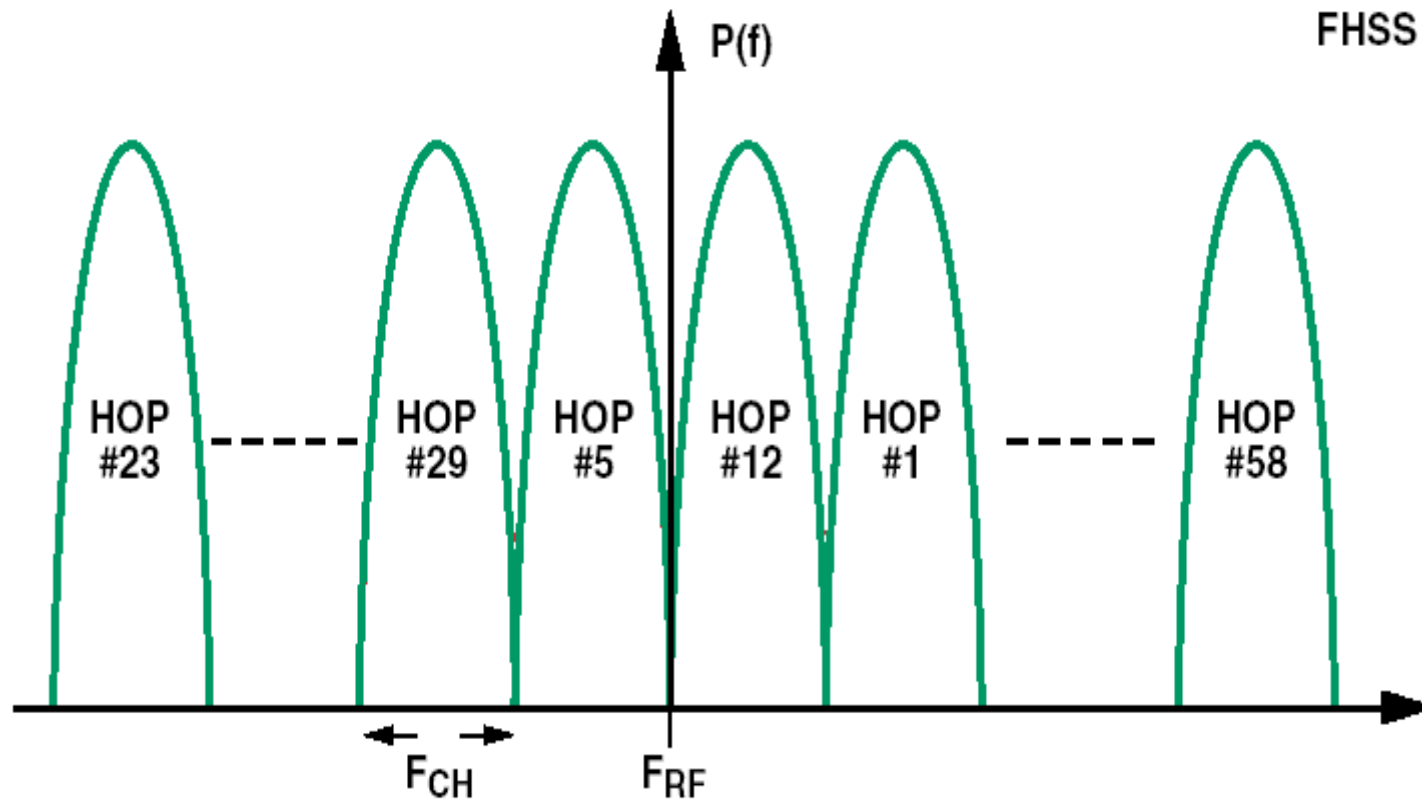
# Radio modulation

- Radios used in wireless submetering applications (and many other applications) utilize spread spectrum modulation schemes
- Spread spectrum minimizes interference by using different frequencies within a given band
- Two basis approaches to spread spectrum:
  - Direct Sequence Spread Spectrum (DSSS)
  - Frequency Hopping Spread Spectrum (FHSS)

# Direct Sequence Spread Spectrum (DSSS)



# Frequency Hopping Spread Spectrum (FHSS)



# ISM bands

- Instrumentation, Scientific and Medical (ISM) bands do not require site licenses for operation
- ISM frequencies:
  - 415 MHz (US/CA)
  - 915 MHz (US/Canada)
  - 2.4 GHz (US/CA/EU)
  - 5.0 GHz (US/CA/EU)

# 415 Mhz

- Characteristics – Limited bandwidth, generally one-way transmission
- **Advantages:**
  - Low cost
  - Low power
- **Disadvantages:**
  - Low band width
  - Susceptible to interference
- **Applications:**
  - Garage door openers
  - Battery powered temp sensors

# 900 Mhz

- Characteristics – FHSS (some DSSS)
- **Advantages:**
  - Good penetration through indoor walls
  - Good long range solution
- **Disadvantages:**
  - Slower
  - Higher latency
  - Not used in EU
- **Applications:**
  - Cordless phones
  - ModHoppers

# 2.4 GHz

- Characteristics – DSSS mainly
- **Advantages:**
  - Worldwide acceptance
  - Faster than 900 MHz
- **Disadvantages:**
  - Short range (~ 300 ft or less)
  - Susceptible to interference
- **Applications:**
  - WIFI
  - Smaller less expensive chipset devices (e.g., 802.15.4)

# 5.0 GHz

- Characteristics – Very high data rates, good for WIFI applications
- **Advantages:**
  - High bandwidth
- **Disadvantages:**
  - Short range (~ 100 ft)
- Applications:
  - WIFI

# ModHopper R9120-x

- FHSS
- 900 Mhz (uses Maxstream radio modules)
- Two versions:
  - Low power (1mW) rated at 300 feet indoors
  - High power (100 mW) rated at 1500 feet indoors
- ModHopper provides the best blend of distance, resistance to interference and data rates
- Uses proprietary Obvius Wireless Routing Protocol, uniquely optimized for Modbus

# Radio configurations

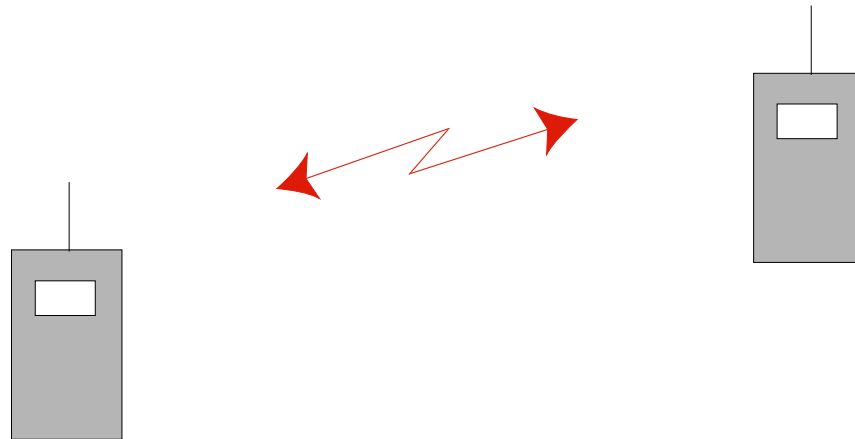
Point to point

Point to Multipoint

Mesh

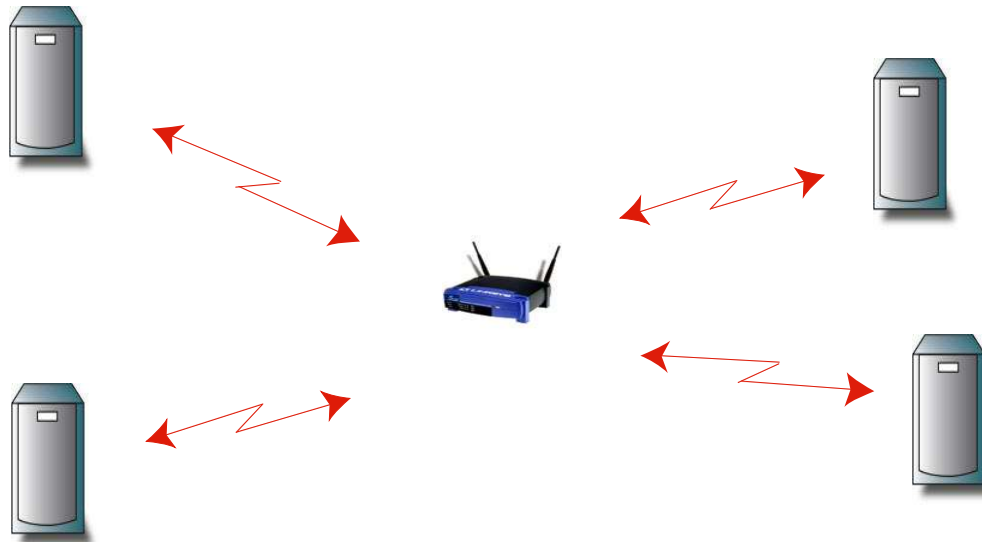
# Point to point

- Mainly serial radios
- Only 2 radios communicating



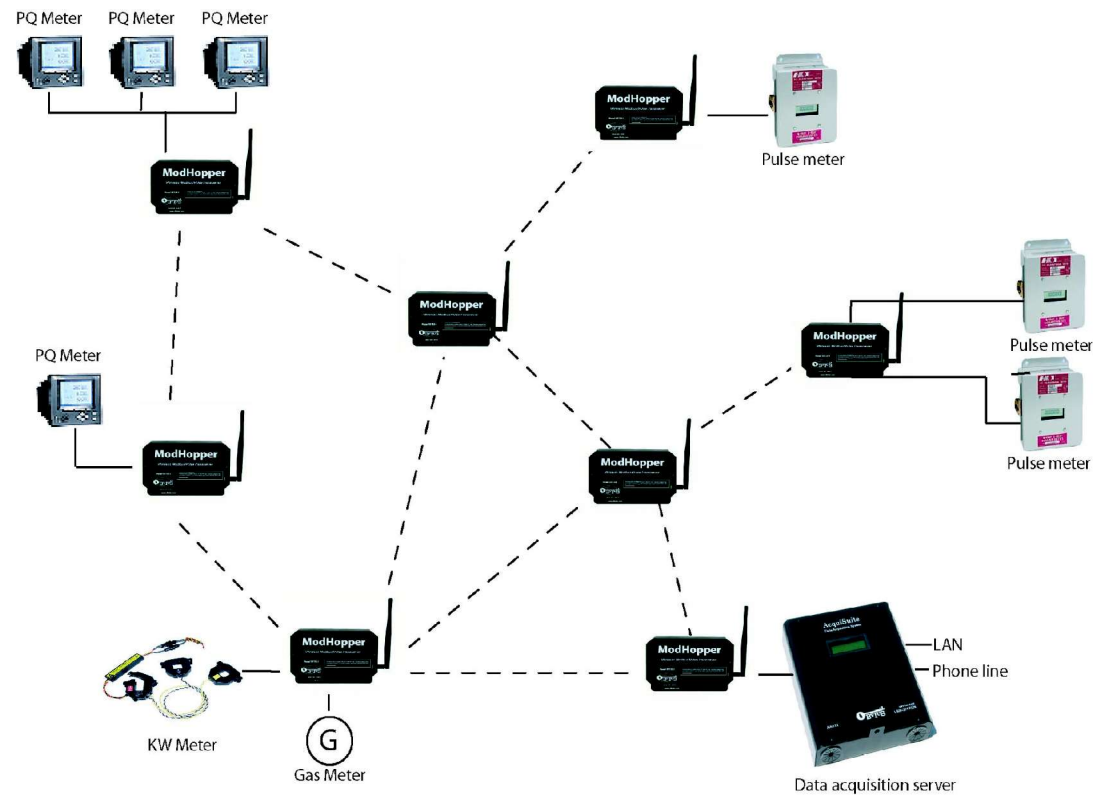
# Point to multipoint

- Mainly WiFi, some serial radios
- All radios must be in range of main data point
- Can be polled, but no delivery confirmation



# Mesh radios

- Multiple nodes talk with each other
- Longer range, higher latency



# Mesh routing options

- **Broadcast routing** – request is broadcast and passed on to all nodes
  - Low cost nodes
  - No packet acknowledgment
- **Source routing** – all routing is determined by a “master” node or PC
  - Lower node costs
  - Requires PC for routing
- **Link state routing** – nodes are all autonomous, routing tables are stored and updated in each node

# Radio system operations

# Basic radio module

- Provides comms between two serial port devices
- Radios can provide checksums or acknowledgment
- Radio is in a pass-through mode and does not interact with the data stream
- Remote diagnostics are generally not available in basic mode

# Sensor radio network

- Data is sent in autonomous packets
- Delivery time varies depending on traffic and other factors (e.g. 1 to 60 minutes)
- Requires high level of integration with complex devices (i.e., meters) to function properly
- Remote diagnostics may be available

# Communications network

- Functionally a replacement for hard-wired comms
- Data is sent in near real time to a specific device and replies are directed back to the source
- Requires no integration to work with devices that use the underlying protocol (e.g., Modbus)
- Example: WiFi routes TCP/IP only

# Sample products/solutions

<i>Product/vendor</i>	<i>Freq</i>	<i>Modulation</i>	<i>Topology</i>	<i>Application.</i>
Maxstream, Aerocomm	900Mhz, 2.4Ghz	FHSS	Point to Multipoint	Serial port to serial port.
WiFi	2.4Ghz, 5Ghz	DSSS, 802.11	Point to Multipoint	Comms network
Sensicast	900Mhz, 2.4Ghz	FHSS (900Mhz) DSSS/802.15.4 (2.4ghz)	Mesh	Sensor network, Source Routing
Dust	900Mhz, 2.4Ghz	FHSS (900Mhz) DSSS/802.15.4 (2.4ghz)	Mesh	Sensor network, Source Routing
Zigbee	900Mhz, 2.4Ghz	DSSS, 802.15.4	Mesh	Sensor network, Source Routing.
Millennial	900Mhz, 2.4Ghz	FHSS (900Mhz), DSSS (2.4ghz)	Mesh	Sensor network, Source Routing.
ModHopper	900Mhz	FHSS	Mesh	Comms Network, Link State Routing