

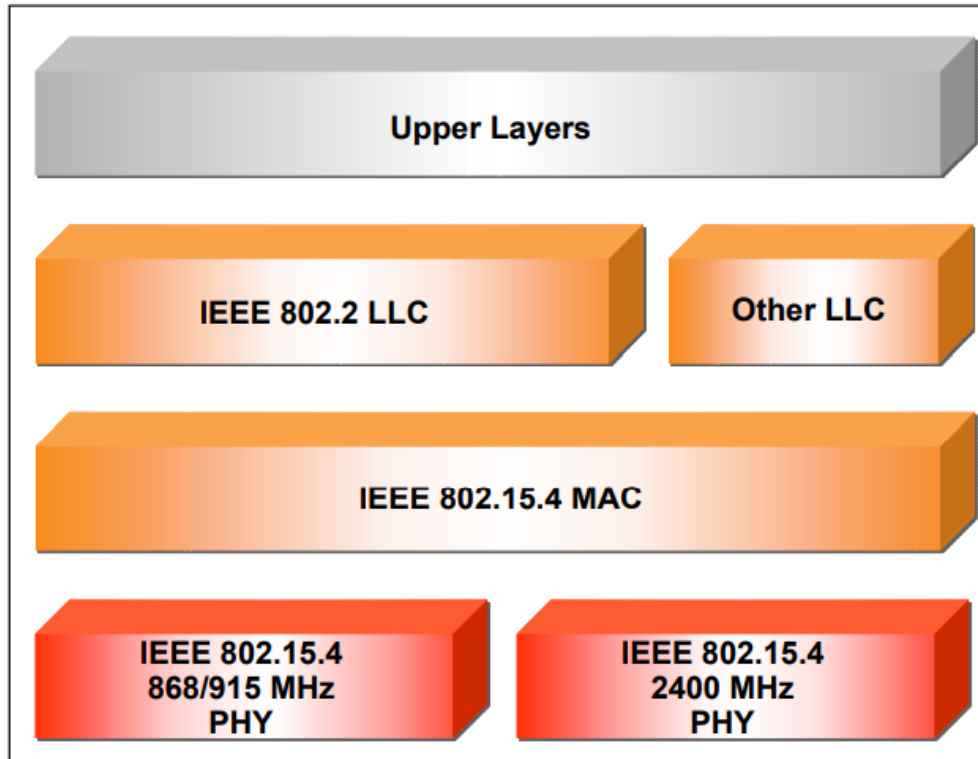
IEEE 802.15.4

Kaushal K | Cdac, Pune | Jun 2022

Main Features

- Data rates of 250 kb/s, 40 kb/s and 20kb/s
- Star to Peer-Peer operation
- Support for Low latency devices
- CSMA-CA Channel access
- Dynamic device addressing

Protocol Architecture



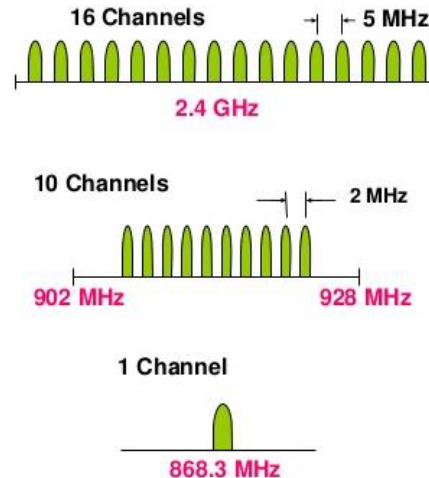
Physical Layer

Among the main characteristics of this layer, the following stand out:

- Transmission and reception of digital data;
- Selection of the channel to be used;
- Existence of 3 frequency bands that are embedded in 27 channels;
- Possibility of automatic addressing of devices;
- Turn the radio transceiver on and off

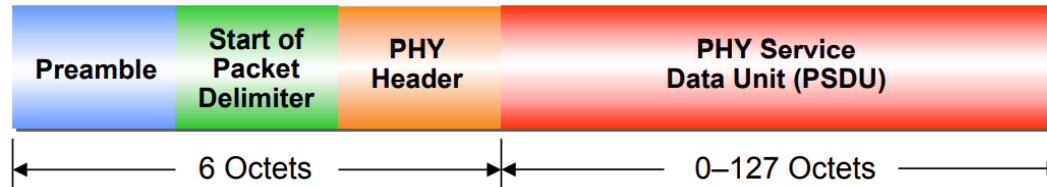
Assign Frequency Bands

- Regarding frequency bands, the IEEE 802.15.4 standard can work with
 - 868 MHz (Europe), 1 Channel
 - 915MHz (USA), 10 Channels
 - 2.4GHz (Others), 16 Channels



Packet Structure

- Packet Fields
 - Preamble (32 Bits) – Synchronization
 - Start of Delimiter – 8 Bits
 - PHY Header (8 Bits)
 - PSDU (0-1016 bits) – Data Field



Modulation Scheme

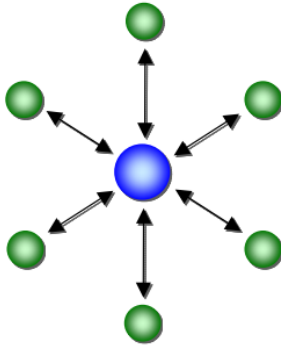
- The frequency bands use the Direct Sequence Spread Spectrum (DSSS) transmission method, due to the need for high interaction and low cost
- Two types
 - BPSK (*Binary Phase Shift Keying*)
 - O-QPSK (*Orthogonal-Quadrature Phase Shift Keying*)
- In BPSK each sent symbol represents 1 bit of data, while in O-QPSK a sent symbol means 4 bits of data.

Access Layer (MAC)

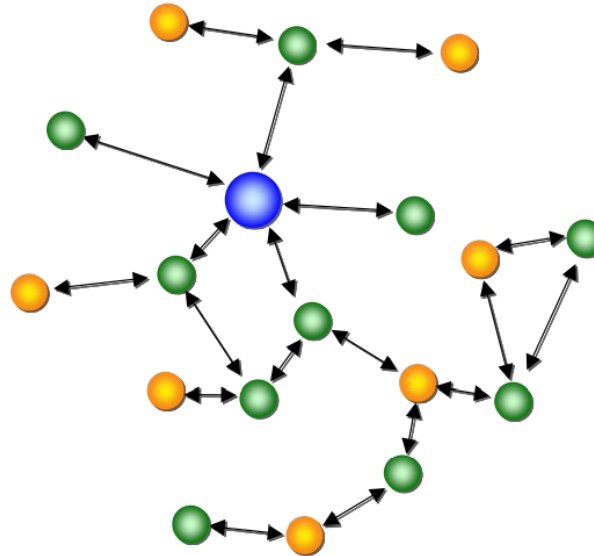
- It has the function of controlling the entire physical layer access operation for data transmission and reception
- Generate/synchronize beacons. *Beacons can* be defined as control packets that delimit frames used by the coordinator to synchronize with other devices
- Uses CSMA-CA (*Carrier Sense Multiple Access with Collision Avoidance*) protocol

Network Topology

Star



Mesh



Network Device Type

- Within the IEEE 802.15.4 standard, two types of devices are defined, which are full feature device (FFD) and Reduce Feature Device (RFD)
- FFD
 - Any topology
 - PAN coordinator
 - Talks to any other device
- RFD
 - Limited to Star Topology
 - Can not become network coordinator
 - Talks only to NC

Device Definitions (Roles)

- Coordinator
 - An FFD with network device functionality that provides coordination and other services to the network
- PAN Coordinator
 - A coordinator that is the principal controller of the PAN. A network has exactly one PAN
- Network Device

Applications

- Zigbee
- Thread
- 6LoWPAN
- WirelessHART



Thank You