# Spectrum Sharing

Unlicensed spectrum benefits:

1. Facilitating Market entry
2. Enabling niche applications and services to be addressed quickly and cheaply using existing technology and spectrum
3. Providing certainty about spectrum access
4. Security of Tenure
5. Reduced Congestion in Licensed bands (Traffic offload from cellular networks to WiFi)
6. The ability to extend the reach of fixed communication networks (wireless local are connectivity etc.)

Users benefits of spectrum sharing:

1. Greater convenience and flexibility by avoiding the need for lengthy runs of cable in home and work environments
2. Ability to connect mobile devices to a fixed broadband network. Reducing dependence on the mobile network
3. Enhanced convenience, safety and security (low cost installation of wireless security systems, unlocking vehicles wirelessly etc.)

## Unlicensed Rules

There are many rules in the unlicensed bands

1. Co-existence with other devices
2. Co-existence with other different systems

If LTE was to use the spectrum that WiFi uses then it must abide by the rules of WiFi within that spectrum.

## WiFi

### 802.11n

- MIMO
- 40 MHz bands
- Up to 450 Mbps per channel

### 802.11ac

- 80 or 160 MHz channels
- 256 QAM
- up to 8 MIMO streams
- 1Gbps

**802.11ah**

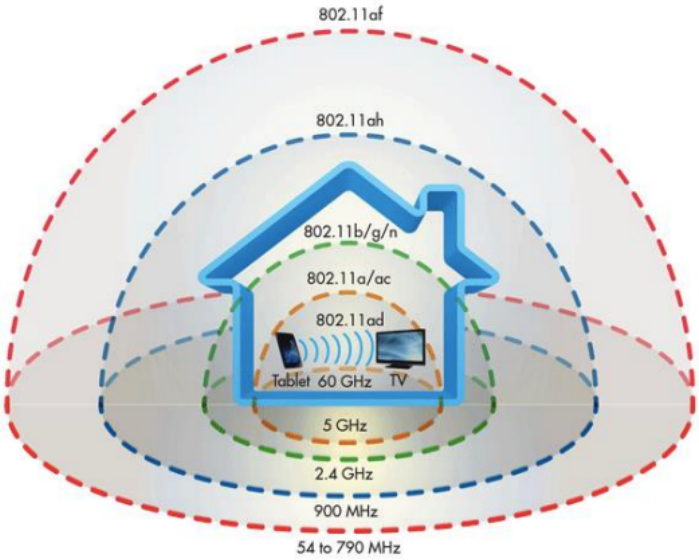
- Primarily for M2M communications
- Low bit rate
- 1, 2, 4, 8, and 16MHz bandwidth options

**802.11ad (WiGig)**

- 60MHz millimeter wave band, high speed short range
- 8GHz of contiguous spectrum available in all EU member states
- Applications
  - Cable replacement for displays
  - wireless docking between devices
  - instant data sycn
  - etc.
- 7Gbps at a maximum range of 10 metres
- extremely high attenuation at these frequencies

**802.11ay**

- Data rates > 30Gbps
- LOS wireless backhaul




## 5GHz

promised land of unlicensed capacity

- trade off between capacity and coverage
- relatively underutilized

- 60GHz doesn't offer useful coverage

**LTE-U / LAA**

Targeting mobile operators using LTE in unlicensed spectrum for new small cell deployments

**LWA / LWIP**

Targeting mobile operators leveraging existing carrier Wi-Fi deployments

**MulteFire**

Broadens LTE ecosystem to enhanced and new deployment opportunities, suitable for neutral host

**Wi-Fi**

Evolving for enhanced performance and expanding to new usage models, used today as neutral host

## Acronyms

ITS: Intelligent Transport Systems LAA: Licensed Assisted Access LWA: LTE Wi-Fi link Aggregation LWIP: LTE Wi-Fi radio level integration with IPsec tunnel