

# Wireless Network Protocols

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## Purpose

To provide detailed technical guidance to installers, deployers, and operators of IEEE 802.11 compliant systems to help assure that such systems are correctly installed and deployed.

# Need for a Recommended Practice

Correct installation and deployment of IEEE 802.11 compliant systems are important to assure that those systems will maximally achieve their design goals in terms of system performance, reliability, and non-interference to incumbent licensed systems with which they will share the TV broadcast bands.

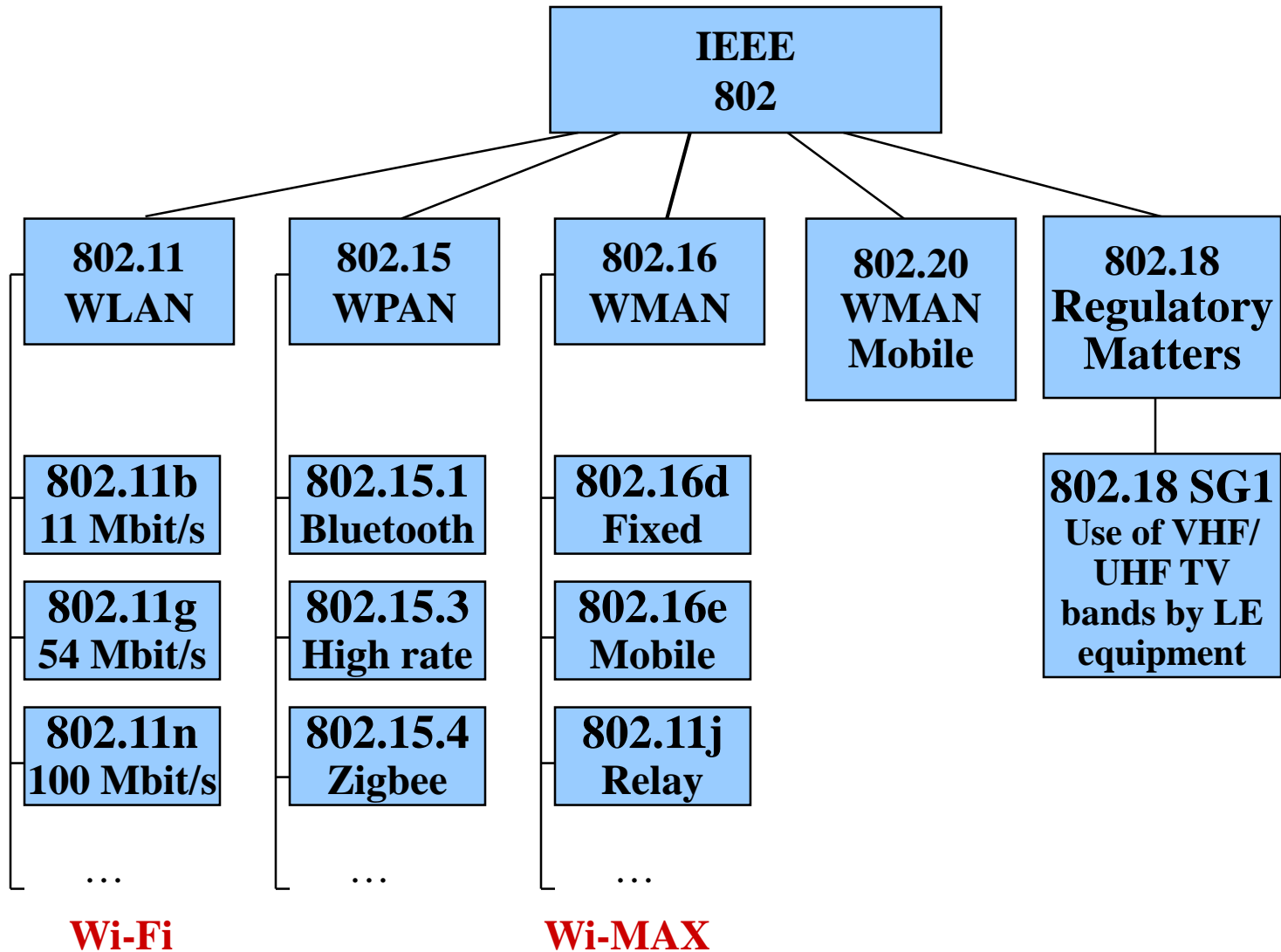
# Stakeholders

Stakeholders are installers, operators, users, and manufacturers of IEEE 802.11 systems.

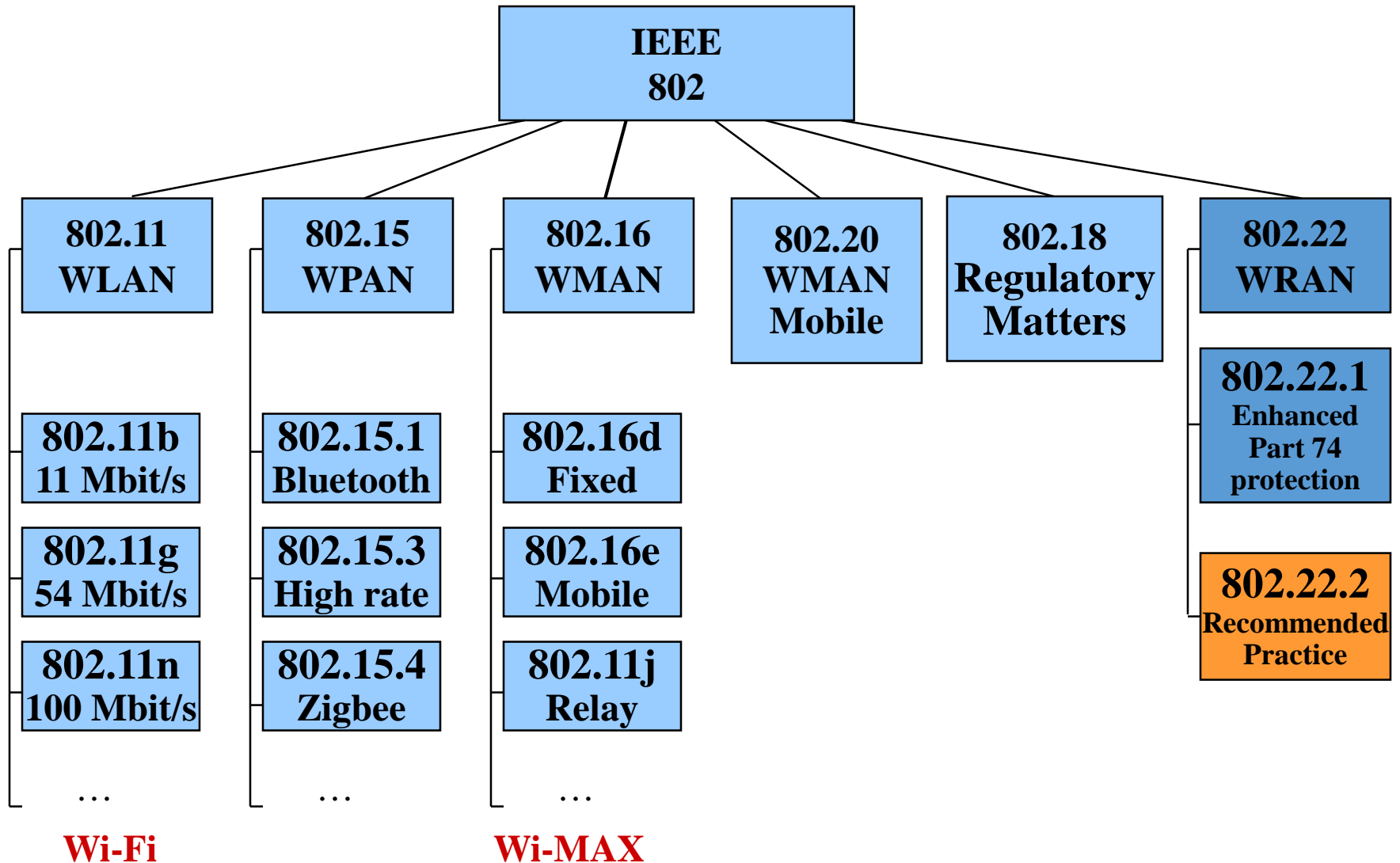
# Fixed/Access

- Transmitter power limit: 1 W
- Transmitter antenna gain limit: 6 dBi
- An incumbent database is required.
- Geo-location technique is required using either a GPS or professional installation.
- Transmission of a unique identifier is necessary.
- Spectrum sensing approach is postulated.

# IEEE 802 Standards Process



# IEEE 802 Standards Process



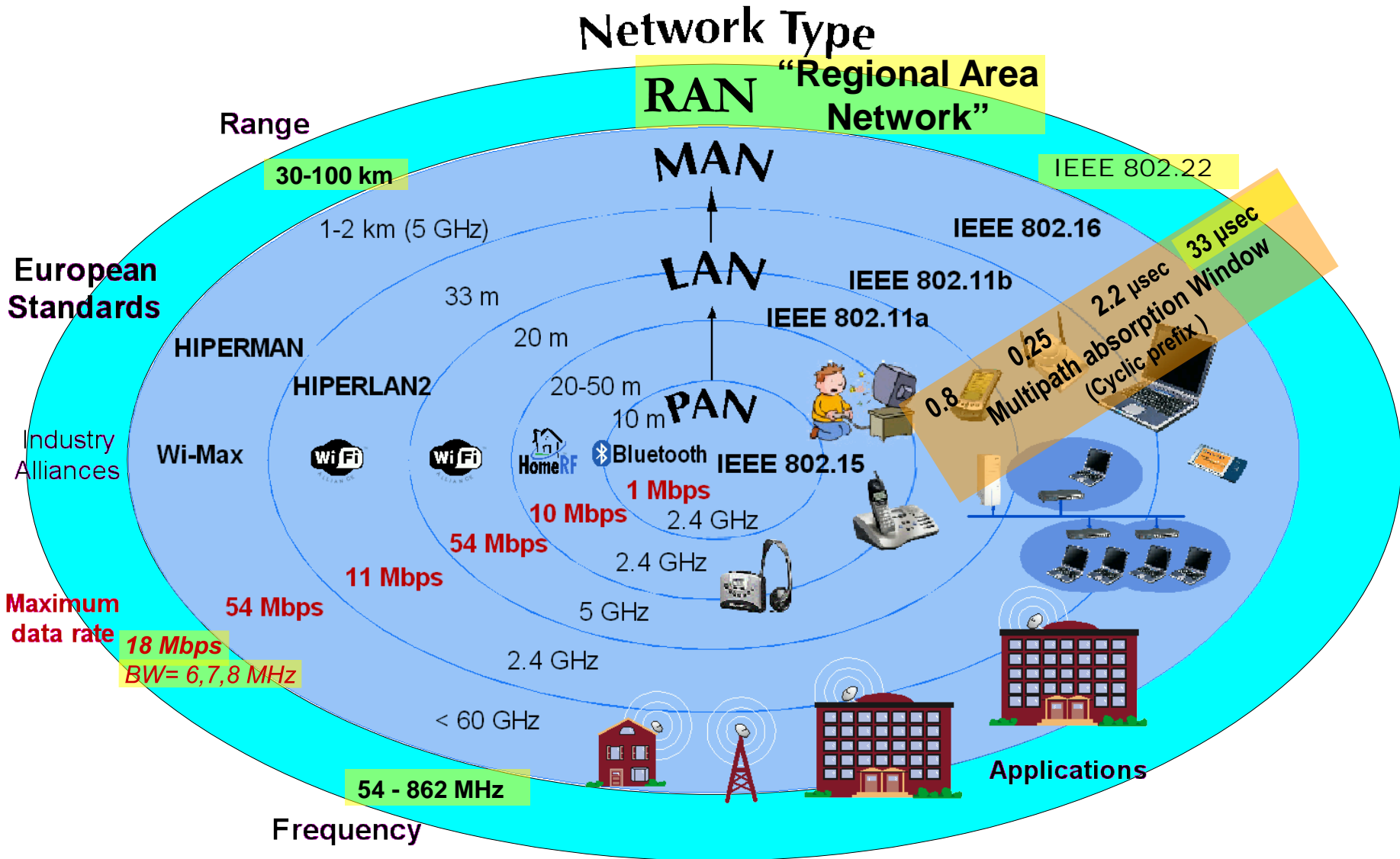
# IEEE 802.22 Functional Requirements

(primarily related to incumbent protection)

- 1 W transmitter power with a maximum of 4 W EIRP.
- Fixed point-to-multi-point access only.
- Base station controls all transmit parameters and characteristics in the network.
- Base station is professionally installed and maintained.
- Location awareness for all devices in the network
- Customer Premise Equipment (CPE) antenna is to be installed outdoors at least 10 m above ground.
- CPE cannot transmit unless it has successfully associated with a base station.
- Base station uses an up-to-date database augmented by distributed sensing to determine channel availability.

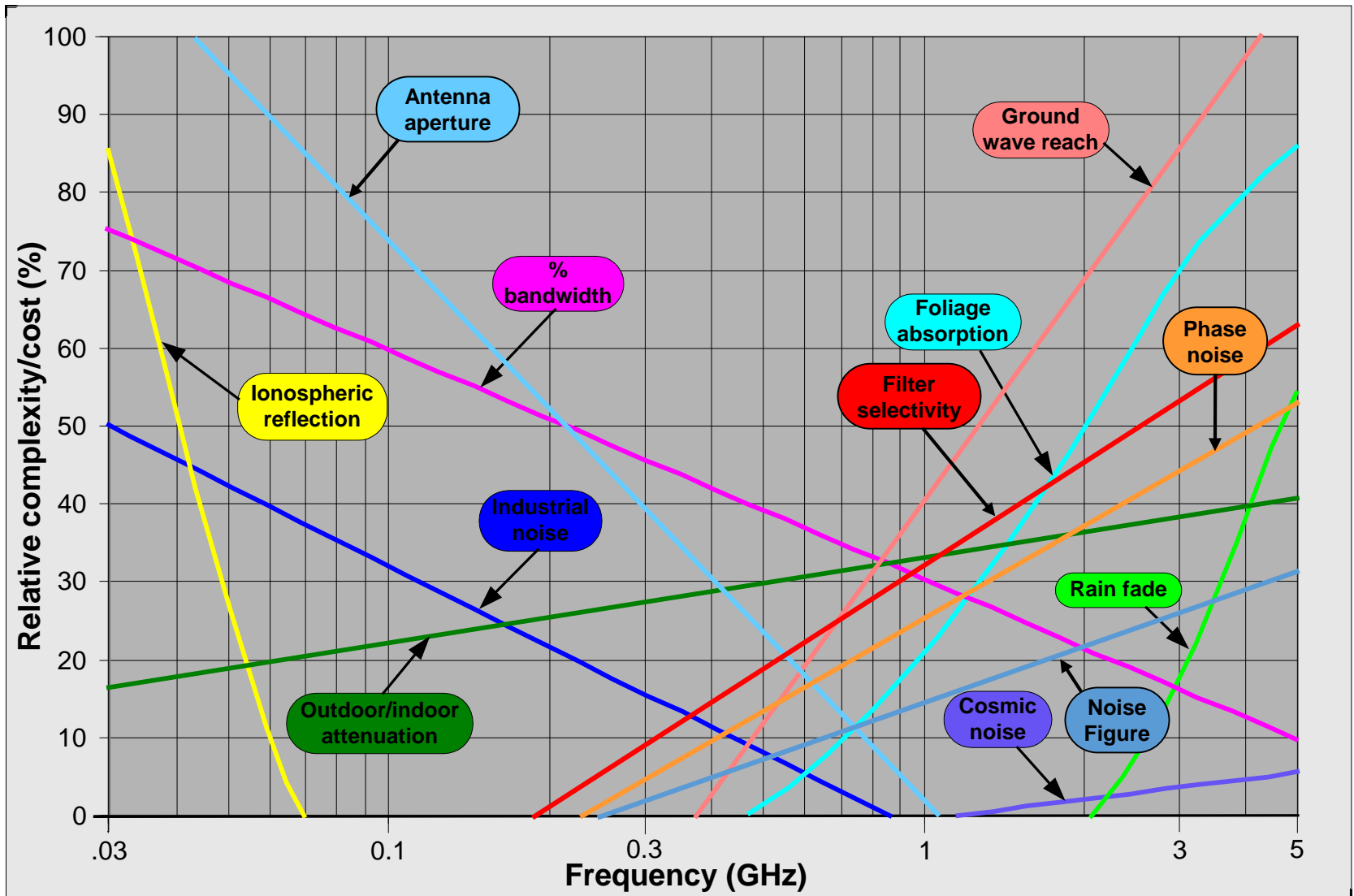


# IEEE Standards



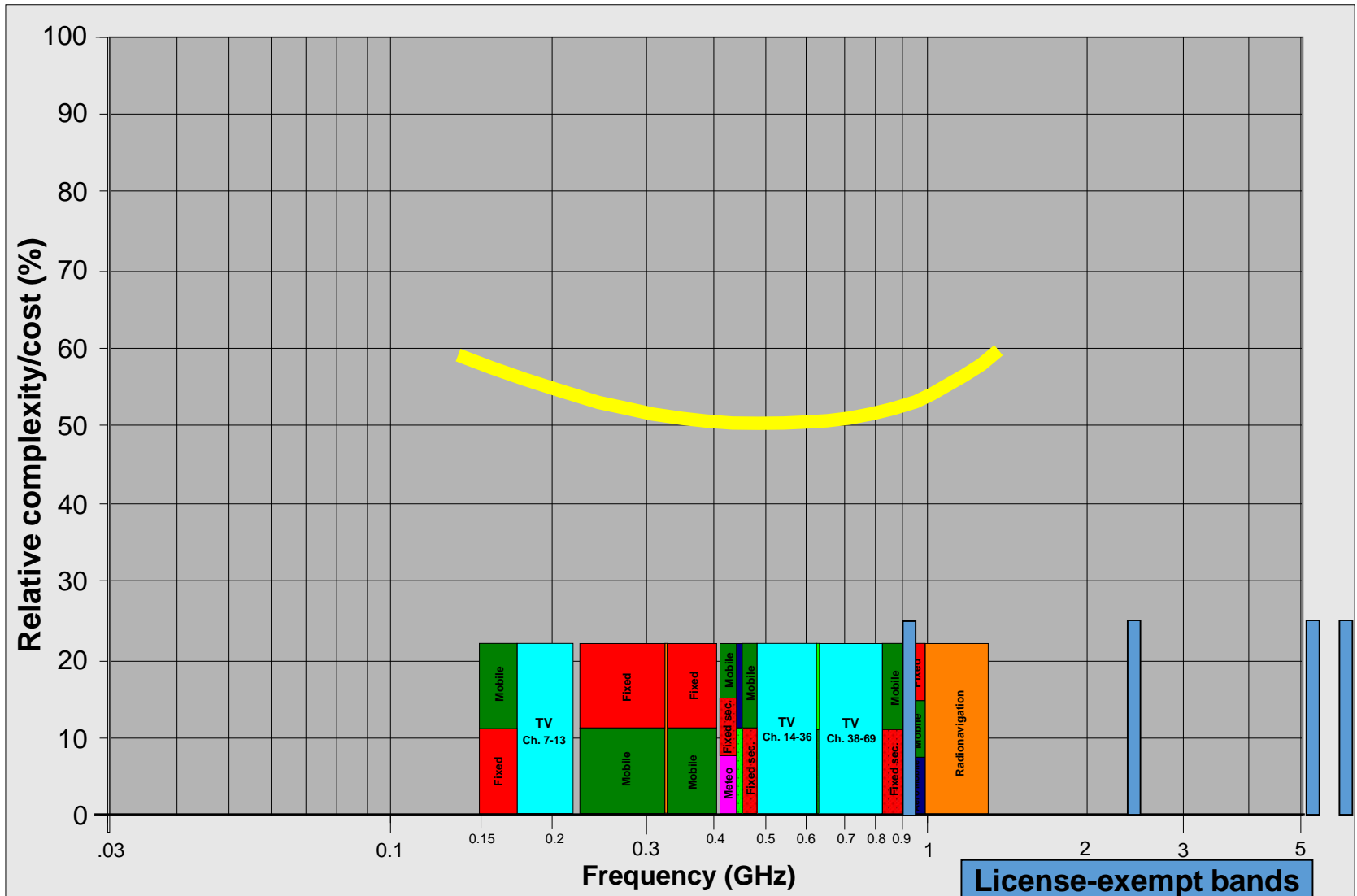
# Optimum frequency range

for large area *Non-Line-of-sight* Broadband Access



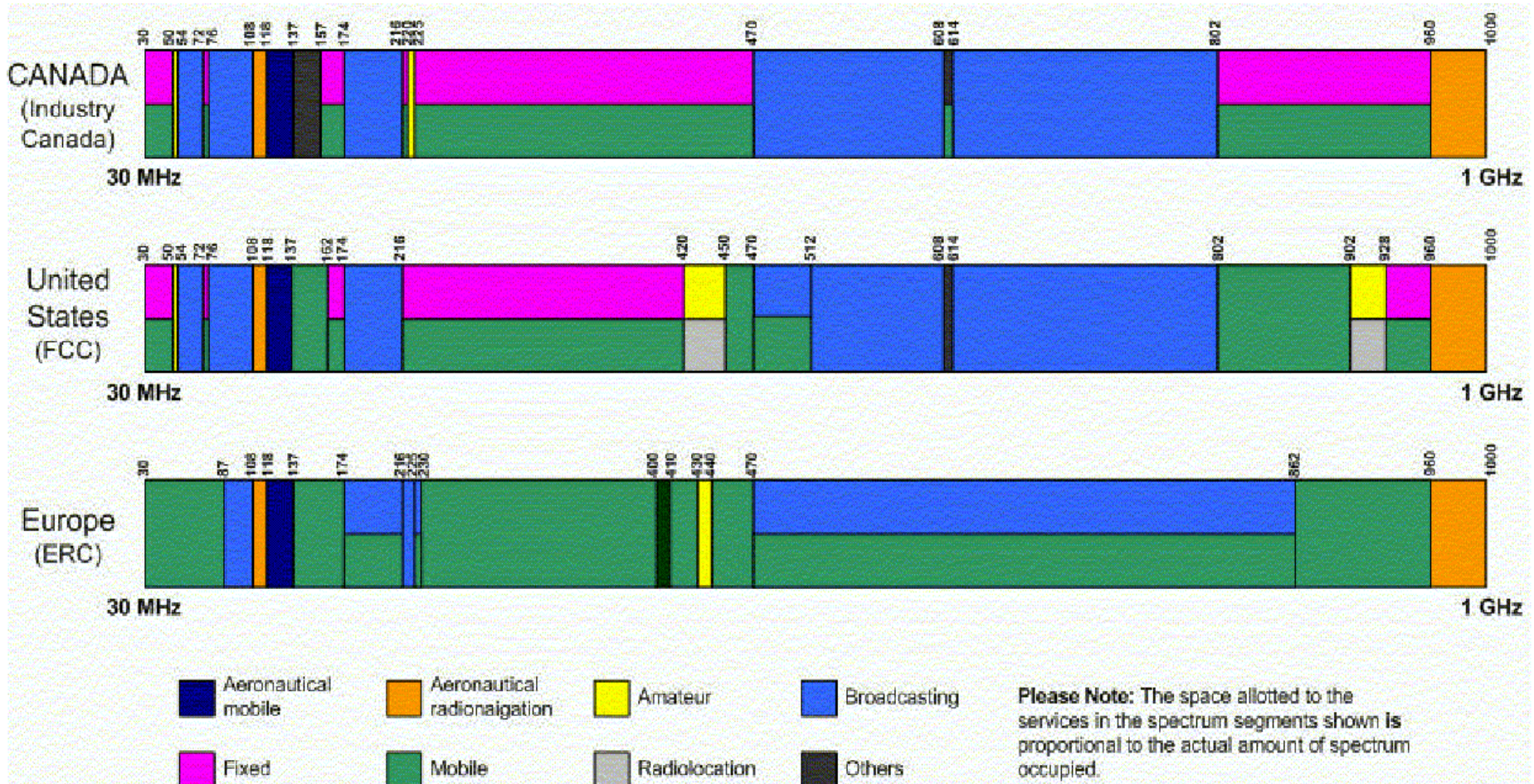
# Optimum frequency range

for large area *Non-Line-of-sight* Broadband Access



# Existing RF spectrum usage

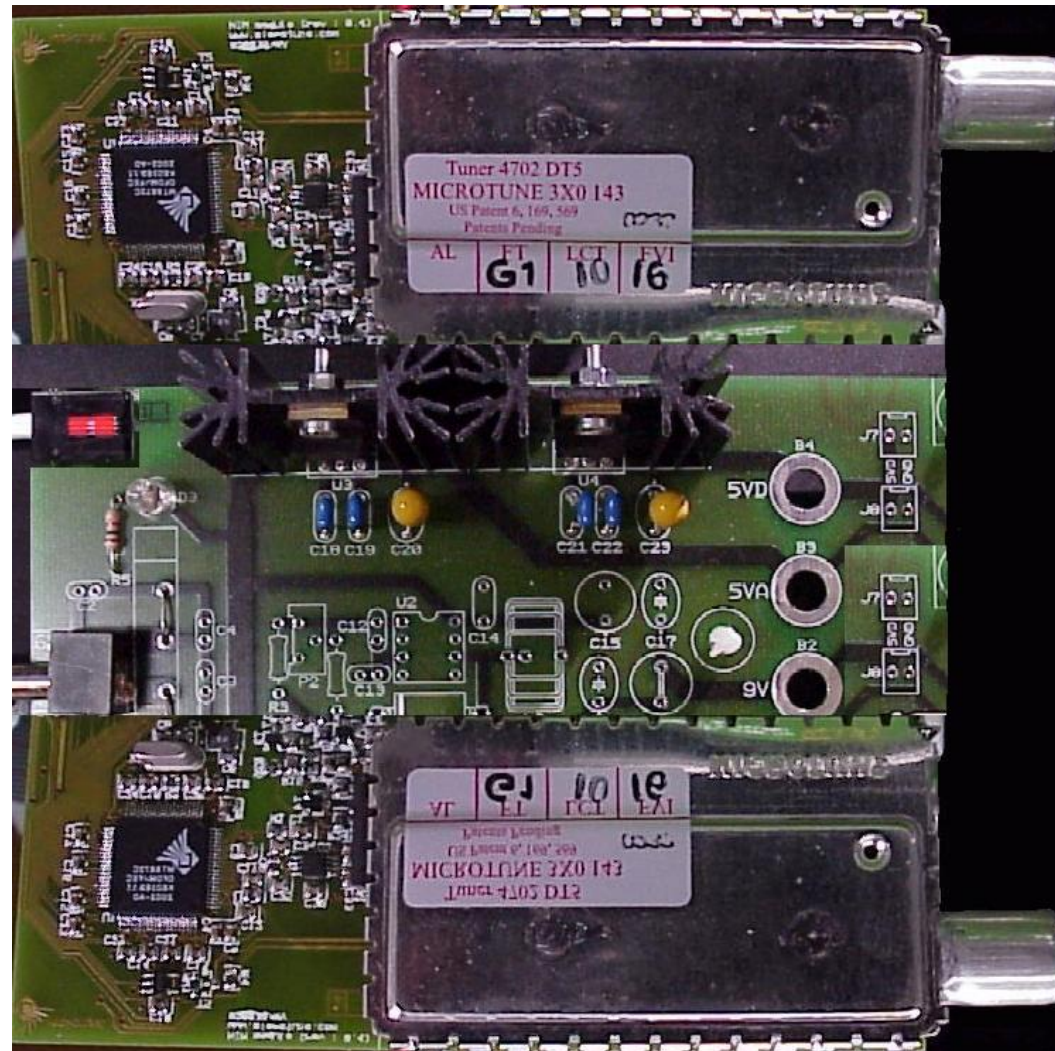
## *Main markets*





# CPE Mock-up

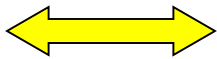
(RF based on low-cost UHF-TV tuners)



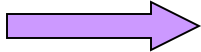
RF Input



Ethernet to  
computer



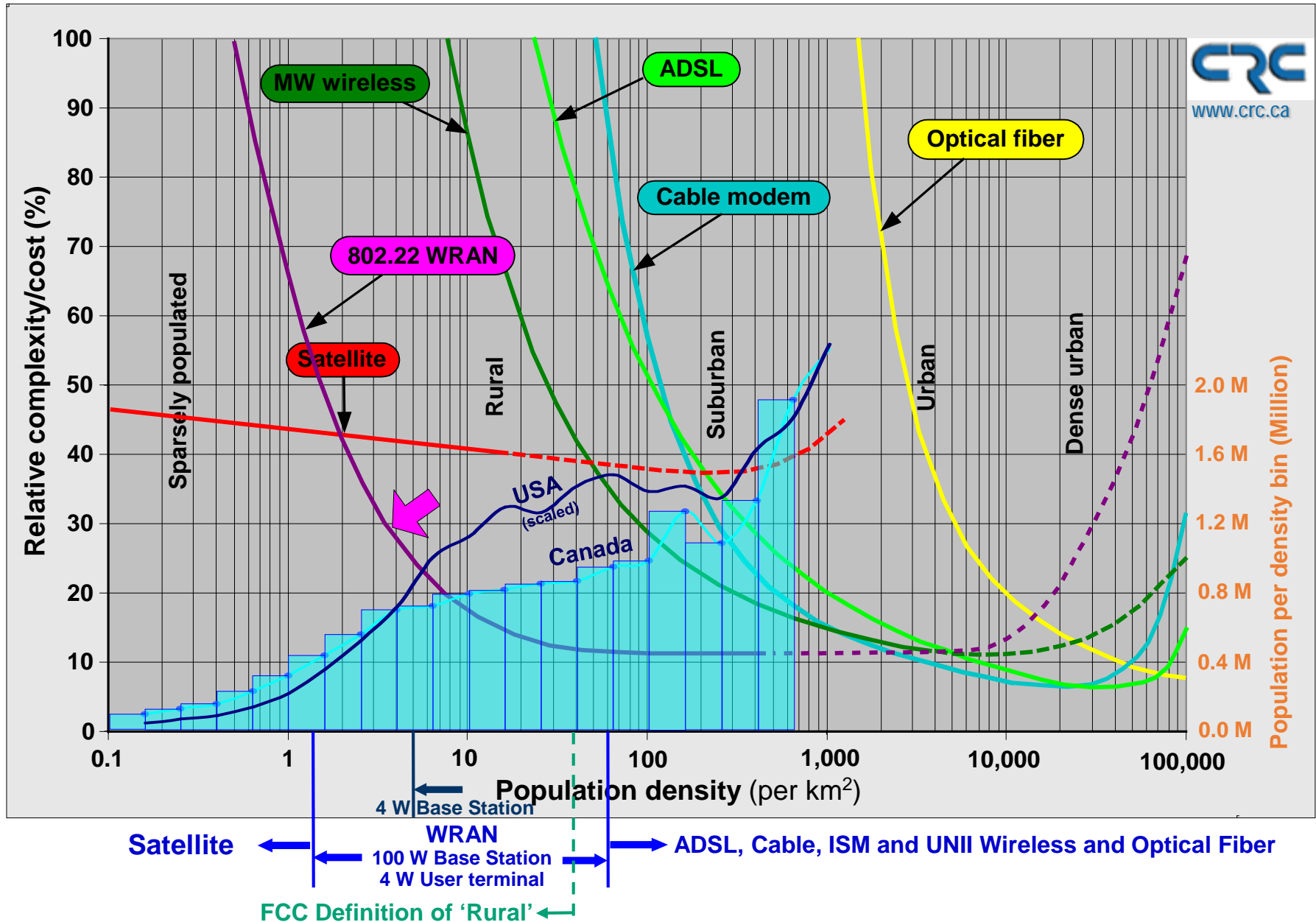
Power Supply



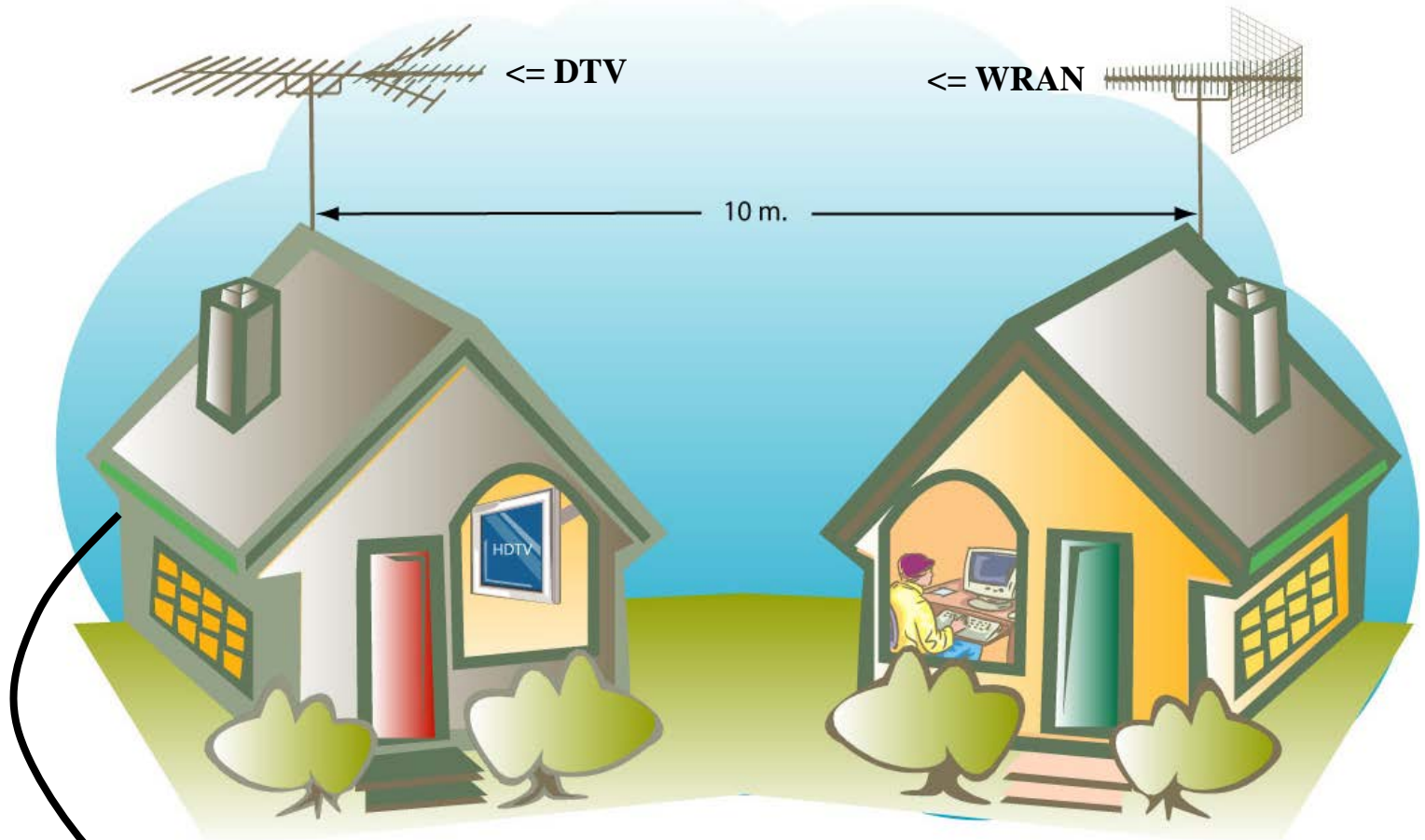
RF Output



# Household reach by technologies (“last mile”)



# Alternate channels interference case

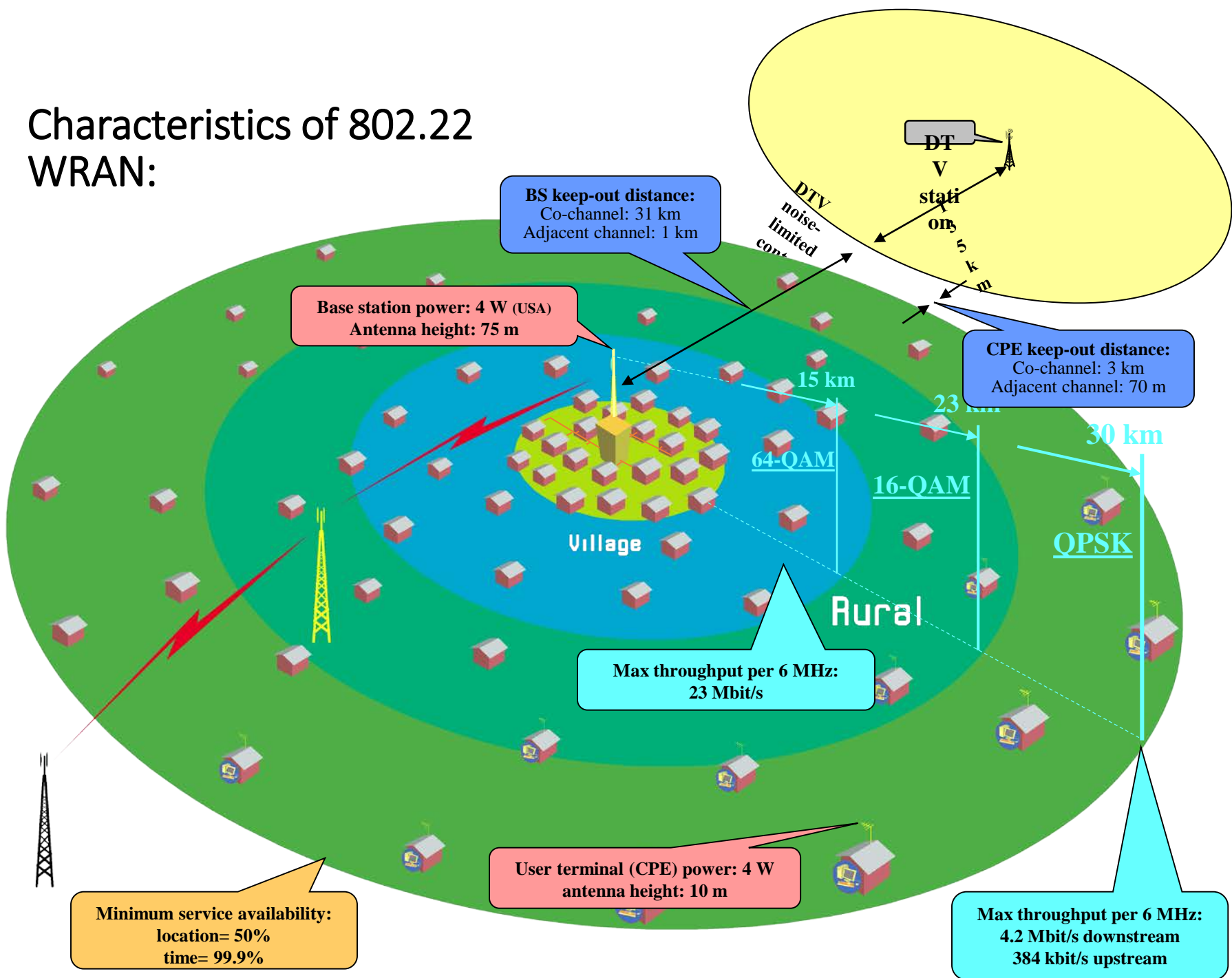


(Co-channel and  
1st adj. channel  
=> keep-out distances)

Noise limited contour  
41 dB(uV/m)

**Saturation of DTV receiver from WRAN  
transmission => control of transmit power**

# Characteristics of 802.22 WRAN:





# Need for Recommended Practice

- Recommended Practice is needed to help operators make best use of the spectrum while protecting incumbents
- Installation and deployment requirements to protect incumbents need to be well understood
- Typical WRAN deployment and installation need to be explained to new potential operators
- Capabilities and limitations of the 802.22 standard need to be known
- Impact of departure from typical operation needs to be understood

# Best practices for base station siting and installation:

- Site selection and frequency selection based on local TV channel usage
- Use of computer based coverage prediction tools and databases to identify potential coverage area and potentially affected incumbents
- Transmit antenna and power constraints for given location
- Co-existence with neighbour WRAN operators

# Best practices for Base Station operation and performance verification:

- Continuous monitoring of the interference environment
  - Normal sensing reporting
  - Special sensing request to CPEs and reporting
  - Data fusion and automatic and/or manual frequency channel control
- Interface with the incumbents for interference resolution
- Smooth increase of service provision by using multiple channels
  - Load balancing
  - Fall-back scheme in case of interference and insufficient channels
- Monitoring of key operational and performance parameters

# Conclusions

- 802.22 sees a compelling need to develop such a Recommended Practice
- The PAR was overwhelmingly approved by the 802.22 WG members
- Licensed incumbents wholeheartedly support the development of this Recommended Practice
- 802.22 wants to proceed and will be seeking EC approval to submit the PAR to NesCom