



# Using License Exempt Spectrum for Wireless Broadband

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**Note: The views expressed in this presentation are those of the author and may not necessarily represent the views of the Federal Communications Commission**



# Part 15: Operational Requirements

- Part 15 provides for operation of low power radio transmitters without a license
- Operating conditions:
  - **May not cause harmful interference**
  - **Must accept any interference received**
- Part 15 minimizes likelihood of interference by:
  - **Limiting operation to certain non-restricted frequency bands (Ref. Section 15.205)**
  - **Limiting power to relatively very low levels**
  - **Requiring equipment approval to ensure compliance**



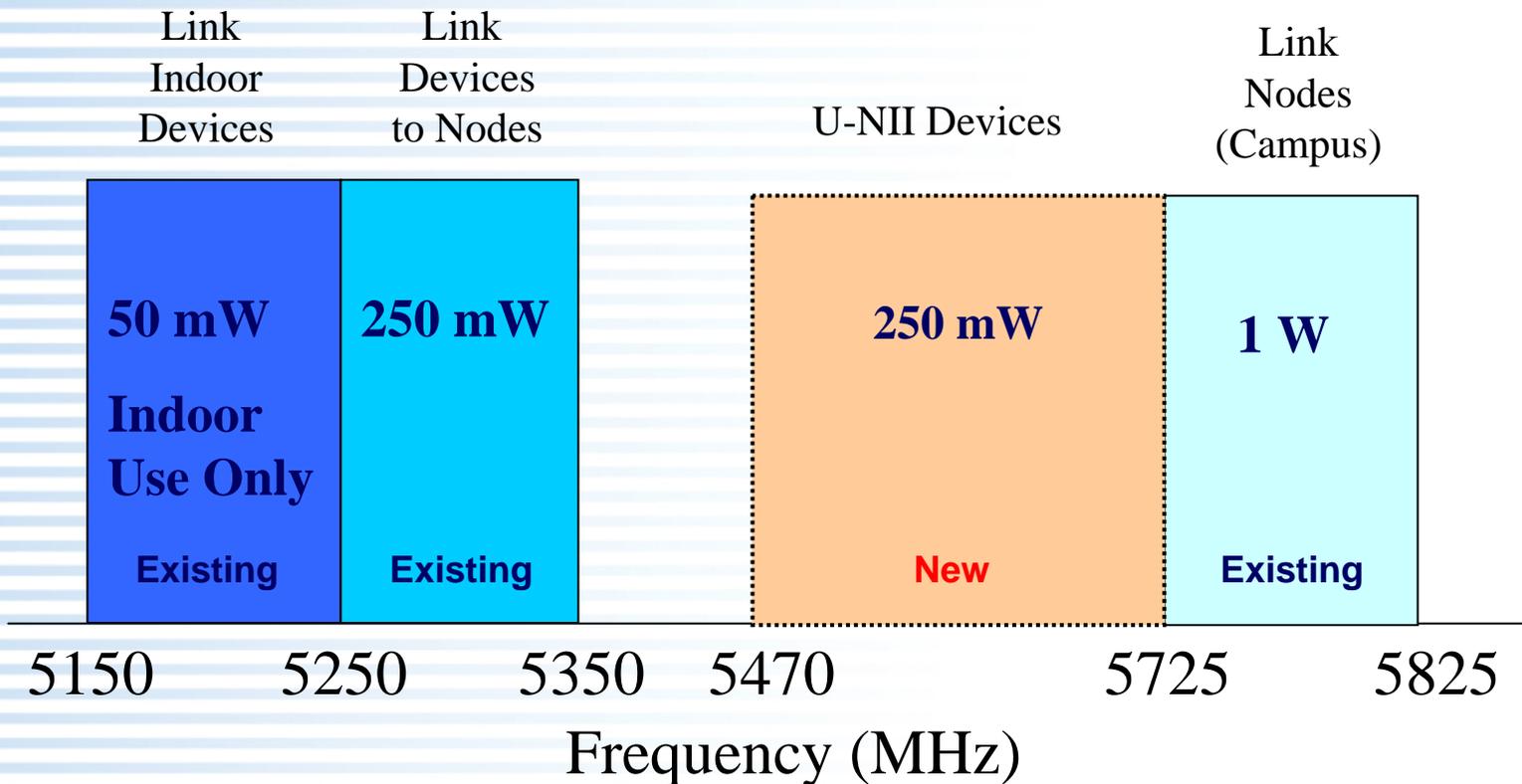
## Part 15: Technical Requirements

- On most frequencies, operation is limited to  $< 100$  mW; duty cycle applies in some cases
- Three (ISM) bands allow 1 W transmitter power:
  - 902-928 MHz
  - 2400- 2483 MHz
  - 5725 – 5875 MHz
    - Power reduction for antenna gain  $> 6$  dB



# More Spectrum Made Available for Licensed-Exempt Operation

- FCC has made available an additional 255 MHz of spectrum for anticipated Wi-Fi growth
  - Provides A Total of 555 MHz of Spectrum for unlicensed operations





# Equipment Authorization Required

- Equipment must be authorized by FCC or telecommunications certification body
- Equipment may not be imported or marketed until certificated
- Check label for FCC ID
- Grants of certification available on FCC web site

## Equipment Authorization (EA)



Office of Engineering and  
Technology (OET)

See  
<http://www.fcc.gov/oet/ea/>

FCC Id: XXXYYYYY





# Wi-Fi: Wireless Fidelity Technology

- IEEE Committee 802.11 developed a family of standards for unlicensed wireless data networks within the framework of the Part 15 rules

<u>Standard</u>	<u>Frequency Band</u>	<u>Modulation</u>	<u>Data Rate</u>
802.11(b)	2.4 GHz	DSS	11 Mb/s
802.11(g)	2.4 GHz	OFDM	54 Mb/s
802.11(a)	5.8 GHz	OFDM	54 MB/s



# Wi-Fi: MiMo Technology

- MIMO: Multiple Input Multiple Output
  - New generation of consumer products
  - Based on IEEE 802.11 standard
  - Allows greater range and data throughput





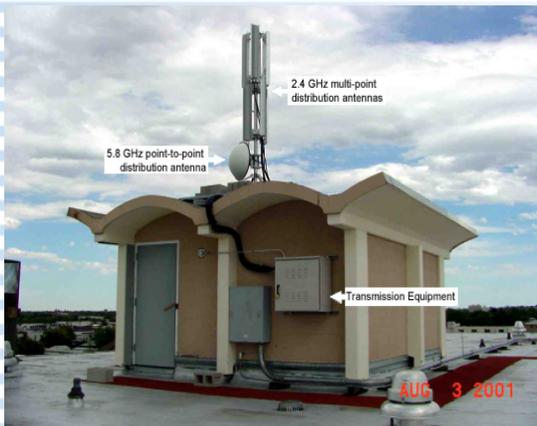
# Wi-Fi Applications



**Home & Business  
networking**



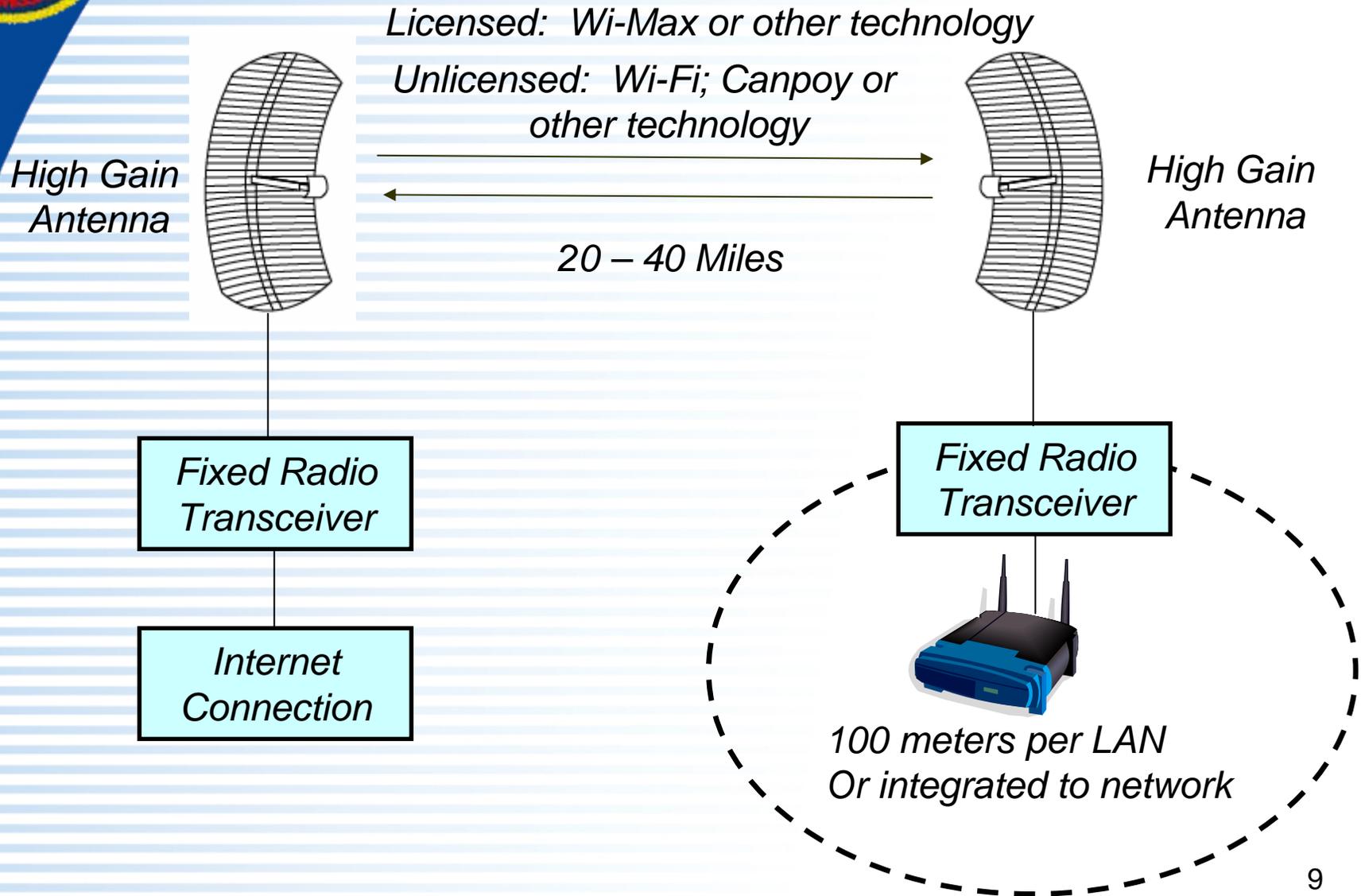
**“Hot Spots” at coffee  
shops, hotels, airports, etc.**



**Metropolitan & Community  
Networks – WISPs**

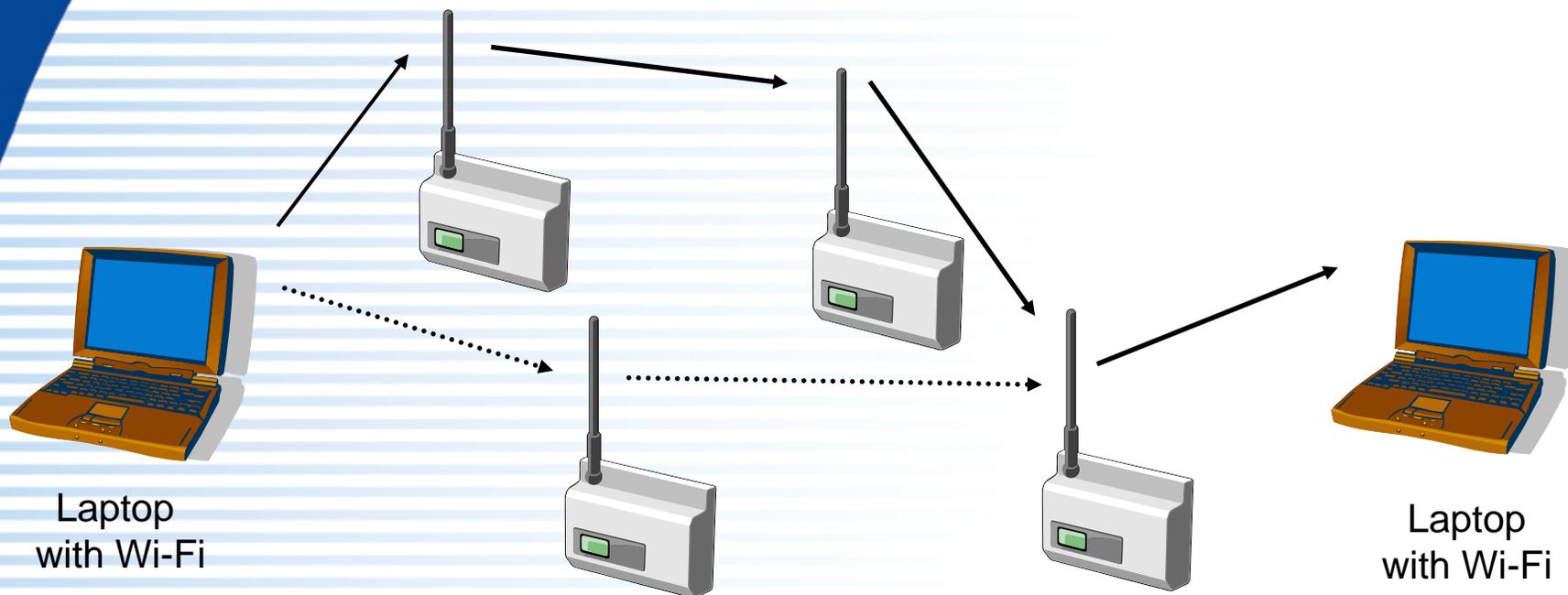


# Basic Network Architecture





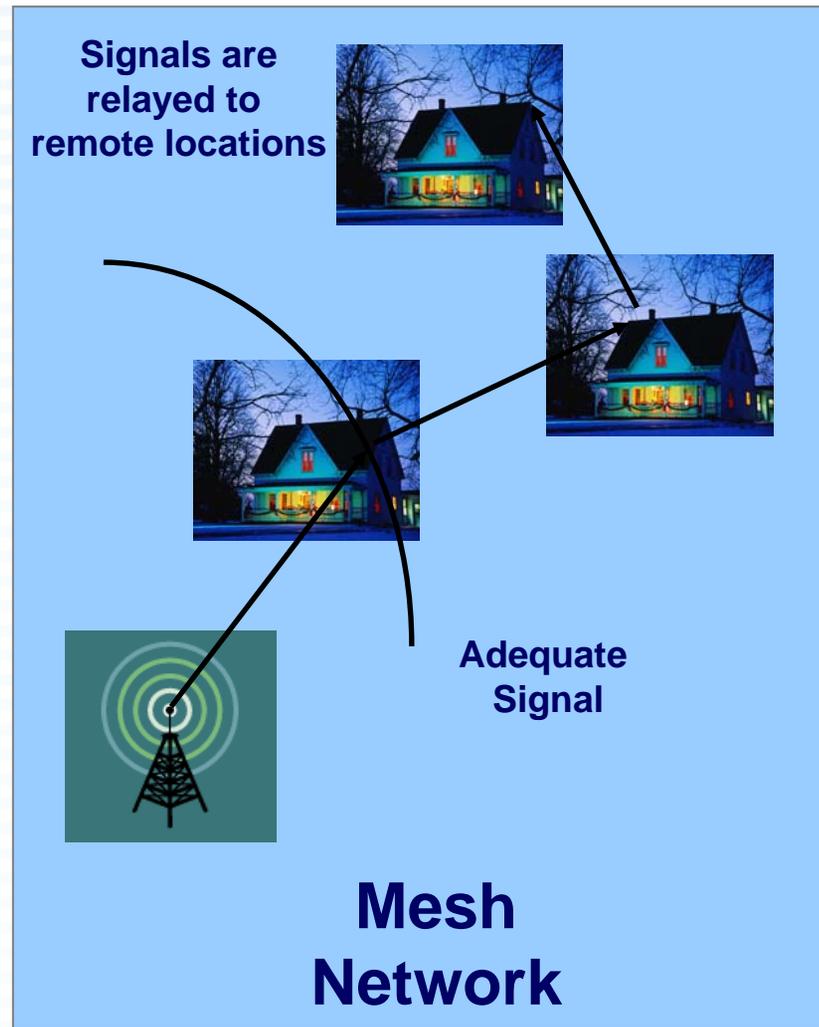
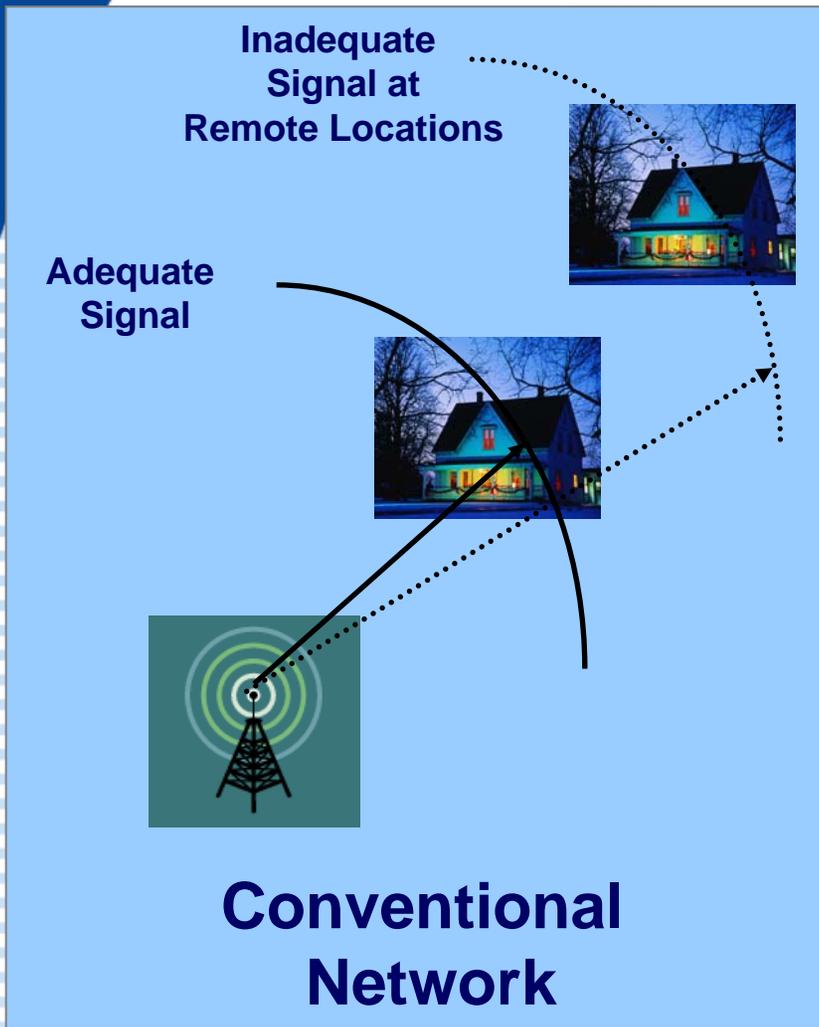
# Wi-Fi Mesh Networks



Mesh networks use each transmitter/receiver as a relay point to provide wide service areas. They are self-forming and provide numerous communication paths- - same principle as the Internet



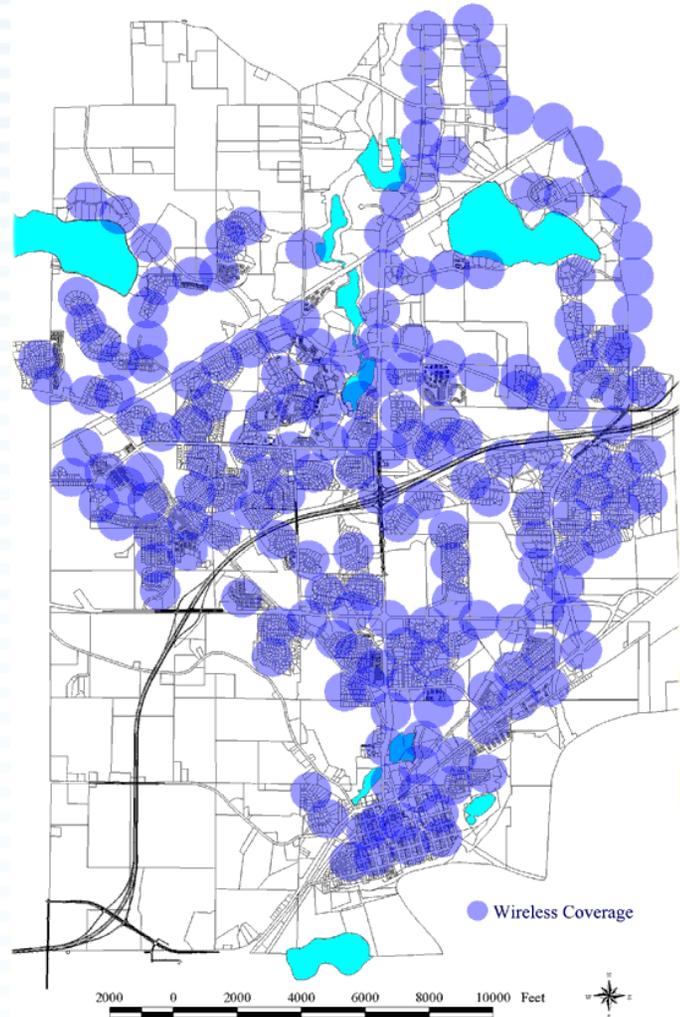
# Mesh Network Coverage





# Example of a Mesh Network

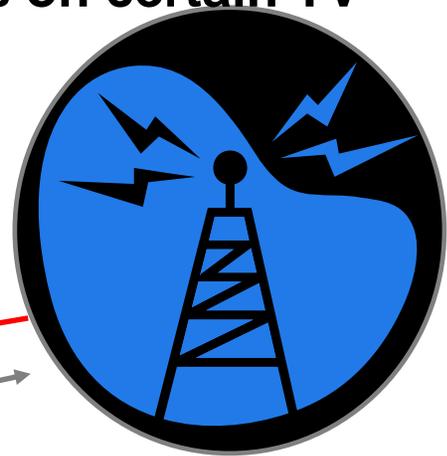
- City of Chaska, Minnesota
- 2000 Wi-Fi subscribers over an area of 16 square miles
- Provided by routers mounted on lampposts - - 15 minute install time
- Consumer data speeds of to 1.2 MB/s
- See [www.Chaska.net](http://www.Chaska.net)





# TV “White Spaces” Proceeding

- **Second R&O (ET Docket Nos. 04-186, 02-380) released 11/14/08**
- **Spectrum below 900 MHz is particularly well suited for penetrating buildings**
- **Permits fixed and personal portable devices on certain TV channels after the DTV transition,**
  - **Power and out-of-band emission limitations**
  - **Geo-location and databases**
  - **Registration**



Device identifies vacant channels

“White Spaces”  
Are channels left vacant in each market



Transmits in vacant channel



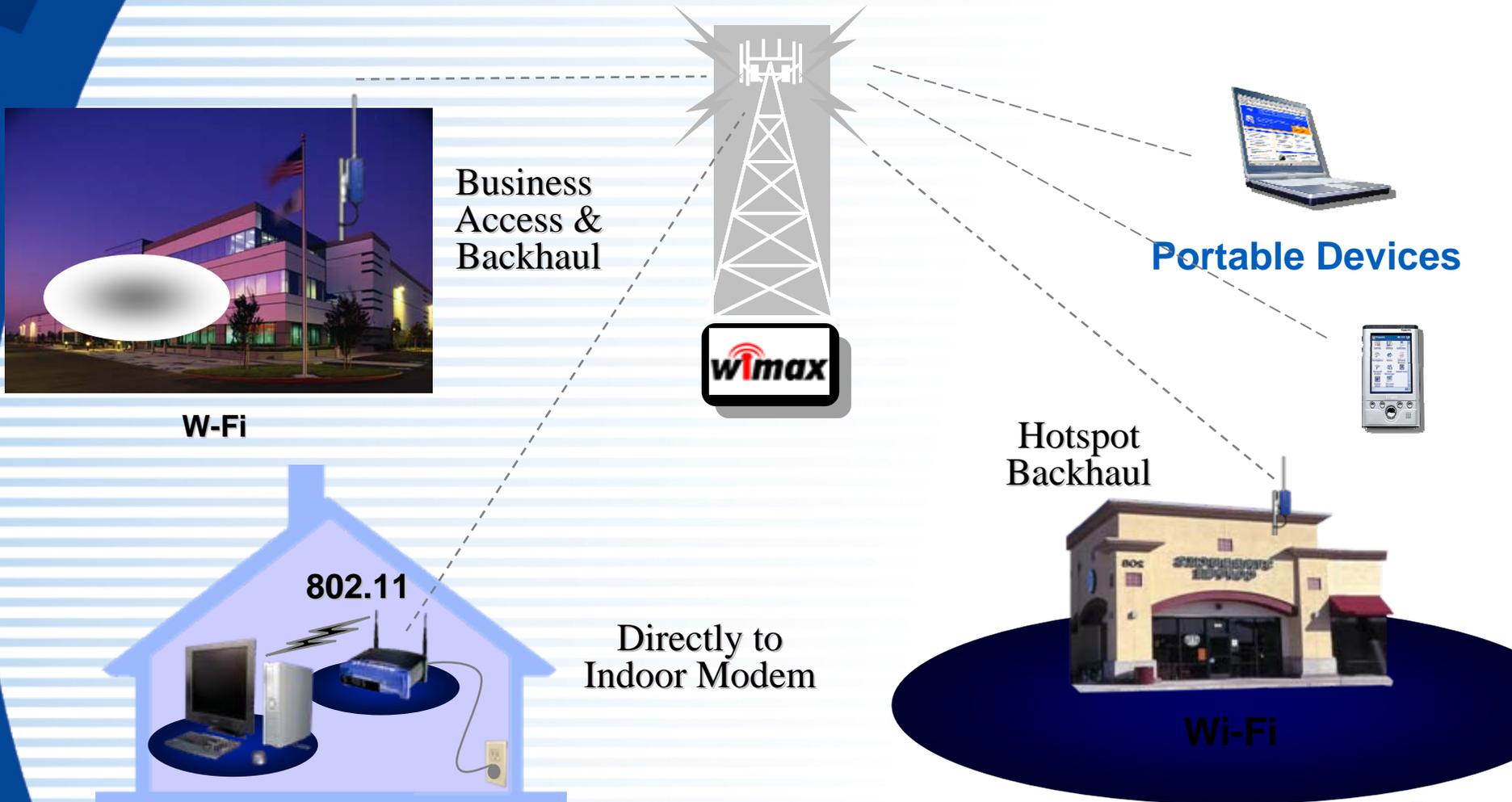
# WISP Resources

- Search: Wireless Internet Service Providers
- WISPA.Org – Includes information on how to establish a WISP
- Part-15.org
- Vendor web sites



# Integrating Licensed & Unlicensed

*WiMAX technology can operate in licensed or unlicensed spectrum:*





# Conclusion

Thank you!

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