Transition to Digital TV & Mobile Broadband:

Impact on Wireless Mics & Solutions Adopted in the U.S.

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2nd ITU Regional Frequency Coordination Meeting on the use of the VHF band and the UHF band.

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Outline

- Wireless Microphones : Definition & Terms
- Frequencies traditionally used by Wireless Mics
- Review of the 700 MHz reallocation in the U.S. from a few years ago
- Licensed versus unlicensed mic operation
- White Space Devices (WSD)
- The FCC Incentive Auction (600 MHz band)
- Consequences of the TV band repacking to wireless mic operators
- Alternate frequency ranges outside of UHF
- Questions and answers

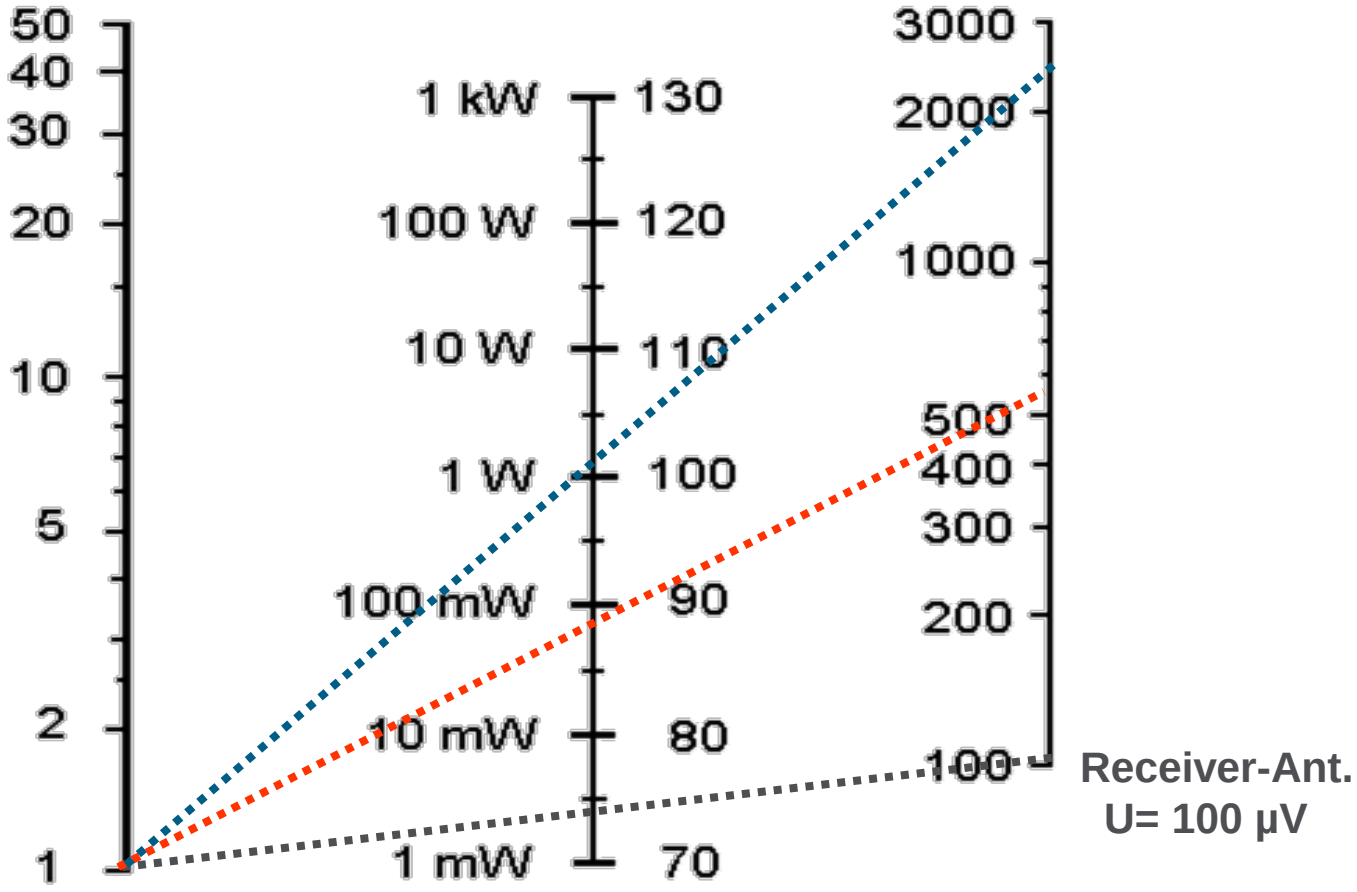
Definition & Terms

- The definition of “wireless microphone” includes a variety of devices used for content creation & live events:
  - Handheld
  - Body Packs with Lavaliers
  - Intercom systems
  - In-Ear monitoring Systems
  - Interruptible Fold-Back (IFB) Systems
- Several terms (i.e., applications) are associated with wireless microphones:
  - Services Ancillary to Broadcast and Program Making (SAB/SAP)
  - Programme Making & Special Events (PMSE)
  - Electronic News Gathering (ENG)
  - Outside Broadcast (OB)

Frequencies Traditionally Used for Wireless Mic's

	Advantages - Disadvantages
30 - 45 MHz (8-m HF)	Antenna length ; RF-interference from (electric) appliances
174 - 216 MHz (VHF)	Good wave propagation; TV-transmitters; RF-distortions from digital equipment
470 - 960 MHz (UHF)	Excellent wave propagation Compact antennas & other components
2400 - 2485 MHz (ISM) Industrial-Scientific-Medical	Less favorable wave propagation ; no exclusive frequencies (license free devices); interference from microwave-ovens

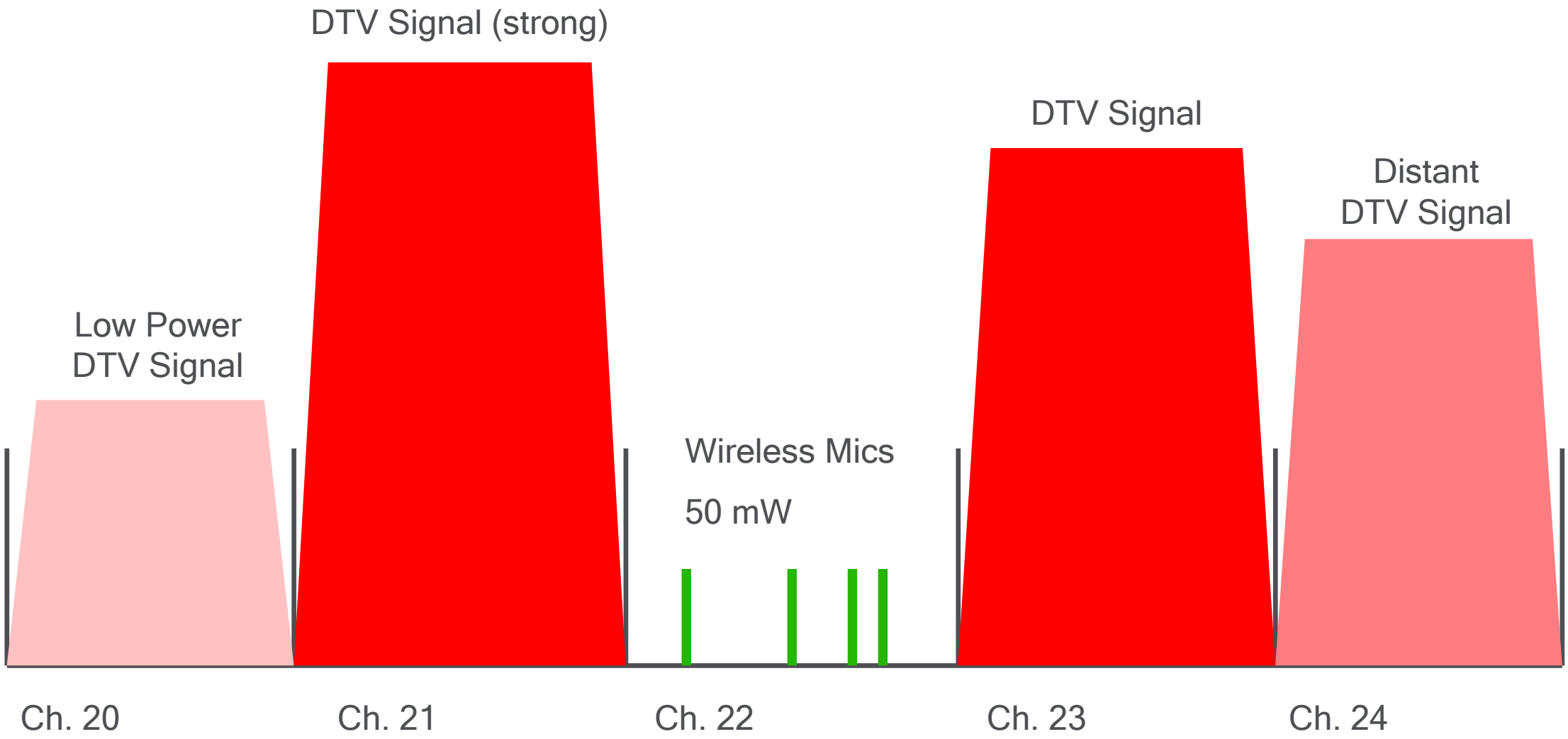
Range / Power / Frequency



UHF is the beach front property in the spectrum

- Provides exceptional wave propagation characteristics
  - Travels through foliage, walls, furniture, etc
- Operates with compact antennas and filter components
  - Important for small mobile transmitters like mics
- Less susceptible to noise from electronic devices
- Long transmission range using moderate power output

Operating in vacant (“white space”) TV channels



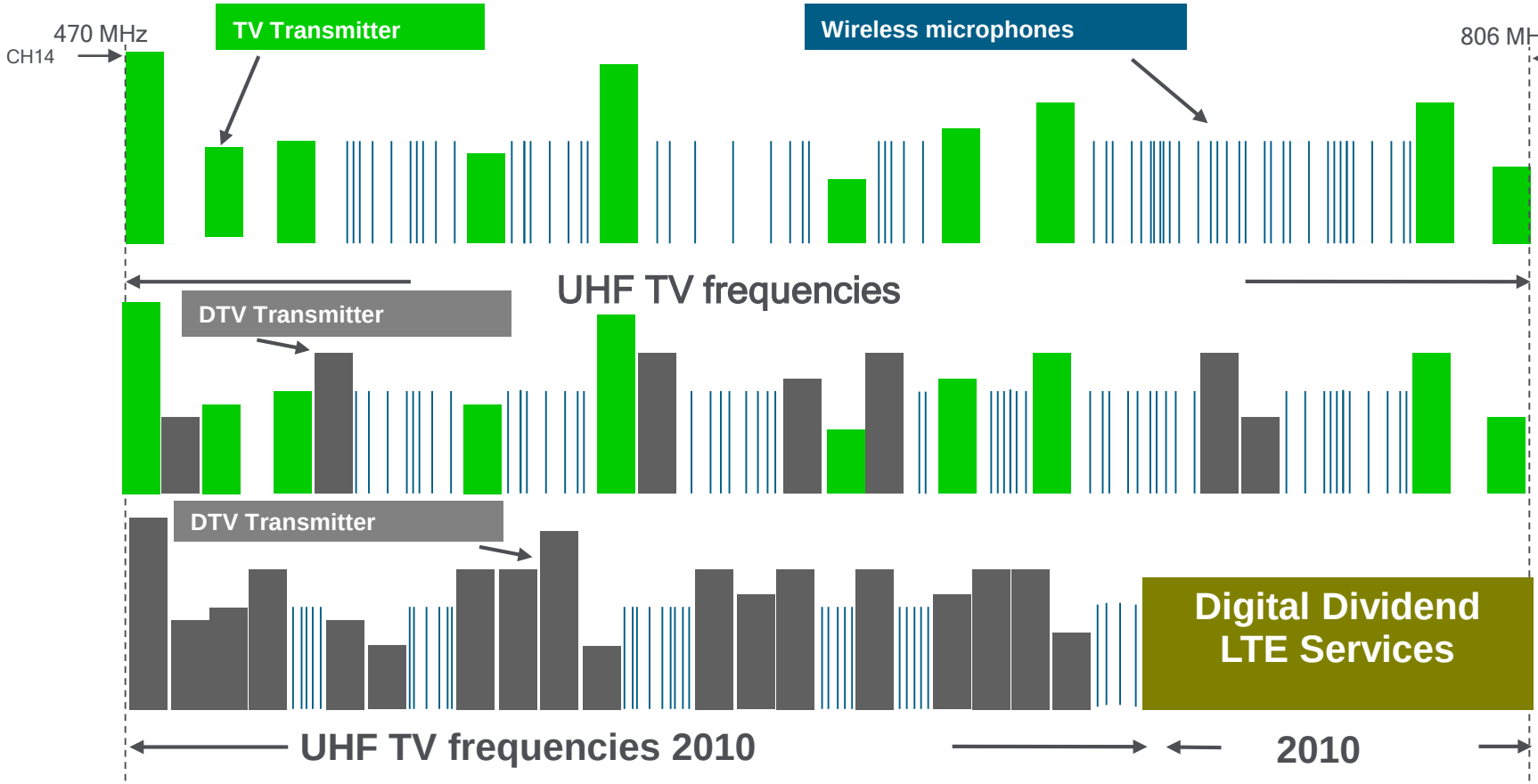
Review of 700 MHz Reallocation

DTV

DIGITAL

LTE

DIVIDEND



~20 years ago:

Analog TV only

Transition:

Analog & DTV

Now:

Full Digital Scenario

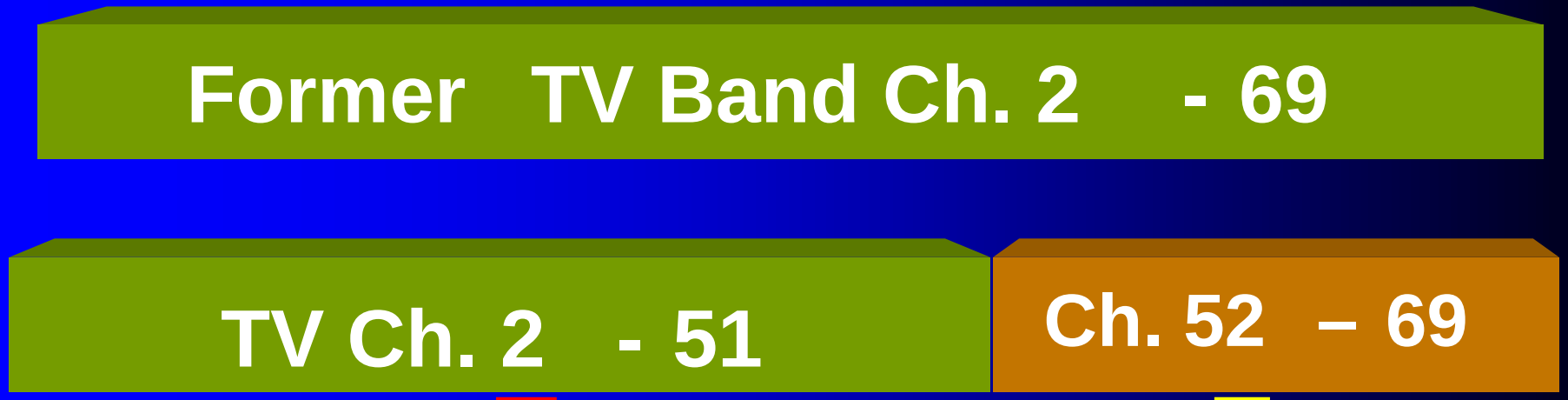
FCC Established Unlicensed Class

- *Licensed (FCC Part 74)*
  - Priority over any unlicensed operation
  - Operate up to 250 mW in UHF band
  - Can reserve channels in white space database system
- Unlicensed (FCC Part 15)
  - Limited to 50 mW
  - No recourse if interference is experienced

Part 74 License Eligibility

- Previously only broadcasters, cable TV operators, film and content providers were eligible to obtain a license.
- Now sound companies and venues who routinely use 50 mics are too.
- FCC plans to further expand eligibility
  - Issued Further Notice of Proposed Rulemaking (FNPRM)

U.S. Television Spectrum pre-2017



White Space Devices (WSD)

a.k.a. TV White Space (TVWS) or TV Band Devices (TVBD)

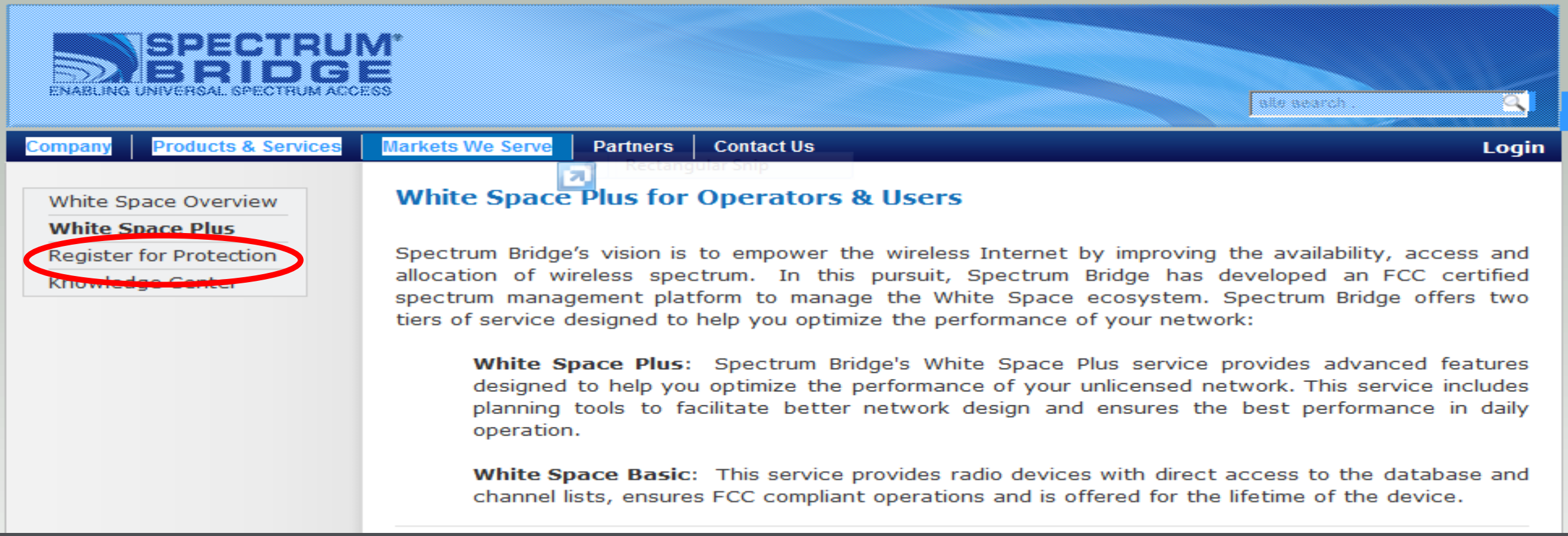
- **TV "White Space" channels are open to unlicensed devices:**
  - Rural broadband internet
  - Metropolitan broadband internet
  - Multimedia services
  - Home networking systems
  - Consumer electronics: PDA's and cell phones w/ advanced features
  - Future products

Safeguards For Wireless Mics

- FCC rules governing WSD include safeguards to avoid interference to wireless microphones:
  - Reserved channels: currently 2 UHF TV channels in each market are reserved for wireless mics.
    - In the future, wireless mics will have portions of the duplex gap and guard band that are exclusive for their use.
  - WSD must use Geolocation/Database system to find channels that are not reserved for TV broadcast or by wireless mic operators
    - Currently WSD “pull” info from database once a day. This means it may take nearly 48 hours to clear channels.
    - Future: database system will “push” info to WSD upon new mic reservation, clearing channels of WSD in about 20 minutes.

Database System

Licensed mic operators can reserve white space channels



Wireless Microphone Protection Area

Microphone operating around a geographic point

Protection from mobile WSDs

Protection from fixed WSDs

May specify up to 25 geographic points per registration

Wireless Microphone Protection Area, cont'd.

Microphone operating around a geographic point

Protection from mobile WSDs

Protection from fixed WSDs

May specify up to 25 geographic points per registration

Protection of composite area

Wireless Microphone Protection Area, cont'd.

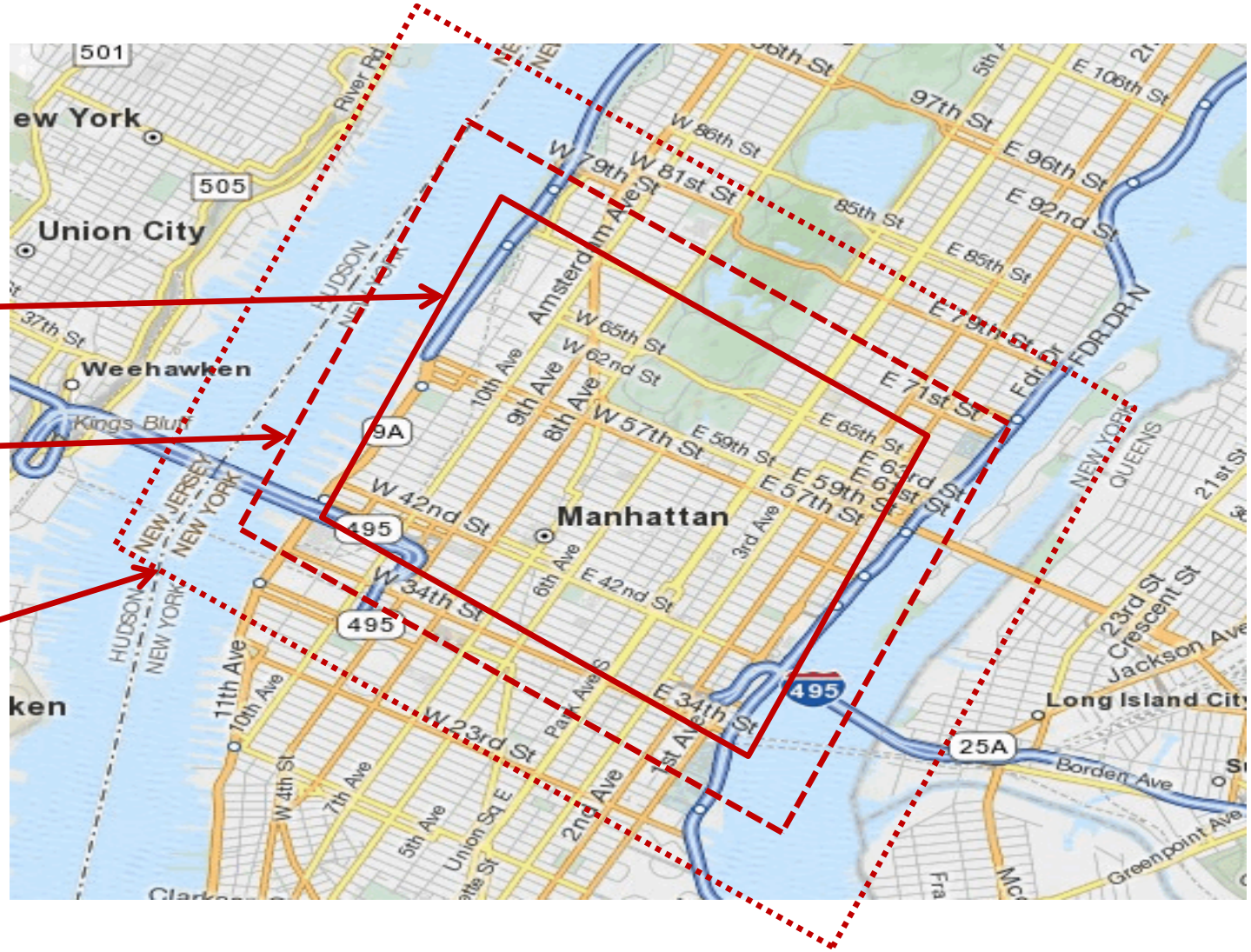
Polygon – limited to
4 vertices & 3 km sides

Microphone operating area

Protection from mobile WSDs

Protection from fixed WSDs

May specify up to 4 polygons per registration



Wireless Microphone Protection Area, cont'd.

Polygon – limited to 4 vertices & 3 km sides

Microphone operating area

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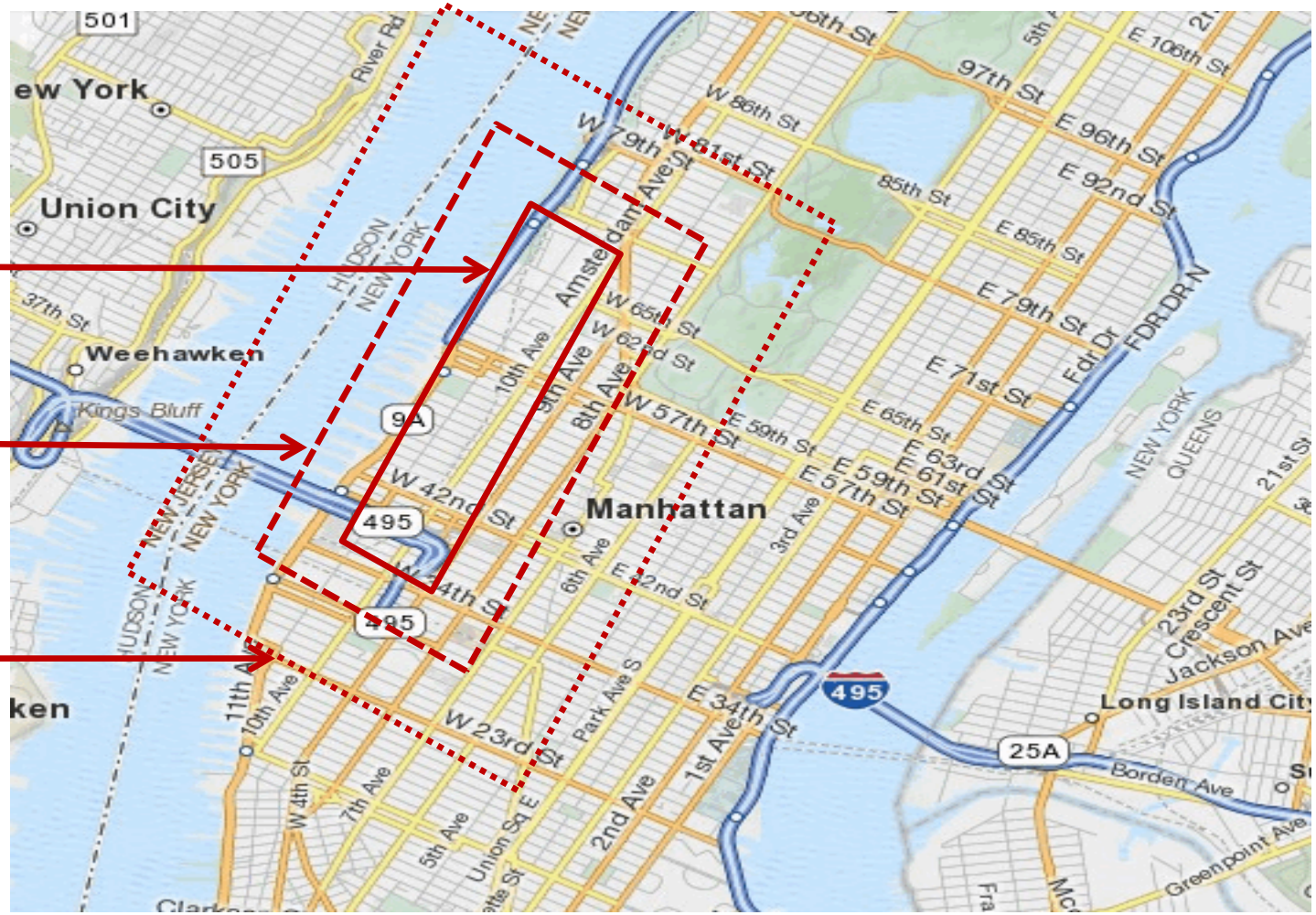
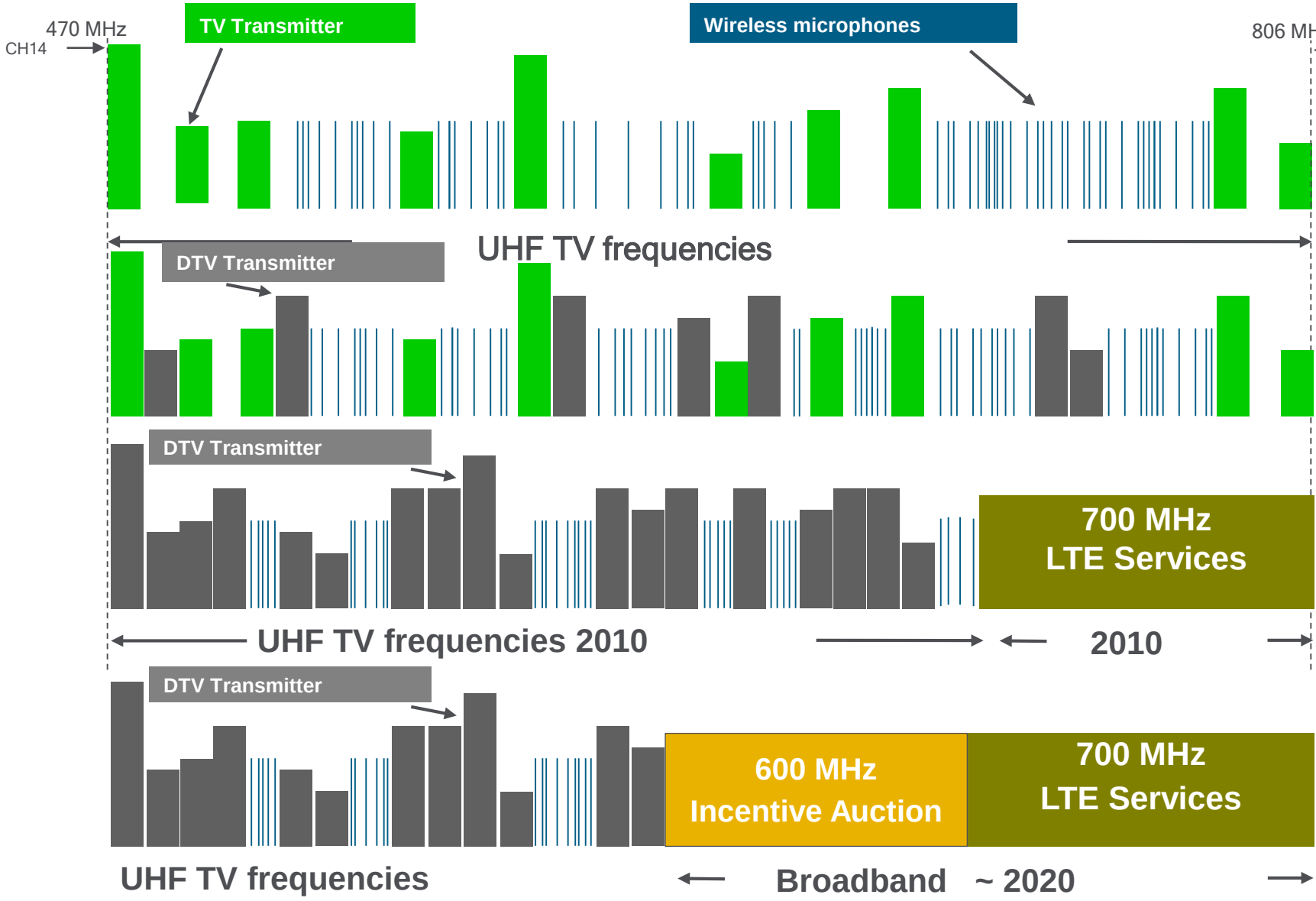


Incentive Auction
&
TV Band Repacking



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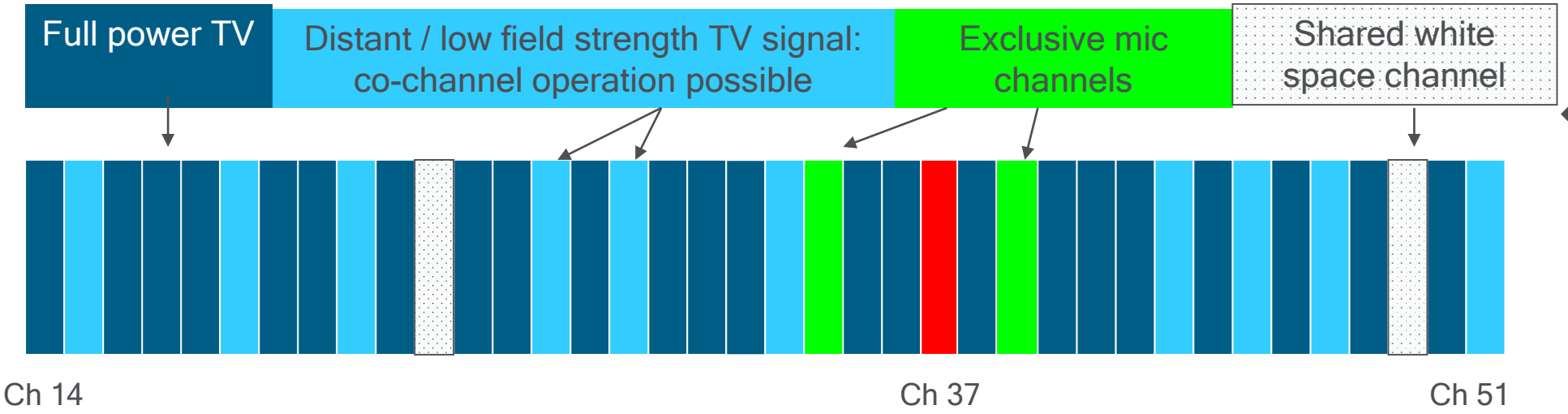
Full Digital Scenario

Future:

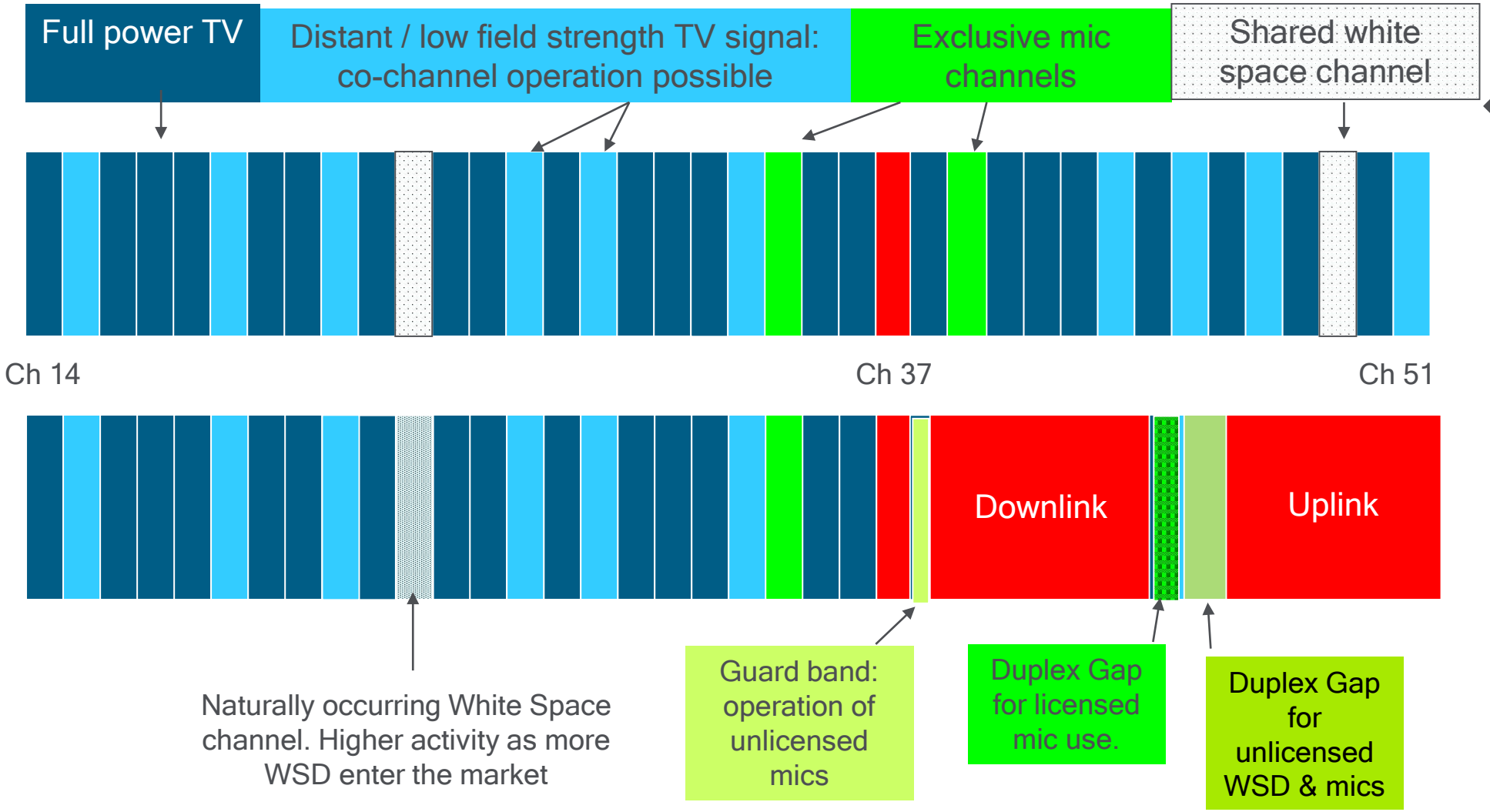
More Broadband services



Current TV Band

White Space Devices (WSD) devices are presently few and far between

Contact: Joe Ciaudelli, Spectrum Affairs 212-688-6666



Current TV Band

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Repacking Scenario

(simplified)

some stations go off air

some stations relocated

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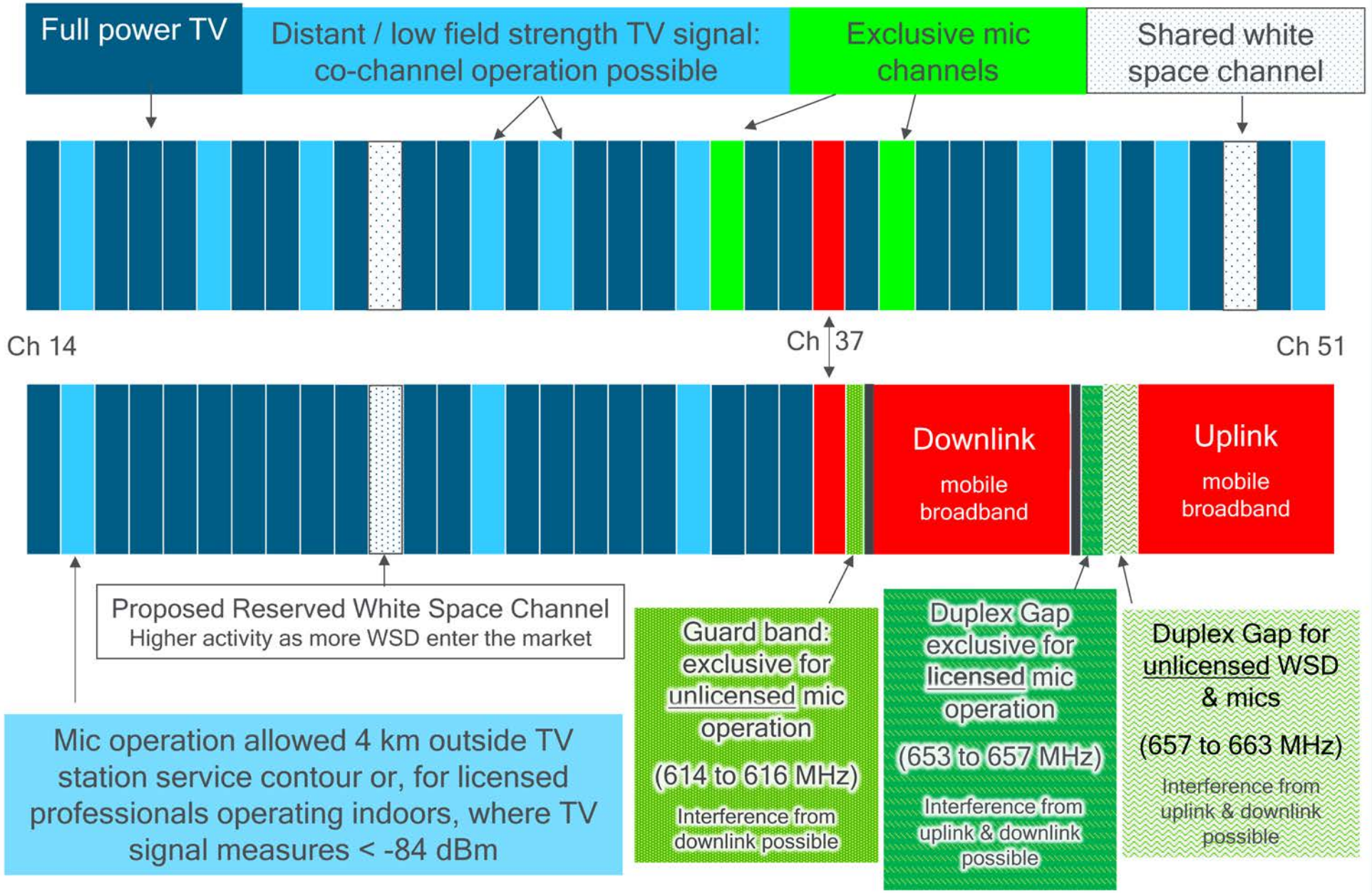
FCC Incentive Auction Outcome

- A large portion of the 600 MHz band, specifically 614-698 MHz, will be repurposed and become unavailable at the end of a 39 month transition period in July 2020.
- About half the existing UHF equipment in the U.S. will need to be modified or replaced.
- There will be pockets (duplex gap and guard band) in the repurposed spectrum where mics will be allowed to operate.
- Co-channel operation rules are revised.
- Mics now have access to alternate ranges

Wireless microphones and monitors can operate in the white and green channels. They are also permitted to use the light blue channels under certain conditions.



Example (simplified): UHF (470 – 698 MHz) band plan for a U.S. city (no specific one)

Current TV Band

White Space Devices (WSD) are presently few and far between

Future

After UHF band repacking circa 2021

with 600 MHz band repurposed for mobile broadband.

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Co-Channel Operation

- The FCC revised rules regarding co-channel operation with TV broadcast, opening channels to wireless mics at locations that were formerly prohibited.
  - 4 km outside of TV service contour, rather than 100 km away from TV antenna, or…
  - Licensed operators can use field a strength benchmark where the TV signal < -84 dBm (indoors), rather than geographical separation.

Alternative Ranges

- **169 - 172 MHz** (just below high band VHF TV channels) rules were revised to make it more practical for wireless mics

- Additional frequency ranges above the TV Bands are now available to licensed wireless microphone operators:
  - **941.5 - 960 MHz** – effectively extends current STL band
    - Now open to all part 74 licensees.
  - **1435 - 1525 MHz** shared with flight training
    - Requires approval from AFTRCC (coordinating agency for this range)
    - Equipment will use an electronic key which will allow its operation at the approved time and location.
  - **6875 - 6900 & 7100 – 7125 MHz** : OK for short range applications

Thank you!

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