



Hogan & Hartson LLP  
Columbia Square  
555 Thirteenth Street, NW  
Washington, DC 20004  
+1.202.637.5600 Tel  
+1.202.637.5910 Fax

[www.hhlaw.com](http://www.hhlaw.com)

March 19, 2010

Michele C. Farquhar  
Partner  
202-637-5663  
mcfarquhar@hhlaw.com

**VIA ELECTRONIC DELIVERY**

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 12th Street, SW  
Room TWA325  
Washington, DC 20554

**Re: Notice of *Ex Parte* Presentation  
ET Docket Nos. 04-186, 02-380**

Dear Ms. Dortch:

Yesterday, Joseph M. Sandri, Jr., Senior Vice President of Government and Regulatory Affairs for FiberTower Corporation (“FiberTower”); Richard Engelman, Director, Spectrum Resources-Government Affairs, Sprint Nextel Corporation (“Sprint Nextel”); Caressa D. Bennet of Bennet & Bennet, PLLC, General Counsel for the Rural Telecommunications Group, Inc. (“RTG”); and Michele C. Farquhar of Hogan & Hartson, LLP, Counsel to Sprint Nextel and Special Counsel to FiberTower and RTG, met with Ruth Milkman, Chief of the Commission’s Wireless Telecommunications Bureau (“WTB”); Jim Schlichting, WTB Senior Deputy Bureau Chief; and John Leibovitz, WTB Deputy Bureau Chief.

During the meeting, the representatives discussed the attached one-page summary of their positions in this proceeding as well as the attached slides and revised proposed technical rules for point-to-point fixed licensed use of the TV Bands White Spaces (“White Spaces”). The parties highlighted the urgent need for point-to-point fixed licensed use of a portion of the vacant White Spaces channels to provide dramatically more cost-effective backhaul options, and cited the favorable language supporting this goal in the FCC’s National Broadband Plan. In addition, the parties noted that often 15-to-45 vacant channels exist throughout rural areas, and reiterated their proposal to allow licensing for fixed use on UHF TV Channels 21-35 and 39-51 of: (1) up to six vacant White Spaces channels second or greater adjacent to a TV broadcast station in rural counties; and (2) any vacant White Spaces channels third or greater adjacent to a TV broadcast station in all counties.

Marlene H. Dortch, Secretary  
March 19, 2010  
Page 2

Pursuant to Section 1.1206 of the Commission's rules, this letter is being filed via ECFS with your office.

Respectfully submitted,

/s/ Michele C. Farquhar

Michele C. Farquhar  
Counsel to Sprint Nextel Corporation  
Special Counsel to FiberTower Corporation  
and Rural Telecommunications Group, Inc.

cc: Ruth Milkman  
Jim Schlichting  
John Leibovitz

## **PROPOSAL FOR LIMITED FIXED LICENSED POINT-TO-POINT USE OF THE TV WHITE SPACES FOR BACKHAUL TO RURAL AREAS**

**Summary:** Approximately 15 to 45 or more TV white spaces channels lay fallow in rural areas. The FCC should authorize limited fixed licensed point-to-point use of the TV “White Spaces” on UHF TV Channels 21-35 and 39-51 for:

- (1) Up to six vacant TV White Spaces channels second or greater adjacent to a TV broadcast station in rural counties; and
- (2) Any vacant TV White Spaces channels third or greater adjacent to a TV broadcast station in all counties.

**Expedited Action Needed:** To enhance BTOP and BIP program efforts to stimulate broadband access in rural areas, the FCC should adopt this narrow proposal on an expedited basis, and before the March 15 application deadline. This will assist BTOP and BIP applicants seeking to deploy far more cost-effective middle mile infrastructure in unserved and underserved areas.

**Benefits:** Authorizing up to six vacant TV channels would bring many public interest benefits:

- **Increased Rural Broadband Deployment.** Backhaul infrastructure must be built before consumers can benefit from innovative new unlicensed and licensed broadband networks and devices; this narrow proposal provides urgently needed, cost-effective “middle mile” backhaul.
- **Dramatically Lower Backhaul Costs.** The favorable propagation characteristics of the TV White Spaces, as well as the readily available small lightweight antennas for the band, would reduce the middle mile backhaul and transport costs by as much as 80-90% in rural areas.<sup>1</sup>
- **Readily Available Fixed Link Equipment and Licensing Scheme.** More than 300 fixed links are already licensed and installed in the TV Bands under the existing Part 74 Broadcast Auxiliary Service (“BAS”) rules; the longstanding use of these frequencies for BAS point-to-point links (some of which are 50-80 miles long or more) ensures the immediate, off-the-shelf availability of point-to-point equipment for backhaul use in TV Channels 21-35 and 39-51. The FCC could amend Part 101 or Part 74 to license non-broadcast fixed link users in the band.
- **Numerous Vacant TV Channels Available in Rural Areas.** TV White Spaces channels are widely available in rural unserved and underserved areas, with approximately 15 to 45 or more channels lying fallow in these areas. This narrow proposal would only authorize fixed licensed use on up to six of these channels, permitting many other uses. By contrast, very few additional links are available even in rural areas in the heavily used 6 GHz band.
- **Protection of Incumbents and New Unlicensed Users.** The limited number of new licensed point-to-point systems could operate without causing harmful interference to the many incumbent users in the TV Bands, and licensed use allows far greater certainty and accountability to those incumbents. Numerous vacant channels exist in the band for unlicensed users, and unlicensed devices could still operate on channels designated for fixed licensed use, subject to the normal protections afforded to licensed users when operational.
- **Broadcast Repacking Already Contemplated.** This narrow proposal only provides for use on a limited number of vacant channels, no matter how they are organized, and would not preclude or require waiting for any broadcast repacking or channel modification proposals.

<sup>1</sup> For example, a 75-mile or longer wireless backhaul link could be constructed at a cost of \$100,000-200,000 using two small lightweight antennas; covering the same distance using 3.65 GHz, 6 GHz, or higher-frequency spectrum would require up to four relay towers and a total of ten six-foot diameter dish antennas, costing \$3 million or more.

# *Licensed, Fixed Use of the TV White Spaces*

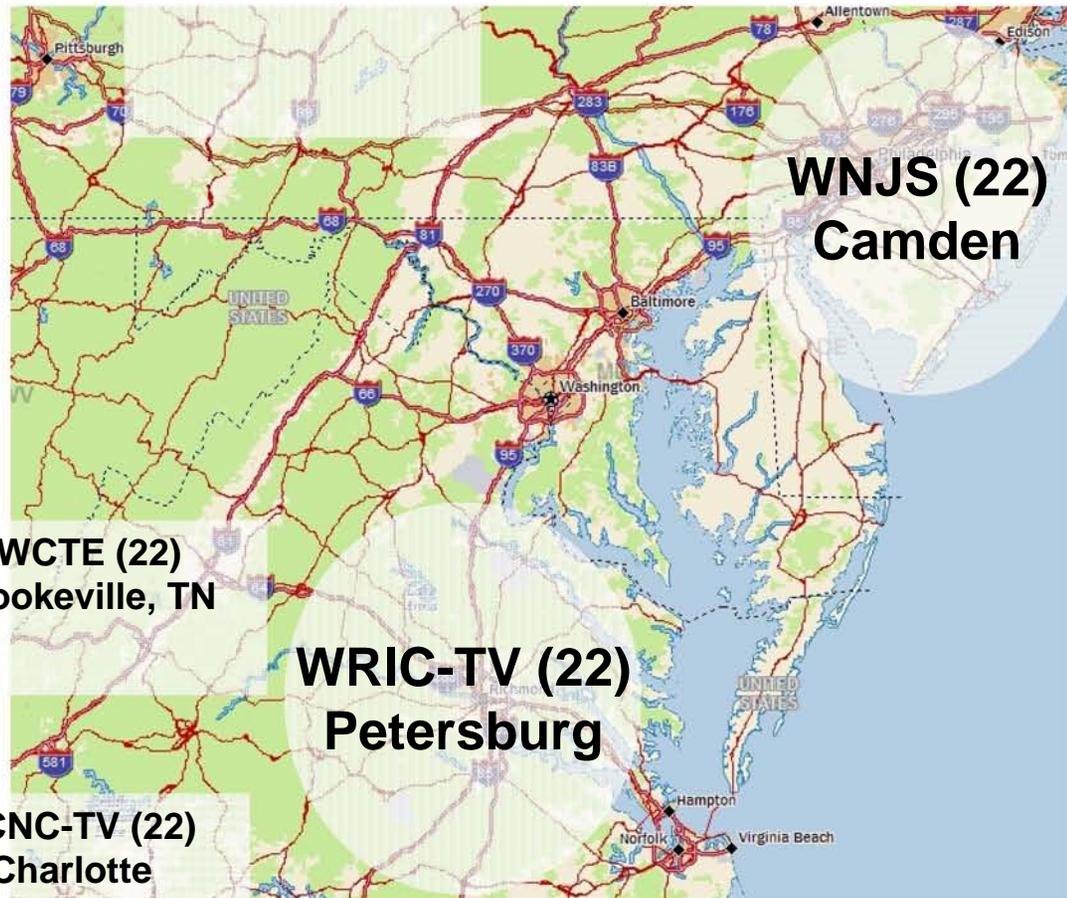
*March 18, 2010*



# What is TV White Space?

- TV stations **must** operate at minimum separation distances to avoid interference
- TV “White Space” exists on frequencies and in locations where TV stations and other operations in the TV bands do not transmit

WFXP (22)  
Erie, PA



*TV stations on Channel 22 near Washington, D.C.*

# *What is TV White Space?*

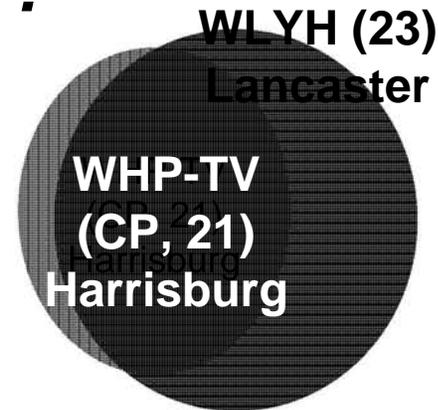
- TV stations must operate at minimum separation distances to avoid interference
- TV “White Space” exists on frequencies and in locations where TV stations and other operations in the TV bands do not transmit

*TV stations on Channel 22 near Washington, D.C.*



# What is TV White Space?

- TV station co-channel and adjacent channels must be protected
  - 1,785 TV stations nationwide

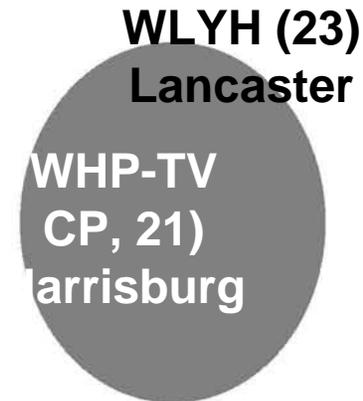


*TV stations on Channels 21-23 near Washington, D.C.*



# What is currently in TV White Space?

- TV station co-channel and adjacent channels must be protected
  - 1,785 TV stations nationwide
  - 2,939 Class A and LPTV stations
  - 4,391 TV Translators
- Approx. 300 broadcast auxiliary fixed links
- Cable TV head ends
- Land mobile radio services in 13 markets
- Offshore radiotelephone service along Gulf of Mexico
- Medical telemetry devices on TV channel 37
- Wireless microphones
- Soon, unlicensed TV band devices

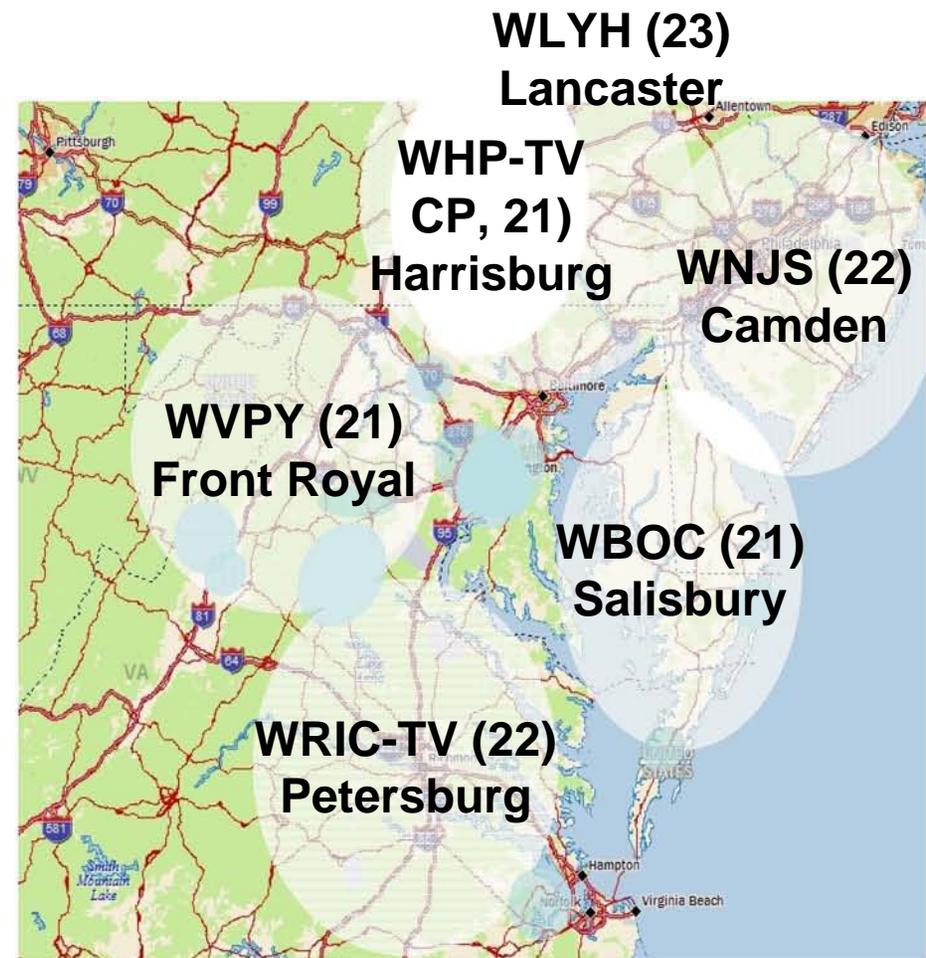


*TV stations on Channels 21-23 near Washington, D.C.*



# What is currently in TV White Space?

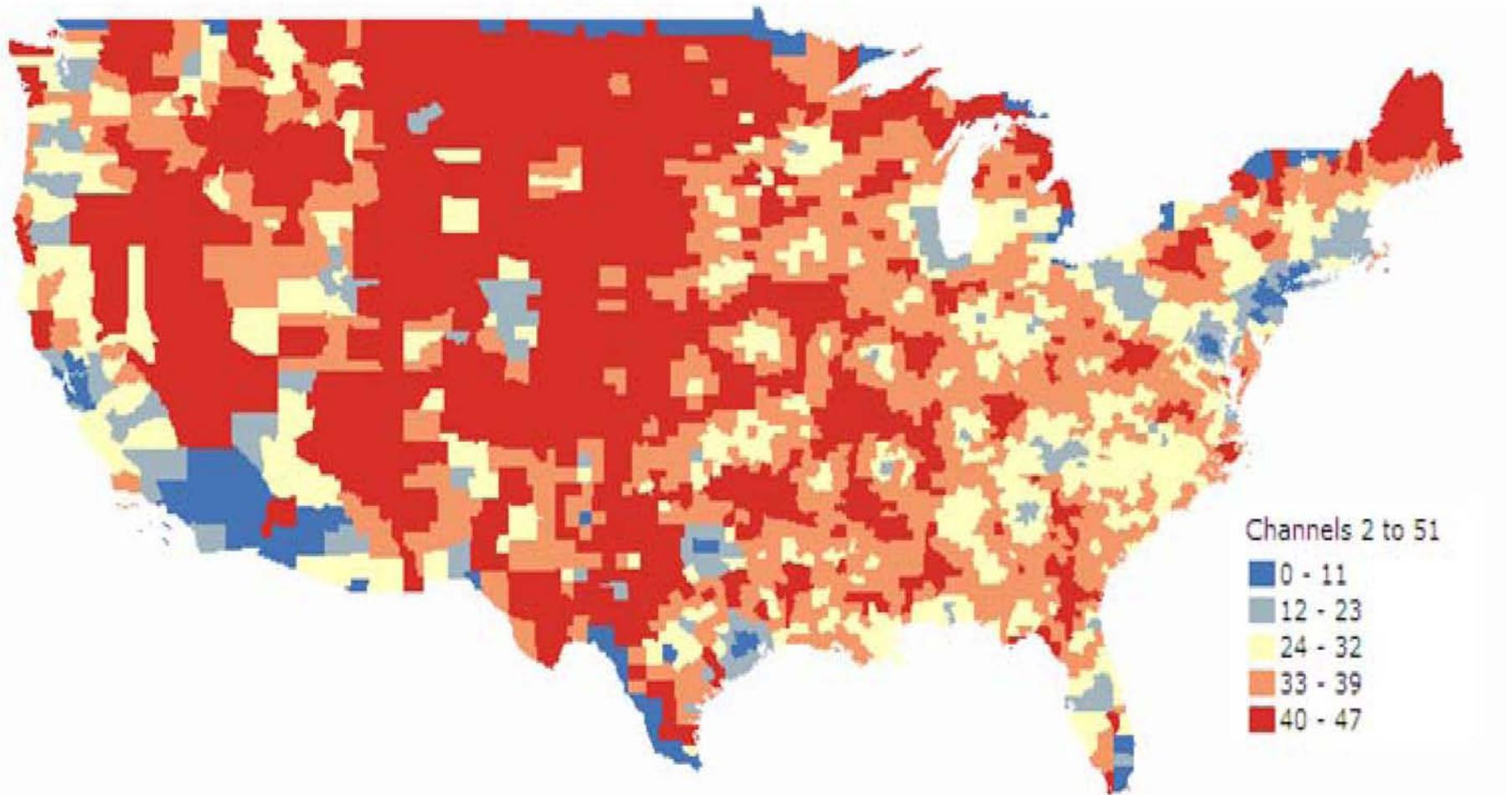
- TV station co-channel and adjacent channels must be protected
  - 1,785 TV stations nationwide
  - 2,939 Class A and LPTV stations
  - 4,391 TV Translators
- Approx. 300 broadcast auxiliary fixed links
- Cable TV head ends
- Land mobile radio services in 13 markets
- Offshore radiotelephone service along Gulf of Mexico
- Medical telemetry devices on TV channel 37
- Wireless microphones
- Soon, unlicensed TV band devices



TV stations on Channels 21-23 near Washington, D.C.

# How Much TV White Space Exists?

## White Space Availability by County

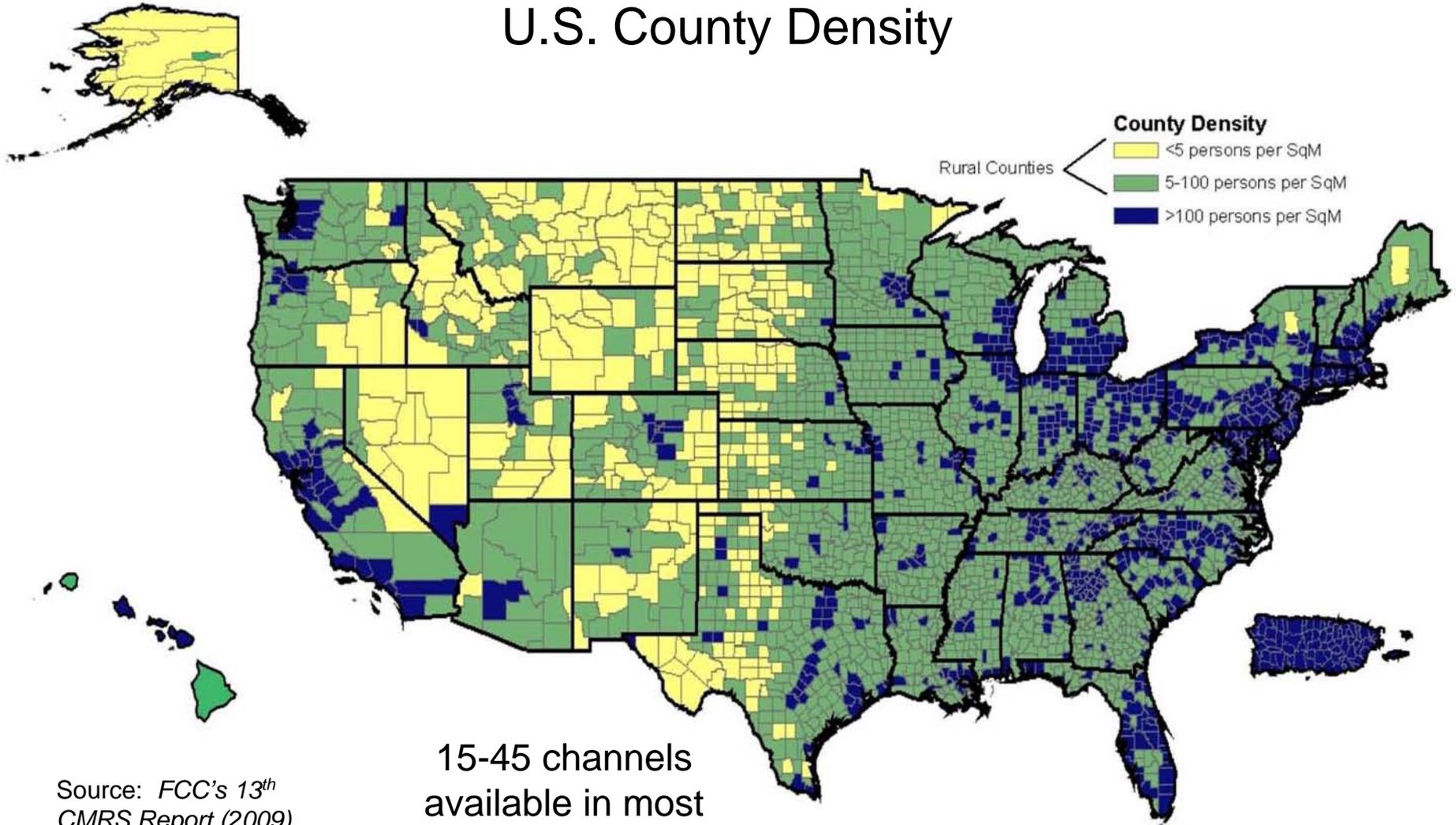


Source: *Ex Parte Letter*, October 1, 2009, filed in ET Dkt. 04-186 by Wiltshire & Grannis LLP, on behalf of Dell, Inc., Microsoft Corp., and Spectrum Bridge Inc.



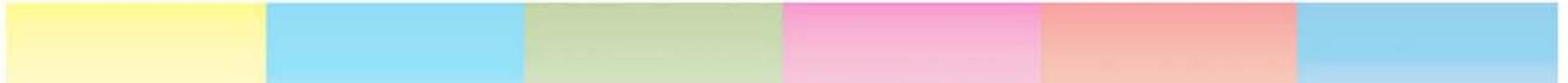
# Substantial White Space in Rural Areas

## U.S. County Density



Source: FCC's 13<sup>th</sup> CMRS Report (2009)

15-45 channels available in most rural areas



# *Chronology of Major Events*

- October 18, 2006 – FCC releases First R&O/Further Notice inviting comment on licensed operations in TV bands
- October 2, 2007 – FiberTower and RTG file their “White Paper” proposing a licensed, fixed model
- January-October, 2008 – Sprint Nextel, T-Mobile, NTCA, COMPTTEL, and the Rural Independent Competitive Alliance file letters of support
- June 25, 2008 – COMPTTEL, RTG, Sprint Nextel, and FiberTower submit draft of proposed technical rules

# *Chronology of Major Events*

- October 29, 2008 – RTG, COMPTTEL, Sprint Nextel, and FiberTower submit revised proposed technical rules
- November 4, 2008 – FCC adopts Second R&O/MO&O
- March 19, 2009 – FiberTower, RTG, COMPTTEL, and Sprint Nextel file Petition for Reconsideration
- June 12, 2009 – DTV transition completed
- July 14, 2009 – FiberTower, RTG, COMPTTEL, and Sprint Nextel file Request for Expedited Consideration of their Petition for Reconsideration



# *Benefits of Licensed, Fixed Use*

- Ideal for long-range, inexpensive wireless backhaul, particularly in rural areas
  - Current high cost of backhaul is the key factor limiting wireless broadband deployment in rural areas
- Equipment available now; would spur immediate broadband deployment to unserved and underserved rural areas and benefit consumers directly
- Fosters regulatory certainty and protects incumbent users, particularly broadcasters
- Other unlicensed or licensed uses not precluded



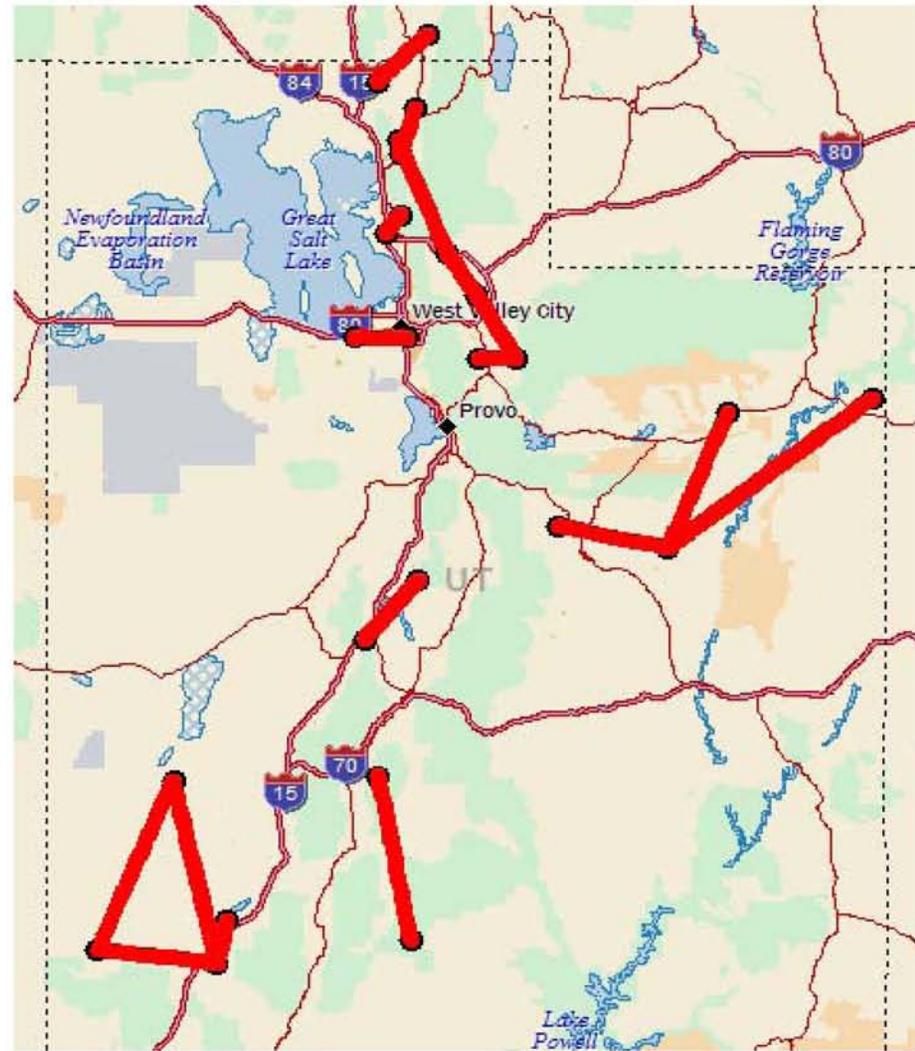
# *Licensing*

- Site-by-site basis under Part 101
- Only on UHF TV Channels 21-35 (512-596 MHz) and 39-51 (620-698 MHz)
- Make available six vacant channels in rural counties; must be 2nd or greater adjacent channel to TV broadcast station
- Also make available 3rd or greater adjacent channels in all counties



# TV Band Links in Use Today

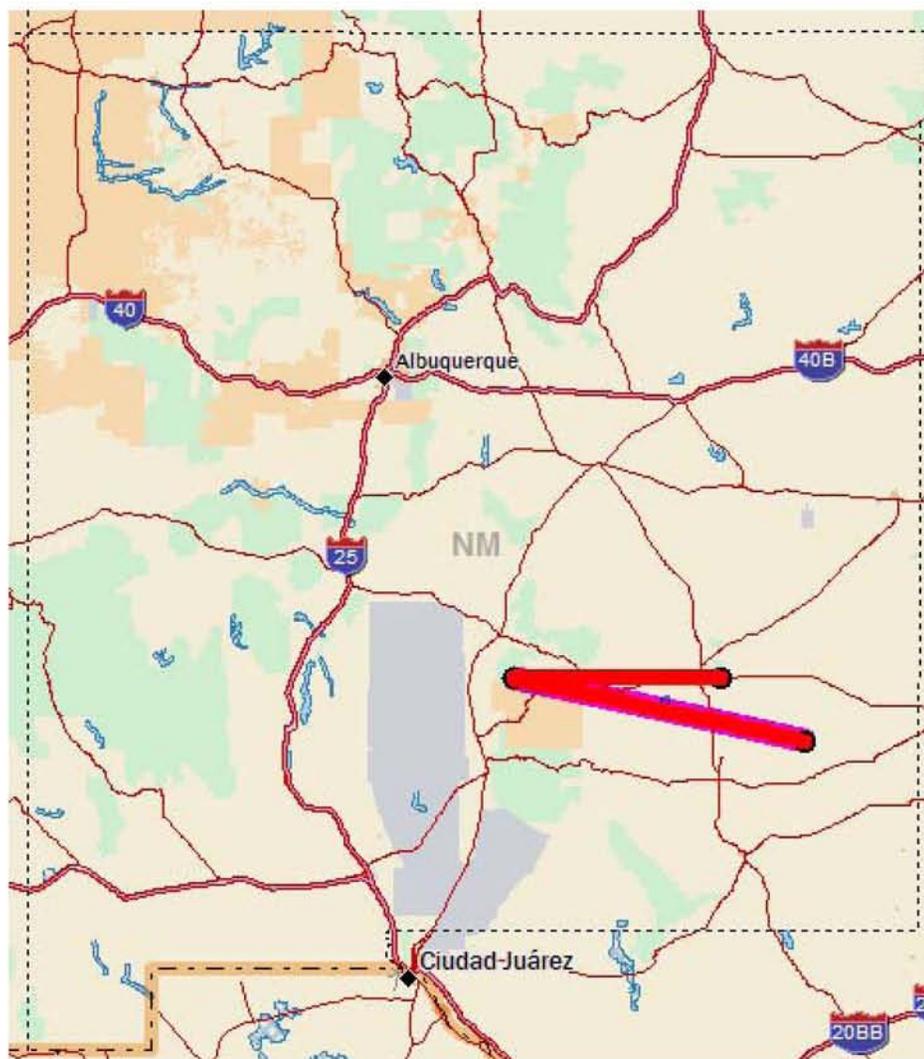
- 25 licensed TV band fixed links in Utah:
  - range in length from 11.7 km (7.3 mi.) to 131.3 km (81.6 mi.)
  - six links longer than 65 km (40 mi.)
  - average length is 51 km (32 mi.)



# Longest TV Band Link (116 mi.)

WPNI810:

- TV intercity relay, formerly licensed to Acme Television License of New Mexico
- two paths
- Buck Peak/Ruidoso to Roswell, 130 km (81 mi.)
- Buck Peak/Ruidoso to rural Chaves County, 186.5 km (116 mi.)
- Both use 62 dBm EIRP and 18 dBi gain antennas
- Buck Peak 2700 m higher elevation than rural Chaves County path end



# *TV Band Path Lengths*

- With urban power limits (24 dBW/6 MHz), modeling indicates path lengths of ~40 miles w/ 99.995% reliability
- With rural power limits (35 dBW/6 MHz), modeling indicates path lengths of ~70 miles w/ 99.995% reliability
  - Distances can be greater from mountain-top locations
  - Distances can be shorter depending on terrain roughness and multipath conditions
  - Rain fading and atmospheric absorption not a factor at UHF (but are factors for microwave bands)



# TV Band vs. Microwave Antennas

## Smaller, Lighter, Less Expensive



### PR-TV series

PARAFLECTOR® ANTENNA

15.5 to 17 dBd gain

470 to 862 MHz



PR-TV	Antenna	HP10-107-D1A
1.7 X 0.9 m (68" X 36")	Size	3 m (10 ft) diameter
38 lb.	Weight	575 lb.
\$1,664 for two, plus installation	Cost	\$26,960 for two, plus installation



### HP10-107-D1A

Parabolic Shielded  
Antenna

48 dBi

10.2-10.7 GHz



# Microwave Path Lengths

*Using FCC's ULS database for Utah*

<b>Band</b>	<b># Links</b>	<b>Avg. Length (km)</b>	<b>Max. Length (km)</b>	<b>Ant. Gain (dBi)</b>	<b>Ant. Size (Feet)</b>
UHF TV	25	51.1	186.5	16-18	3'x5.5'
6 GHz	1,652	51.6	166	38.8-46.4*	6'-15'
11 GHz	682	25.1	99.7	33.7-49.8	4'-10'
18 GHz	318	11.9	48.1	30-48.5	8'
23 GHz	176	4.2	20	30-46.9	1'-4'

- 32 links > 130 km (80 mi.): all use 42-45.6 dBi gain antennas (10'-15')
- 313 links w/6' antennas: avg. len. 32 km, max 100 km



# Spectrum Usage – What's Available

Frequencies	Typical Path Length	Maximum Channel Bandwidth	Maximum Channel Capacity (typical)	Minimum Dish Diameter	Typical Weight, including mount
400 – 700 MHz (in Progress)	30 - 75+ Miles	6 MHz	25 Mbps*	< 3x6 Ft (smaller available for different applications)	< 35 lbs
4 GHz	20+ Miles	20 MHz	DS-3+	8 Ft	500 lbs
6.1 GHz	20+ Miles	30 MHz	OC-3	6 Ft	360 lbs
6.7 GHz	20+ Miles	10 MHz	DS-3	6 Ft	360 lbs
10 GHz	10 Miles	5 MHz	16 x T1	2 Ft	33 lbs
11 GHz	8 Miles	40 MHz	OC-3	2 Ft	33 lbs
18 GHz	4 Miles	80 MHz	OC-3, OC-3+	2 Ft	33 lbs
23 GHz	2 Miles	50 MHz	OC-3	1 Ft	21 lbs
24 / 39 GHz	1.5 Miles	200-700 MHz	1 Gbps	9" (in market)	< 20 lbs

\* Assumes 64 QAM. 50 Mbps achievable by using two 6 MHz TV channels or two antennas with different polarizations;  
 1 > 40 Mbps may be achievable with 128 QAM over shorter distances

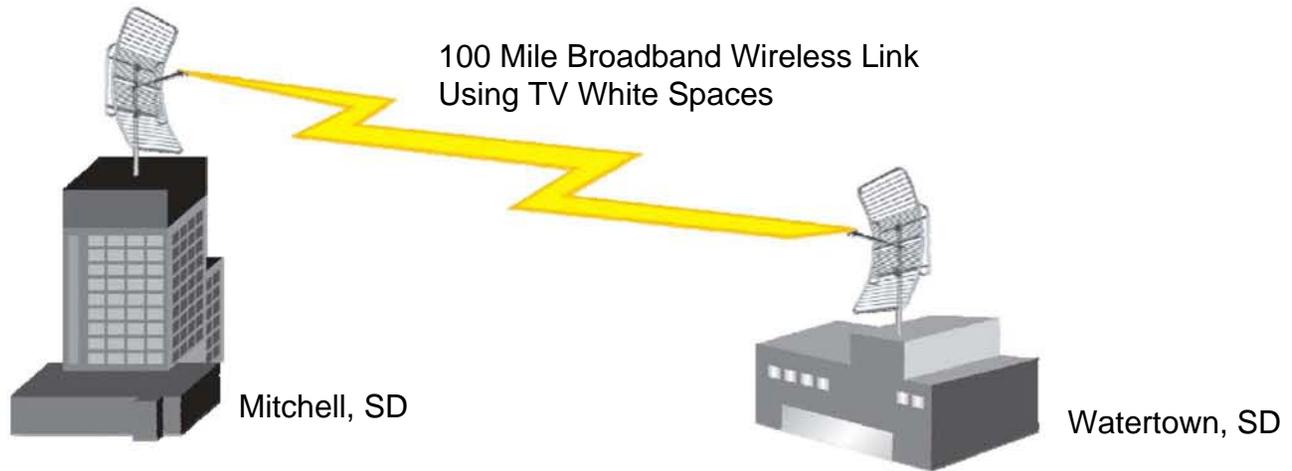


# Data Rates

- When received signal-to-noise ratio is sufficient, links would be able to operate with up to 128 QAM (maximum data rate ~ 41 Mbps in 6 MHz channel)
  - 64 QAM likely to be more typical; max. data rate ~ 28 Mbps gross, and 20-25 Mbps net after coding
  - Rate could be doubled by using dual polarization
  - Rates could be less for longer links with low received signal-to-noise ratio



# 100 Mile Broadband Connection Comparison



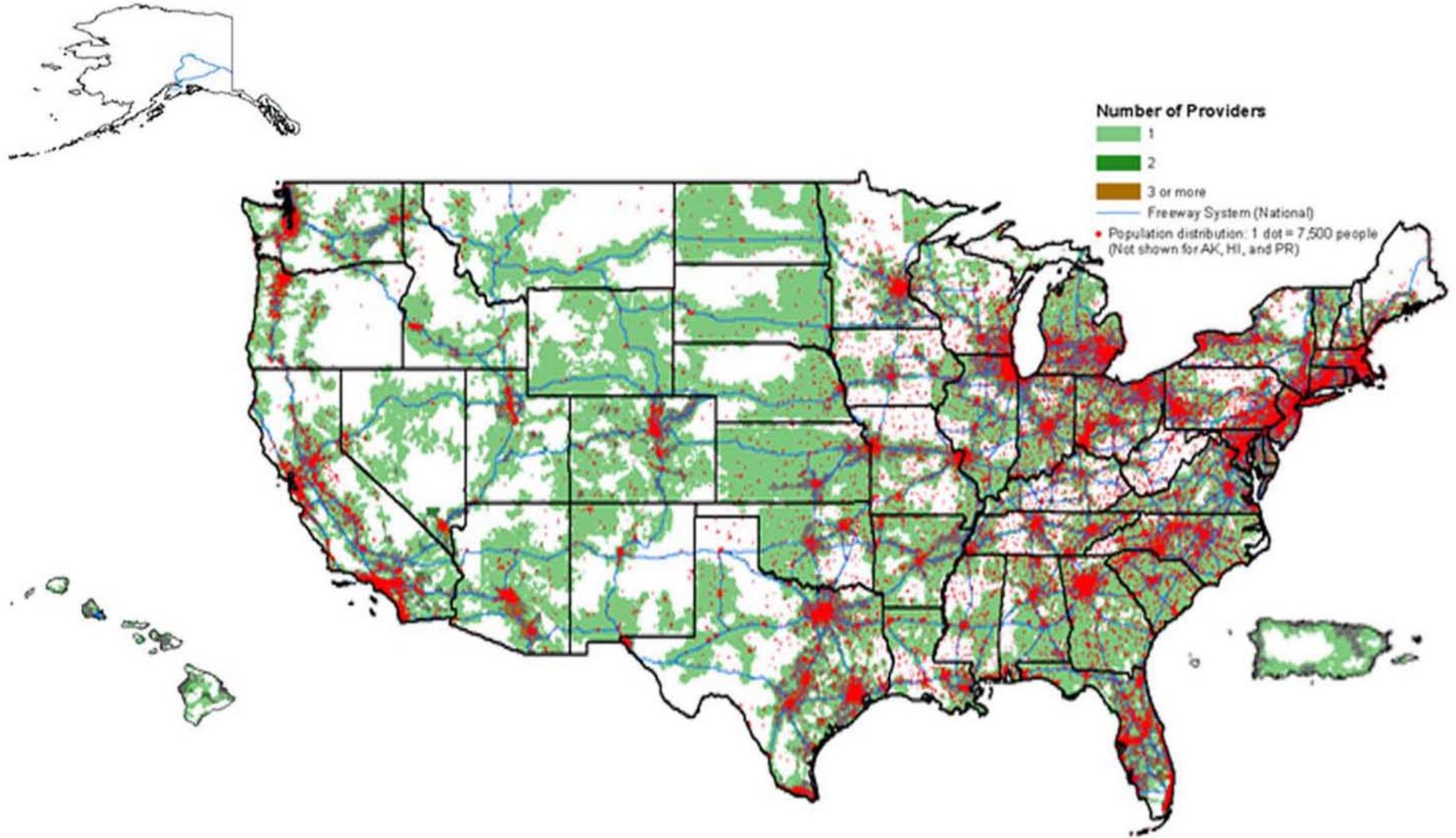
100 Miles using TV White Spaces (450-698 MHz): Small lightweight grill-style antenna fits on building/tower. Cost <\$100,000 - \$200,000



6 GHz or 3.65 GHz. Total cost: >\$3 million. Fiber Optic costs even more!



# Population Areas w/o Mobile Broadband



Source: FCC's 13<sup>th</sup> CMRS Report (2009)



# Proposed Technical Rules for Licensed, Fixed Use of TV White Spaces

October 26, 2009

## Summary of Proposed Rules

1) **Part 101 Site-Based Licensing:** Fixed use would be licensed on a site-by-site basis under Part 101. Applicants would be subject to frequency coordination with other Part 101 fixed service licensees, pursuant to procedures outlined in Section 101.103(d). Applicants also would need to demonstrate that their proposed Part 101 fixed operations will protect existing primary and secondary incumbents in other services, as discussed below. The licenses would be granted for ten-year, renewable terms, and each licensed site would need to be placed in operation within eighteen months of licensing.

2) **Frequencies/Channels:** Fixed use would be licensed only on UHF TV Channels 21-35 (512-596 MHz) and 39-51 (620-698 MHz). Fixed use channels would be 6 MHz wide and align with the UHF TV channels. In rural counties, six vacant channels second or greater adjacent to a TV broadcast station licensed under Part 73, Subpart E would be made available for licensed, fixed use provided such use would protect existing incumbents in other services as discussed below.<sup>1</sup> In addition, in all counties, all vacant channels third or greater adjacent to a TV broadcast station licensed under Part 73, Subpart E would be made available for licensed, fixed use provided such use would protect existing incumbents in other services as discussed below. Fixed use operations also could be licensed in other unserved and underserved areas where spectrum remains unused, as determined by the FCC. The designation of urban and rural counties would be based on existing PCS and cellular rules (*i.e.*, rural counties are counties that have population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census. *See, e.g.*, Section 24.232(b).).

Contiguous channels, if available, may be aggregated to obtain a bandwidth greater than 6 MHz. For contiguous channel applications, the applicant must submit as part of the original application a detailed plan indicating how the bandwidth requested will be utilized. In particular, the application must contain detailed descriptions of the modulation method, the total data throughput (specified for each link), the channel time sharing method (if applicable), and any error detecting and/or correcting codes. Further, any contiguous channel applications must include a separate analysis of the spectrum efficiency, including both information bits per unit bandwidth and the total bits per unit bandwidth.

3) **Power Limit:** On any authorized frequency, the average power delivered to an antenna in this service will be the minimum amount of power necessary to carry out the communications desired. The average EIRP on any authorized frequency would be limited to 24 dBW/6 MHz in urban counties and 35 dBW/6 MHz in rural counties.

---

<sup>1</sup> There may be rare instances of rural areas that have few vacant channels, and the Commission could limit the total channels available for licensed, fixed operations in such areas to no more than one-half of the second or greater adjacent channels.

4) **Antenna Requirements:** Vertical polarization, horizontal polarization, and cross polarization would be allowed. If multiple polarization modes are used on the same frequency at the same location, the maximum permitted average EIRP would be reduced to keep the total power limited to 24 dBW/6 MHz in urban counties and 35 dBW/6 MHz in rural counties. The transmitting antenna must comply with the following antenna standards, which would apply in both the azimuth (horizontal) and elevation (vertical) planes:

Maximum beamwidth to 3 dB points: 25°

Minimum antenna gain: 15 dBi

Minimum radiation suppression from centerline of main beam:

15° - 20°	4 dB
20° - 25°	7 dB
25° - 30°	11 dB
30° - 40°	15 dB
40° - 55°	20 dB
55° - 150°	25 dB
150° - 180°	30 dB

5) **Protection of Other Operations in the Band:** Licensed, fixed use would be secondary to, and would be required to protect, all current and future “full service” TV broadcast stations (*i.e.*, stations licensed pursuant to Subpart E of Part 73) and Class A TV broadcast stations (*i.e.*, stations licensed pursuant to Subpart J of Part 73). Licensed, fixed use would share co-secondary status with analog and digital low-power TV (“LPTV”) stations, TV translators, TV booster stations, TV studio transmitter links (“STLs”), TV relay stations, TV translator relay stations, and Low Power Auxiliary Services stations (*e.g.*, wireless microphones). Secondary status stations generally would be protected from other secondary stations on a “first come, first served” basis, *except that* licensed, fixed use would protect LPTV stations, TV translators, and TV booster stations filed during a limited filing window, as discussed below.

a. **Existing Part 73, Subpart E TV Broadcast Stations.** Licensed, fixed operations would be required, at a minimum, to protect co-channel and first-adjacent channel TV broadcast stations, just as DTV broadcast stations must protect each other. That is:

- Licensed, fixed co-channel or adjacent-channel operational endpoints and the path length between endpoints would not be permitted within the 41 dB $\mu$ V/m noise-limited service area contour of a DTV broadcast station, as defined in Section 73.622(e).
- Licensed, fixed operations may not exceed, at any location within the DTV broadcast station’s noise-limited service area contour, the desired-to-undesired (D/U) signal ratio thresholds contained in Section 73.623(c)(2) for co-channel DTV-into-DTV (D/U of +15 dB), lower first-adjacent channel DTV-into-DTV (D/U of -26 dB), and upper first-adjacent channel DTV-into-DTV signals (D/U of -28 dB).
- Licensed, fixed operations that operate with endpoints with antenna height above average terrain (“HAAT”) less than 152 meters (500 ft.) can demonstrate the necessary D/U protections by providing a minimum

buffer distance of 19.3 kilometers (12 miles) from all adjacent channel DTV broadcast station noise-limited service area contours (adjacent channel frequencies based on -28 dB protection for DTV broadcast stations) and a minimum buffer distance of 67.6 kilometers (42 miles) from all co-channel DTV broadcast station noise-limited service area contours (co-channel frequencies based on 15 dB protection for DTV broadcast stations).

**b. Existing Part 73 Subpart J Class A TV Broadcast Stations.** Licensed, fixed operations would be required, at a minimum, to protect co-channel and first-adjacent channel Class A TV broadcast stations, just as Class A TV broadcast stations must be protected from other TV stations. Thus, Part 73 Subpart J Class A TV broadcast stations must receive, from licensed fixed operations, protections that meet or exceed the Class A protections articulated in Sections 73.6012-73.6019.

**c. New DTV Broadcast and DTV Broadcast Station Maximization/Relocation Requests.** New licensed, fixed stations may not object to, and must protect, any new “full power” DTV station or an existing DTV station’s maximization or relocation request. However, if a new DTV station, or maximization or relocation of an existing DTV station, is implemented after June 12, 2011, then the DTV licensee must provide at least 120 days’ advance notice of such changes to the fixed service licensee to ensure that the fixed service licensee’s network is reconfigured as necessary. Class A station facility change/relocations shall receive, from licensed fixed operations, protections that meet or exceed the Class A protections articulated in Sections 73.6012-73.6019.

**d. LPTV, TV Translators, and TV Booster Stations.** New licensed, fixed stations must protect all existing LPTV, TV translators, and TV booster stations as well as the following “grandfathered” secondary stations:

- all LPTV, TV translators, and TV booster stations in operation by June 12, 2010;
- all LPTV, TV translators, and TV booster stations that have been granted construction permits by June 12, 2010; and
- all LPTV, TV translators, and TV booster stations for which applications are filed in the first six months after the opening by the FCC of a new application filing window, provided such window opens no later than June 12, 2011.

Licensed, fixed co-channel or adjacent-channel operational endpoints and the path length between endpoints would not be permitted within a 8 kilometer (5 mile) buffer surrounding the “grandfathered” station’s 74 dB $\mu$ V/m noise-limited service area contour.

**e. Low-Power Auxiliary Stations, Including Wireless Microphones.** Licensed, fixed stations must coordinate with Low-Power auxiliary stations whose locations are registered with the FCC or frequency coordinators. In order to accommodate the temporary and/or transient use of Low-Power Auxiliary Stations, licensed, fixed devices will also: 1) not operate on UHF TV Channels 36 through 38 nor in the first-adjacent channels to DTV stations; 2) provide a 30-day coordination notice, prior to system turn-up, to any previously-registered wireless microphone and production venues within 8

kilometers (5 miles) of the fixed link path and its endpoints. Any potential frequency interference issues that arise from the coordination notice will be worked out by the parties affected.

f. **Medical Devices and Healthcare Facilities.** Licensed, fixed stations are prohibited from operating on Channel 37, which is set aside for radio astronomy and wireless medical telemetry service (“WMTS”) use, and on the first-adjacent Channels 36 and 38.

g. **TV STL and Relay Links.** Licensed, fixed stations must protect existing TV STL and relay links, as well as “grandfathered” TV STL and relay links, in operation by June 12, 2010. New TV STL and relay links authorized after June 12, 2010 would need to be coordinated with and protect previously-existing fixed, licensed stations or obtain the consent of the fixed station licensee to operate. However, every effort should be made to accommodate coordination requests from TV STL and relay links that must be moved to another channel as a result of the DTV transition.

h. **Other Licensed, Fixed Operations.** Any pre-existing licensed, fixed operations shall receive coordination protection in accordance with Section 101.103 frequency coordination procedures.

i. **Cable Television Operations.** The cable industry will establish a voluntary database of CATV headends which will include, at minimum, the latitude and longitude of each headend, a list of the over-air television stations which are received there, and the azimuth direction towards which the receiving antenna for each television station is pointed. Licensed, fixed stations must adequately protect against interference with reception of over-air television programming at any headend listed in the database. This may be demonstrated by coordination with each individual headend for which the technical design of the licensed, fixed station predicts that the field strength of the licensed, fixed station, as measured at the headend location, will be greater than +19 dB $\mu$ V/m on any over-air television channel that is received at a given headend or greater than +75 dB $\mu$ V/m on any channels that are adjacent to any channel received at the same headend.

Adequate protection will be demonstrated if the signal of the licensed, fixed station is at least 23 dB below the same-channel over-air television signal as received at the headend, and no greater than 33 dB higher than higher or lower adjacent channels of such signals as received at the headend, as measured at the downlead of the headend receiving antenna used for the desired station. The over-air signal strength reference for this comparison will be that which is achieved 99% of the time as determined by extended signal level tests.

j. **Television Receiver Direct Pickup.** In general, licensed, fixed operations shall be designed to produce no more than 99 dB $\mu$ V/m at the external wall of any building where a television receiver is likely to be located (*e.g.*, residences, apartment buildings, office buildings). The field strength from a licensed, fixed operation can be calculated considering a number of factors, including the following: path loss (distance from

transmitter), transmitter power, antenna gain/suppression at the relevant angle, and terrain attenuation.

6) **Protection from TV Bands Devices:** Licensed, fixed use would receive interference protection from unlicensed TV Bands Devices (“TVBDs”) pursuant to the same framework that the FCC has adopted for Broadcast Auxiliary Services links under 47 C.F.R. § 15.712(c). Thus, for licensed, fixed use point-to-point receive sites appearing in the Commission’s Universal Licensing System, TV Bands Devices may not operate within an arc of +/-30 degrees from a line between the licensed, fixed use receive site and its associated permanent transmitter within a distance of 80 km from the receive site for co-channel operation and 20 km for adjacent channel operation. Outside this +/-30 degree arc, TVBDs may not operate within 8 km from the receive site for co-channel operation and 2 km from the receive site for adjacent channel operation. The transmitter and receiver coordinates, channel number, and call sign for each new site-based point-to-point link will be added to the TV bands database.