SUPER WiFi™ SUMMIT

Building your Business in the TV White Space

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Jim Carlson, CEO, Carlson Wireless

Visit: www.superwifisummit.com

Jim Carlson

CEO Carlson Wireless

CARLSON WIRELESS

Broadband Data and Voice Products

- 25 years, hands-on, in radio design
- Started locally in Northern California
- Maintains commitment of bringing state-of-the-art services to low population density
- Continues to work with FCC and WISPA advocating for unlicensed use of TVWS
- Delivering TVWS service to Yurok Tribe today

Building your Business in the TV White Space

- Overcome failed installations
- Expand into challenging terrain
- Satisfy customer demand for bandwidth
- Planning an install

Special Characteristics of TVWS Frequencies

- Non line of sight
  - Penetrate obstacles such as foliage and buildings
  - Requires less infrastructure
- Ground wave component is much larger
  - Greater coverage – 1 to 2 mi cell radius NLOS
- Abundant spectrum
  - Even more channels available in rural areas

Business Model Trajectory

- First, cover failed installs to build revenue
- Second, use that capital to expand into challenging terrain
- Third, use additional spectrum to add bandwidth for existing customers

Overcome Failed Installations

- 20 to 30 % of business lost due to poor coverage with Wi-Fi
- TVWS can bridge many of these areas
- Most infrastructure already in place

Expanding into Challenging Terrain

- Use where too hilly for Wi-Fi
- Also forested or heavy foliage
- Less infrastructure required than Wi-Fi
- Cost effective for low teledensity

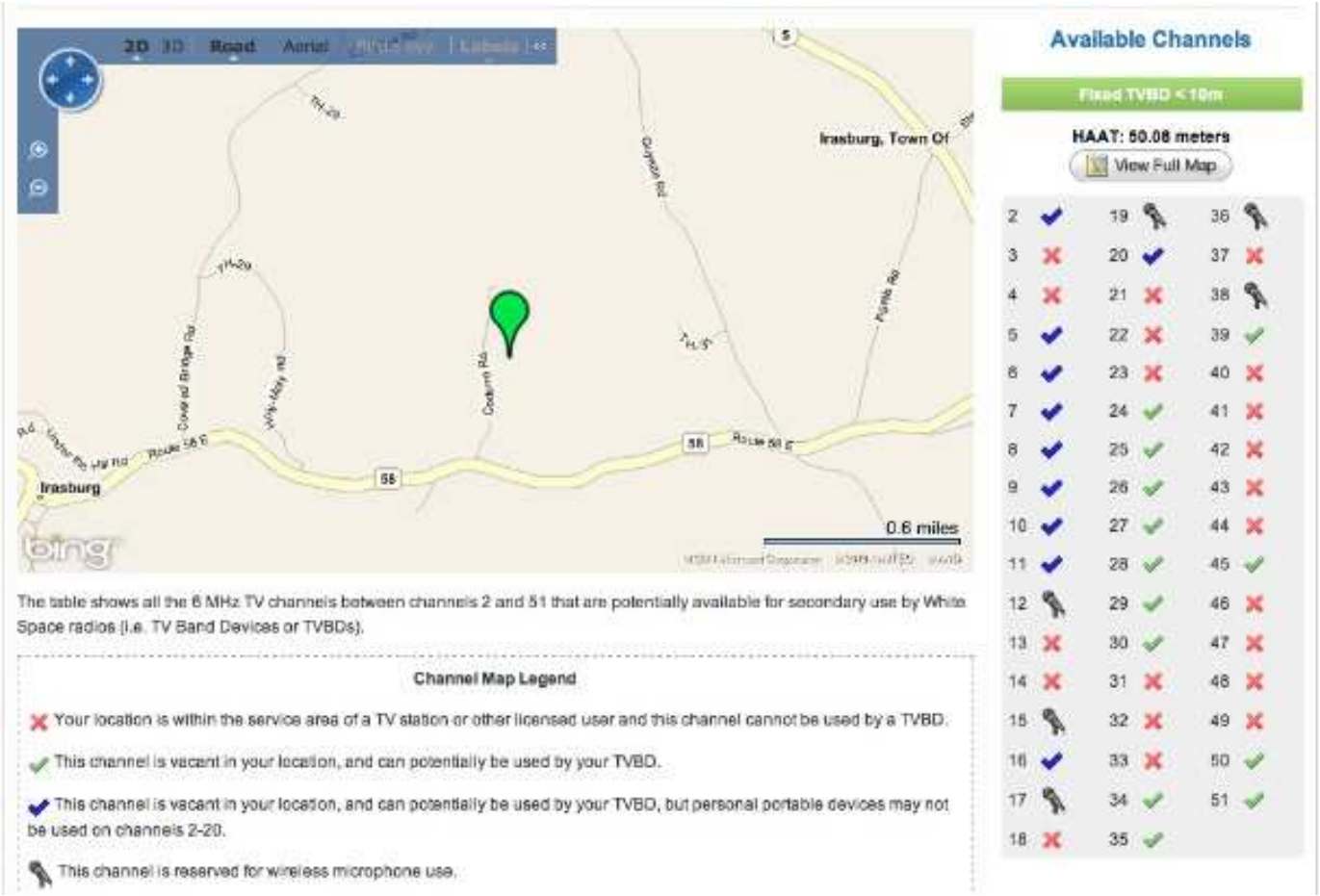
Planning a TVWS Network

- Examine database for available channels
- Examine database for HAAT
- Maximum antenna height
- Area coverage mapping
- Link budget
- Cell size depends on obstructions
- Bandwidth considerations
- Network Management

Examine Database – Enter lat long

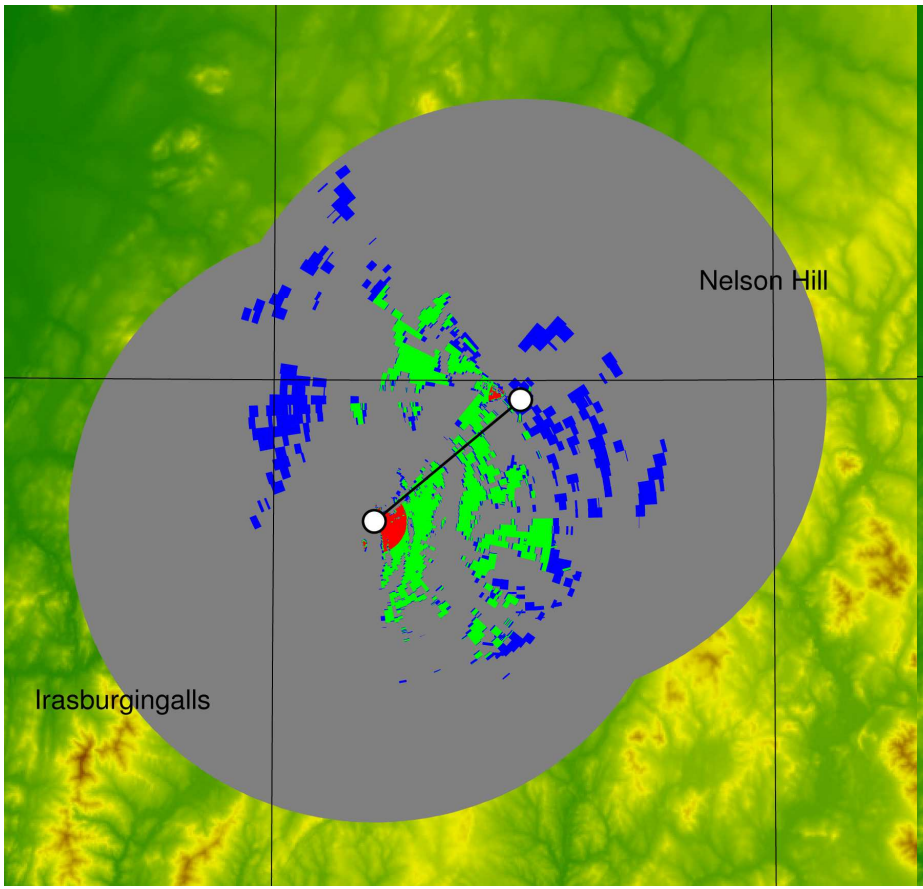
Enter TVBD: (Television Band Devices)
Courtesy of: Spectrum Bridge, ShowMyWhiteSpace.com

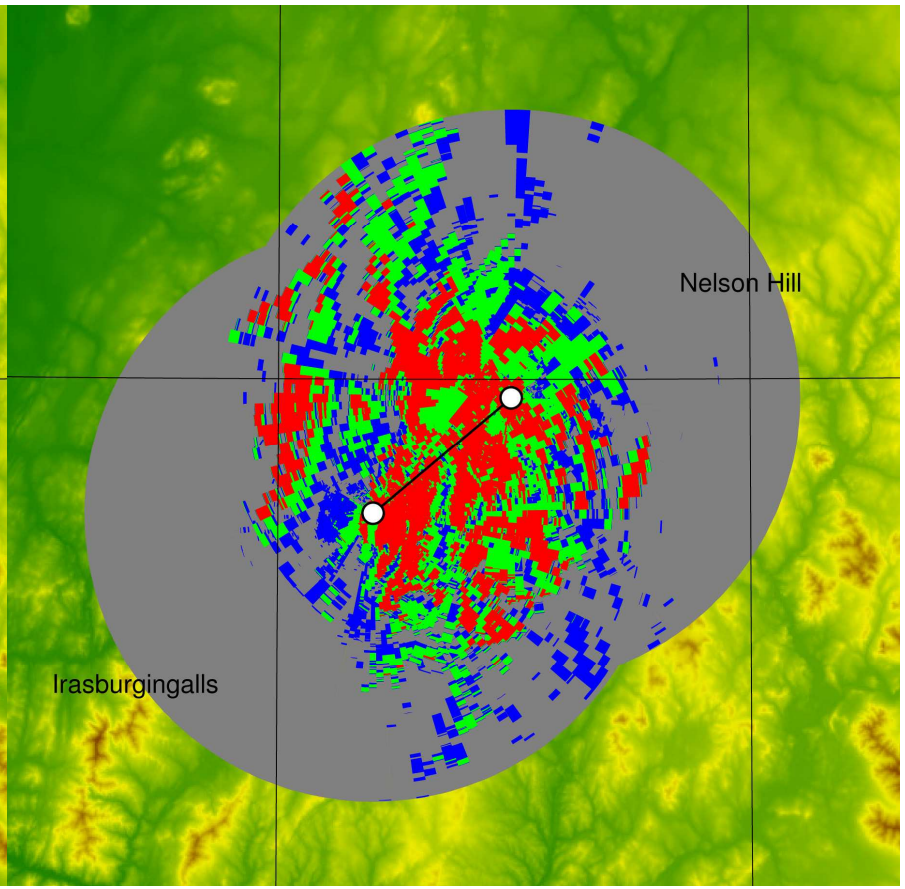
Examine Database – Check HAAT



Courtesy of: Spectrum Bridge, ShowMyWhiteSpace.com

Area Coverage with Wi-Fi vs. TVWS





Coverage with 5 GHz **Coverage with 200 MHz**

source: Irasburg Ingalls, Nelson Hill, VT

Calculating Link Budget - VHF

Link Budget - VHF (200 MHz typical 1 to 4 mile radius cell size)

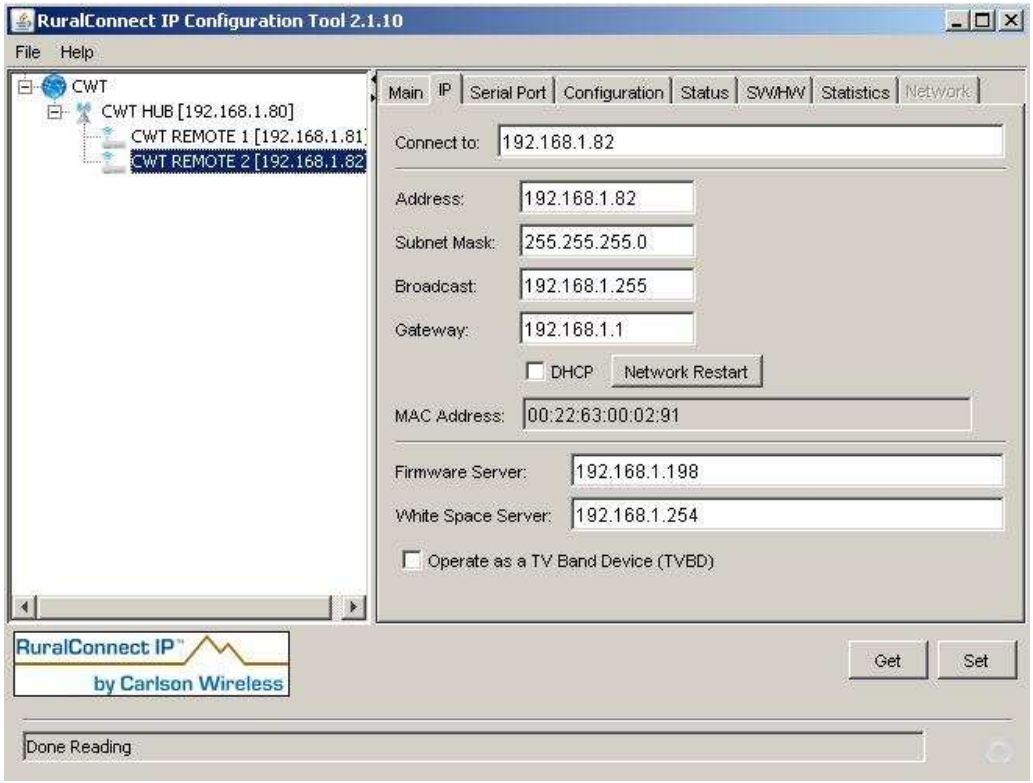
Transmit RF out	+27	Receive Antenna Gain	+ 8
Cable loss	- 2	Cable loss	- 2
Antenna Gain	+ 8	Available Signal	- 62
EIRP out	+33	Receive threshold	96
Free Space Loss 9m	-101	Link Margin	33 dB

For 99%, allow 12 dB for clear paths, 18 db for partial obscured paths, 24+ dB for indoor locations

Bandwidth Considerations

- Access point needs 3+ Mbps dedicated
- Consider subscribers per access point in relation to service plan
  - If residential and 2:1 service then 30 subs/AP
  - If business and 2:1 service then 16 subs/AP

Network Management



- Typical GUI Screen

An Evolution (or Not) for Future White Spaces Service Providers?

- Use to backhaul remote Wi-Fi hotspots
- Limited throughput - tight emissions mask
- In many cases it will cure “failed installs”
- In hilly or heavy foliage it will allow new service where none is..
- In some cases it is simply “more spectrum”

Future Predictions – Next 12 months

- Subscriber price point – price drop 50%
- Rules allowing higher modulation complexity
- Bandwidth – from 4 Mbps to 16 Mbps
- Standardization 802.11af, more?
- EMS, Radius authentication etc.
- Compatibility with portable devices

CARLSON WIRELESS™

Microwave Broadband and Telephone

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