



Building your Business in the TV White Space

February 2-4, 2011

Miami Beach Convention Center in Miami, FL

Jim Carlson, CEO, Carlson Wireless

Visit: www.superwifisummit.com



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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**

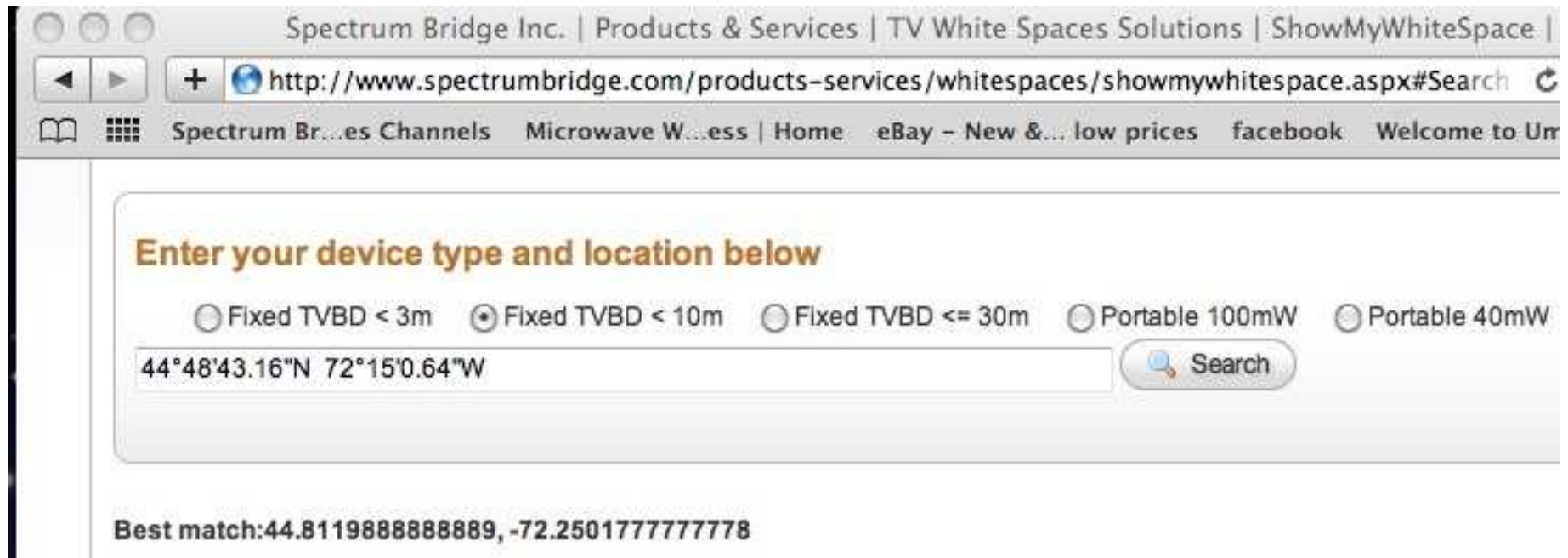
Expanding into Challenging Terrain

- 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



Spectrum Bridge Inc. | Products & Services | TV White Spaces Solutions | ShowMyWhiteSpace |

http://www.spectrumbridge.com/products-services/whitespaces/showmywhitespace.aspx#Search

Spectrum Bridges Channels Microwave Wireless | Home eBay - New &... low prices facebook Welcome to Ur

Enter your device type and location below

Fixed TVBD < 3m Fixed TVBD < 10m Fixed TVBD <= 30m Portable 100mW Portable 40mW

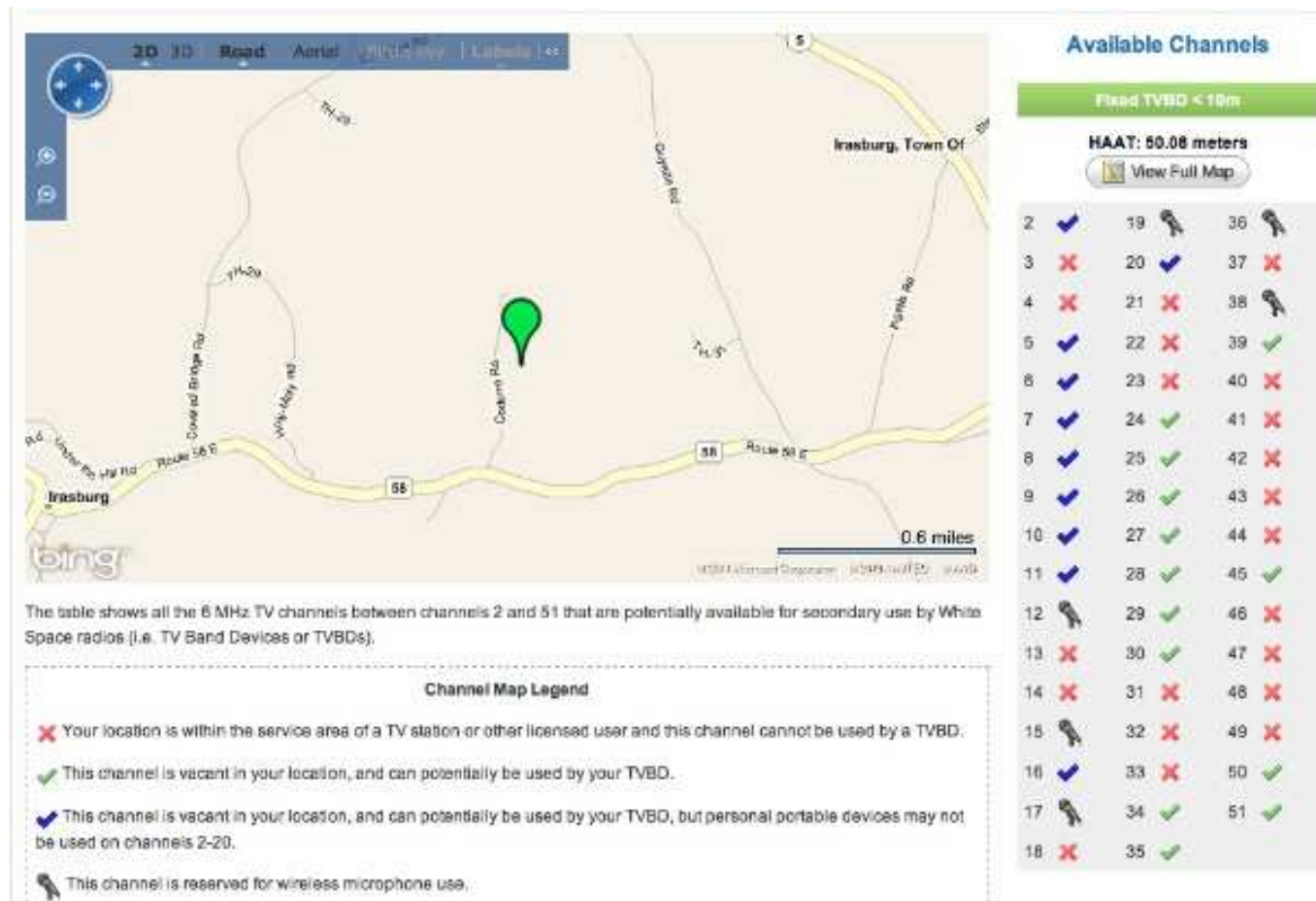
44°48'43.16"N 72°15'0.64"W

Best match:44.8119888888889, -72.2501777777778

Enter TVBD: (Television Band Devices)

Courtesy of: Spectrum Bridge, [ShowMyWhiteSpace.com](http://www.showmywhitespace.com)

Examine Database – Check HAAT



Available Channels

Fixed TVBD < 10m

HAAT: 50.08 meters

[View Full Map](#)

2	✓	19	📻	36	📻
3	✗	20	✓	37	✗
4	✗	21	✗	38	📻
5	✓	22	✗	39	✓
6	✓	23	✗	40	✗
7	✓	24	✓	41	✗
8	✓	25	✓	42	✗
9	✓	26	✓	43	✗
10	✓	27	✓	44	✗
11	✓	28	✓	45	✓
12	📻	29	✓	46	✗
13	✗	30	✓	47	✗
14	✗	31	✗	48	✗
15	📻	32	✗	49	✗
16	✓	33	✗	50	✓
17	📻	34	✓	51	✓
18	✗	35	✓		

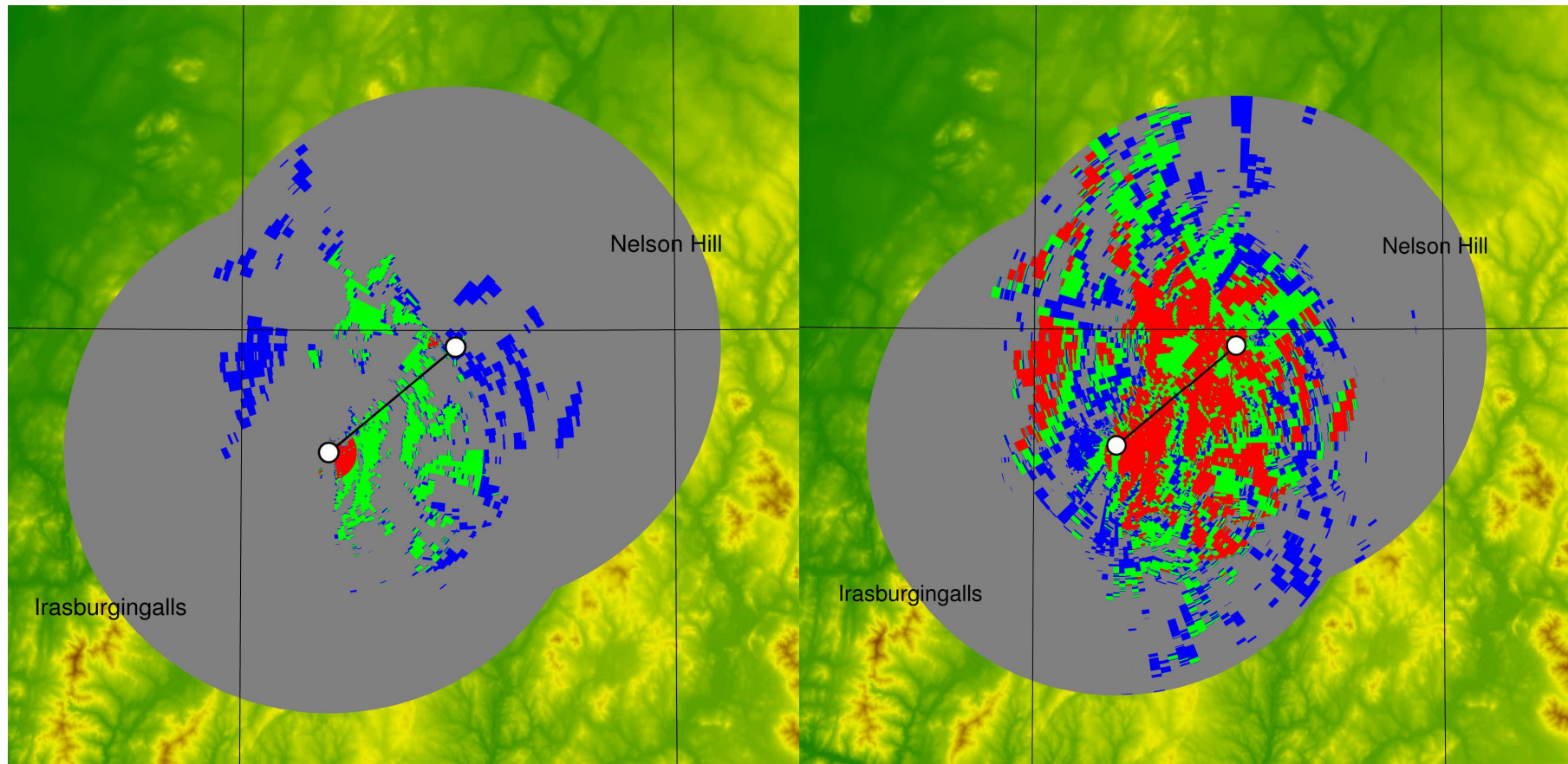
The table shows all the 6 MHz TV channels between channels 2 and 51 that are potentially available for secondary use by White Space radios (i.e. TV Band Devices or TVBDs).

Channel Map Legend

- ✗ Your location is within the service area of a TV station or other licensed user and this channel cannot be used by a TVBD.
- ✓ This channel is vacant in your location, and can potentially be used by your TVBD.
- 📻 This channel is vacant in your location, and can potentially be used by your TVBD, but personal portable devices may not be used on channels 2-20.
- 📻 This channel is reserved for wireless microphone use.

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)

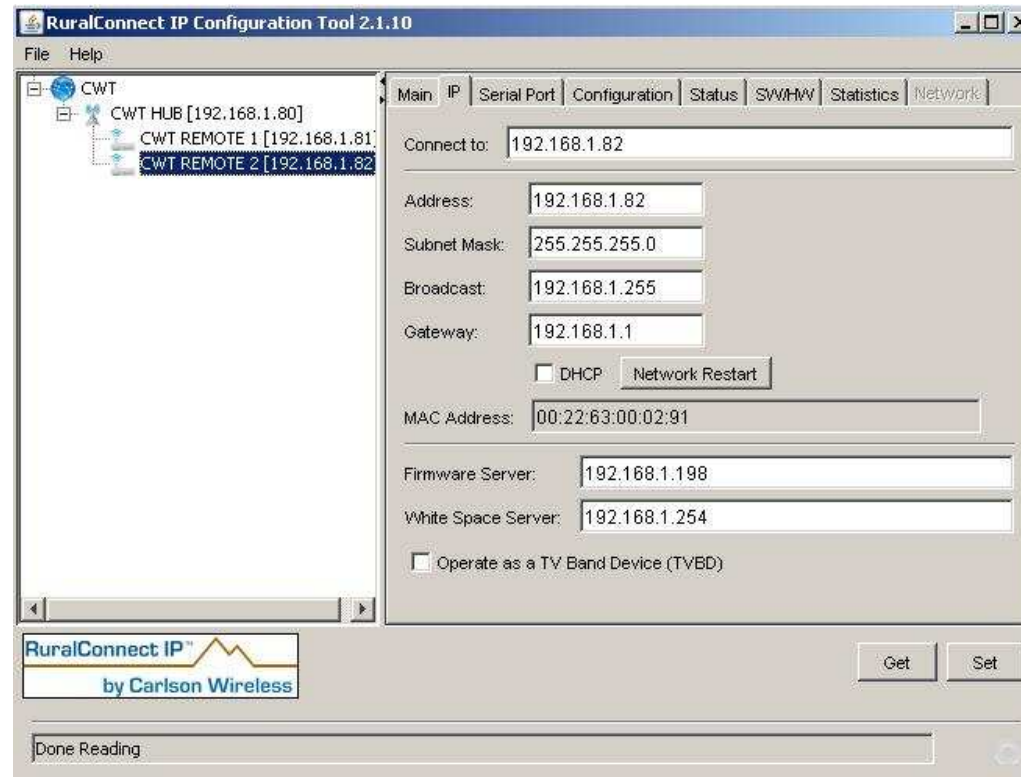
Transmit RF out	+27	Receive Antenna Gain	+ 8
Cable loss	- 2	Cable loss	- 2
Antenna Gain	+ 8	Available Signal	- 62
EIRP out	+33	Receive threshold	96
Free Space Loss 9m	-101	Link Margin	33 dB

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**



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CARLSON WIRELESS™

Microwave Broadband and Telephone

For more information:

Carlson Wireless Technologies, Inc.

1385 8th Street

Arcata, CA 95521

707-822-7000

Sales@CarlsonWireless.com

Engineered by:

KTS

Wireless



Product Vision

Visit: www.superwifisummit.com