

TV White Space: A Smart Choice for Rural Smart Grids

Jim Carlson, CEO, Carlson Wireless
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A Brief Introduction

- Carlson Wireless
 - Designer, manufacturer of fixed-wireless equipment for broadband and backhaul
 - Since 1999
 - Located in Northern California
 - TV white-space product: RuralConnect IP
- Jim Carlson, CEO
 - Radio engineer with 25+ years experience



White Space 101

- Vacated TV channels, newly available for broadband uses
- VHF/UHF signal penetrates obstacles
- Abundant Spectrum, esp. in rural regions
 - Unlicensed
 - Managed by database
- Availability
 - Under experimental license - now
 - Commercially ~July



White Spaces=Open Spectrum

- 2009 DTV Migration
 - Broadcasters made more efficient use of VHF/UHF spectrum
- 2010 FCC Ruling
 - Vacant channels would be available for unlicensed broadband
- National Broadband Plan
 - TV spectrum is ideal for rural broadband because of “excellent propagation characteristics”



The Power of VHF/UHF

- Propagation
 - Ground waves, hug the ground and go over hills
 - Penetrates soft obstacles such as foliage
 - Wide range
 - Minimal infrastructure required
- Rural abundance
 - More vacant channels in rural areas
 - 290 MHz of spectrum 174-216, 470-698Mhz
 - 6 MHz per channel



Ideal Spectrum for the Rural Smart Grid

- Non-line-of-sight performance
 - Travels over mountains
 - Penetrates foliage and walls
 - Reaches where microwave won't
 - Leverages existing infrastructure

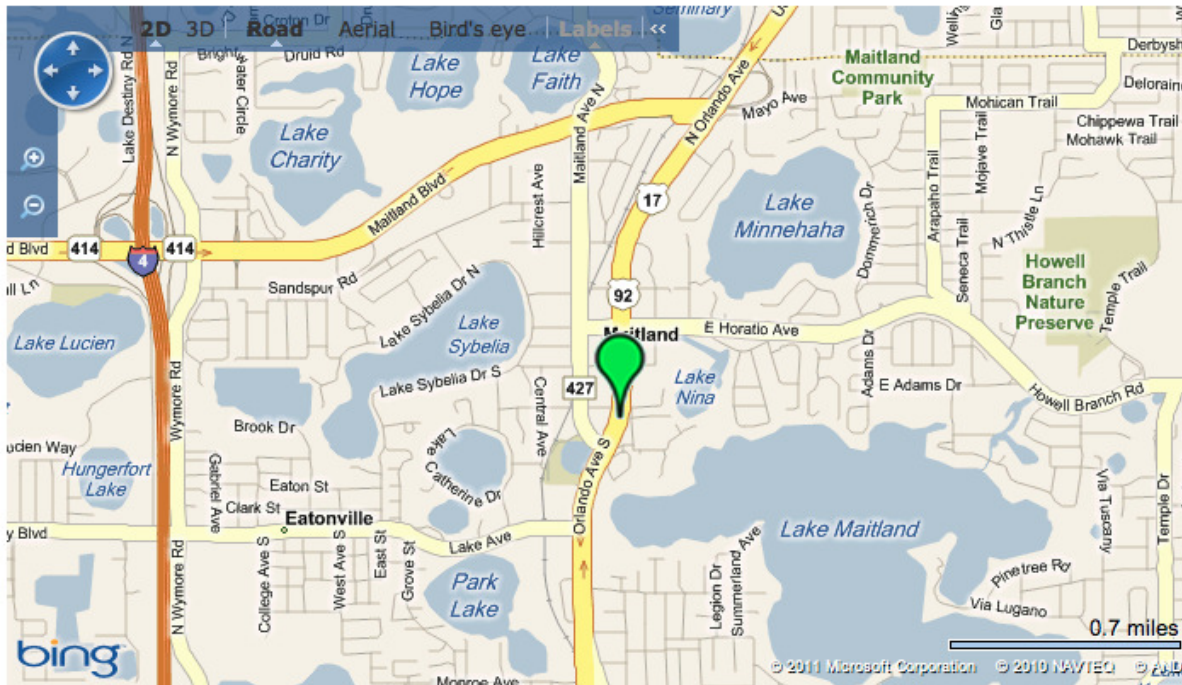


Spectrum Databases

- FCC appointed 9 companies to map available channels in the U.S. by database
- Software in TV white-space devices interacts with database
 - Database providers certify equipment
 - Example: Spectrum Bridge & RuralConnect IP
- This prevents interference



Spectrum Bridge: showmywhitespace.com



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.

Available Channels

Fixed TVBD < 3m

HAAT: 03.68 meters

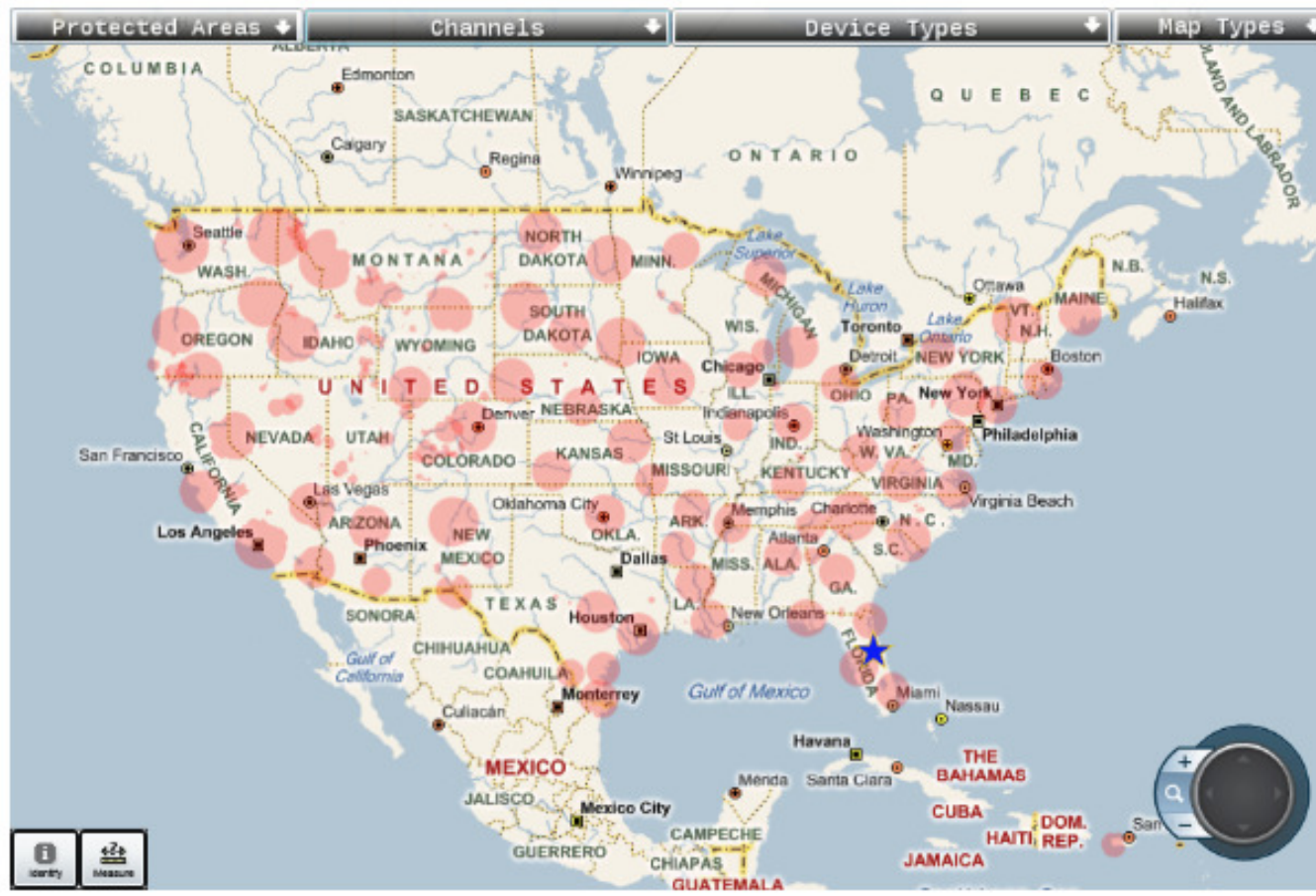
[View Full Map](#)

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	📻		

Spectrum Bridge: interactive map CH13

U.S. Interactive TV White Space Map

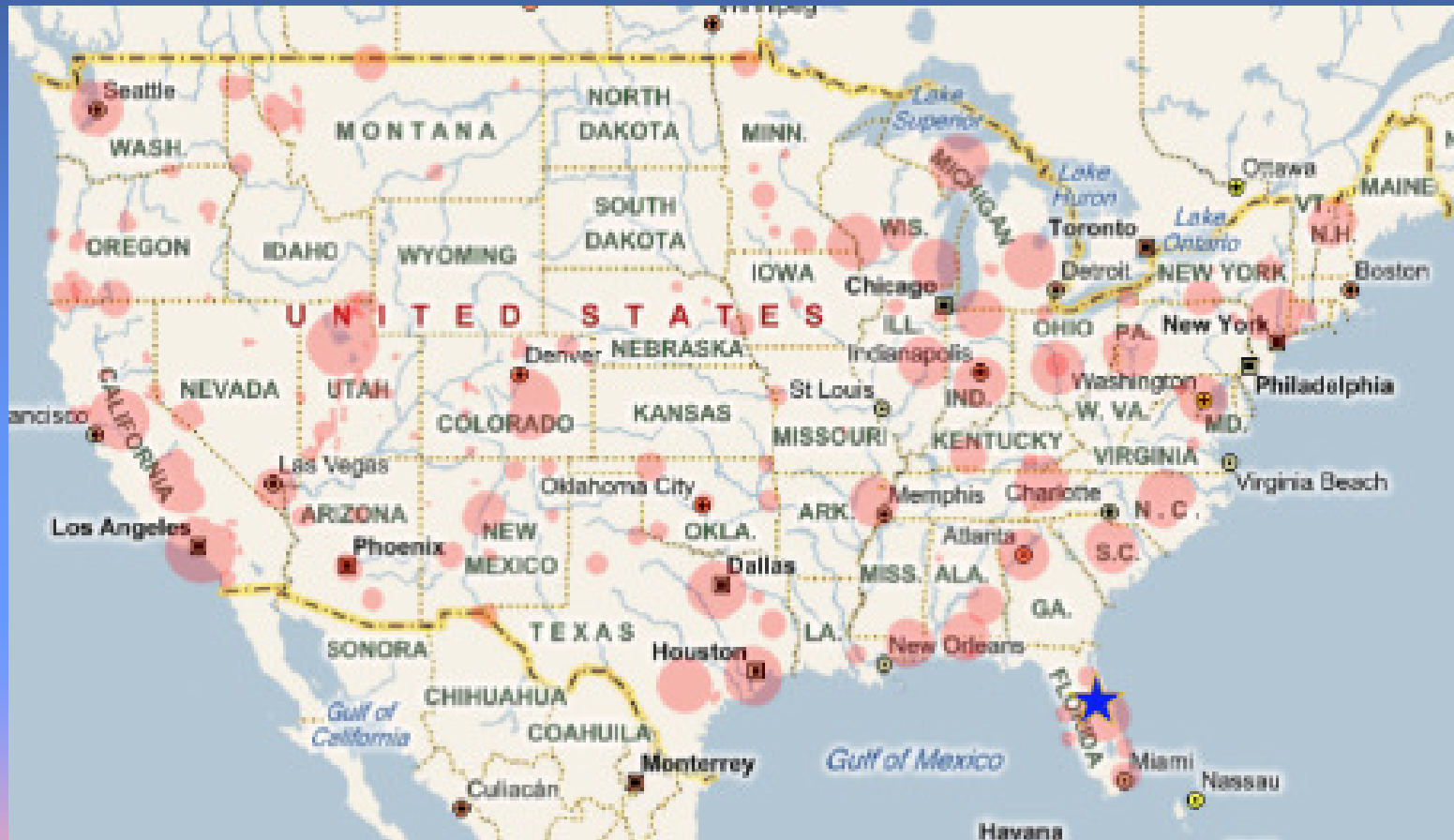
This map allows you to display protection areas by channel(s). Click [here](#) for more information, or enter a new location.



Spectrum Bridge: interactive map CH25



Spectrum Bridge: interactive map CH 48



Plumas-Sierra Electric Co-op

- White-space success story
- Serves 6,600 customers scattered throughout 3 remote N. California counties
- Service challenges due to terrain
- Participated in TV white-space trial with Spectrum Bridge
- Implemented Smart Grid upgrades with excellent results



TV White-Space Network

- Delivers real-time broadband connectivity to remote substations and switchgear
- Allows system operators to
 - Manage the electrical system remotely,
 - Request critical data from the substations,
 - Manage power flow and
 - Protect the systems and employees
- Maintains the local grid
- Provides broadband access to an underserved community in a remote area.



Utilities Need:

- Spectrum
- High capacity, low latency
- Resistance to interference
- Security
- Reliability
- Ease of deployment
- Reasonable cost
- Low maintenance, low cost of ownership
- Faster return on investment

Good for Business

- Improve Service
 - Improve reliability and efficiency, minimize disturbances
 - Integrate intermittent renewable energy options into the system
 - Customers can manage own demand
- Lower Operating Cost
 - Leverage existing infrastructure
 - Reduce personnel costs. improve personnel efficiency
- Increase Revenues



Applications

- Remote access of control data
- Smart Grid Networks
- Remote monitoring of equipment & investments
- Networks & Broadband

Access Critical Data from Remote Substations

- Technicians can access the main server from the substation
- Provide operators with real-time information and diagnostic tools needed for rapid decision-making
- Take corrective action and restore service quickly to customers that aren't directly affected



Beyond SCADA: Manage System Remotely

- Process control
- Remotely monitor the grid
 - Remotely check power flows and status of breakers in real-time
 - Gather data regarding grid conditions
 - Isolate problems on the grid, enabling faster restoration of power
- IP-based applications



Implement More Automation

- Security cameras, remote monitoring of investments
- VoIP Phones at substations
- Prepare for SmartGrid applications
- Support AMR (automated meter reading) and SCADA
- Backhaul Systems without Line of Sight
- Replace leased lines to connect AMR head-end to substations
- Process control

Networks & Broadband

- Access points at service centers and power plants
 - Subscriber modules at distribution substations
- Network offices
- Provide broadband services to customers



Rural Co-ops Take the Lead

“Co-ops have
taken the lead in
deploying smart-grid infrastructure
and **understand the benefits that**
high-speed communications can bring
to their operations and
to the rural areas they serve.”

– Glenn English, CEO, NRECA (National Rural Electric Cooperative Association) 3-18-2010

