Understanding & Implementing White Space Solutions

Presented by Tessco
and KTS Wireless
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The KTS Wireless and Tessco Relationship

**Tessco is KTS Wireless’ NA Master Distributor**

First FCC Certified White Space Ethernet Radios (June 2012) Launch at Tessco

KTS Wireless Agility WhiteSpace Radio (AWR)

Zero White Space Competition at this Time

Agility Telemetry Radio (ATR) SCADA Radio (January, 2013)

Customers/Integrators wishing to Migrate from SCADA or to Implement White Space can Now Source from Tessco

_Inquiries Come In From All Over the World Every Day!_
KTS Wireless Overview
(partnering with Spectrum Bridge)

• Founded in 1982 and headquartered in Lake Mary, FL
• Nearly 30 years experience designing, developing and manufacturing wireless products and solutions
• Founders in numerous wireless product companies including MeshNetworks (sold to Motorola), Intelesys (sold to Comsat RSI) and Atlantic Communications Sciences (sold to PCOM).
• Excellent performance record on government programs
• KTS Wireless is standard products division of KTS

Partner Information:
• Spectrum Bridge, leaders in shared spectrum solutions
  o First Live TVWS Shared Spectrum Platform, certified by FCC
  o First to Launch TV White Space Commercial Service in Wilmington, NC
  o Involved in TV White Space initiatives Globally-UK, Finland & Singapore
What is TV White Space?

• As a result of the Digital Transition from analog TV, additional spectrum became available for broadband applications.

• Traditional TV channels were from 2-69. Over time these channels have been compressed and some have been sold to cellular carriers for 4G solutions.

• The rules are quite complex, but at a high level this spectrum is available on an unlicensed basis to users for broadband applications similar to WiFi.

• TV White Space is attractive, due to it’s much lower frequency compared to existing unlicensed spectrum.

• Lower frequencies propagate better over greater distances and through walls.
KTS Wireless’ Product to Market Strategy

**KTS Wireless and Spectrum Bridge**  
**Leverage Radio Physics of White Space**

Come to Market With a Simplified Modulation Scheme  
(FSK Then SOQPSK)

Achieve an FCC Certification in a Timely Fashion  
(UHF AWR June, 2012)

Target Telemetry Plus Market

- SCADA Migration  
  Narrowband to Broadband

- Industrial Processes  
  O & G, Utilities, Smart Grid  
  Security, Logistics, etc.

- Limited WISP Applications  
  Last Mile  
  Limited Density  
  Special Apps

**Lower frequency white space, at 470 MHz to 698 MHz, produces longer waveforms**

**Therefore, long wave, low frequency white space spectrum produces larger and more resilient coverage areas**
Narrowband Migration Into White Space

Narrow Band
  - Low Bandwidth
  - Long Range

Broad Band
  - High Bandwidth
  - Shorter Range

White Space
  - Improved Bandwidth
  - Improved Range

Data Rate (Mbps)

Range (miles)

- 473 MHz
- 695 MHz

- Data rate (Mbps)
- Improved Bandwidth
- Improved Range
Drivers of Narrowband Migration to White Space

Increasing Data Reporting Requirements
- Gov’t Regulatory Data (EPA)
- Operational Data
- Corporate Data

More Sophisticated Control Software Platforms
- Larger, More Complex Data Files
- Exceeds ~ 68K Throughput
- Exceeds Channel Size of 50KHz
- Utilizes 6 MHz Channels

Leverage Unlicensed Spectrum
- Greater Simplicity
- Less Costly/More Flexible
- No Recurring Costs
- NLOS Capability
Limited WISP Applications – Last Mile

Last Mile / Content Distribution

Remote user

Wireless subscriber device

Wireless access point operating on channel A

Terrestrial distribution medium, e.g. fiber, coax connected to internet – available along easements but too costly for last mile connectivity.

Wireless access point operating on channel B

Wireless access point operating on channel C

Channel allocation engine and data base, connected via internet
Comparing White Space With Wi-Fi

White Space Spectrum
- Defines a technology that operates in the 470-698 MHz ISM band
- Excellent NLOS propagation characteristics
- >100 MHz spectrum available in rural areas
- Range up to 3 miles or further
- 1 km obstructed area would require 1, perhaps 2 APs

Traditional Wi-Fi Spectrum
- Defines a technology that operates in the 2.4 GHZ ISM band
- Despite 80 MHz spectrum available, often congested
- High contention & interference in 2.4GHz
- Range <100 m
- 1 km obstructed area would require 25 APs
TVWS complements existing solutions

- FCC rules for unlicensed White Space operation are similar to those in existing 2.4 GHz and 900 MHz unlicensed bands:
  - Part 15 rules (*regulations on unlicensed transmission*)
  - Non-exclusive use
- Aside from the additional capacity afforded by white space spectrum, operating in the VHF and UHF band enables improved coverage and Non-Line of Sight performance
Spectrum Available for High Power (UHF Fixed Channels)

Find available White Space at www.ShowMyWhiteSpace.com

Represents lots of available white space channels
Spectrum Available for Low Power (UHF Personal/Portable Channels)

Find available White Space at www.ShowMyWhiteSpace.com

Represents lots of available white space channels
Current State of TV White Space

- First commercial, TV White Space network launched in January 2012 for SmartCity applications in Wilmington, NC
  - SmartGrid Trial for Plumas-Sierra Electric with Google
  - Tele-medicine Trial for Hocking Valley Hospital with Google
  - Rural broadband Trial for Claudville, VA with Microsoft
  - Autonomous Vehicle Testing in High Obstruction Environments
  - Large Platform Equipment Coordination
  - Logistics Yards / Asset Tracking Operations

- U.S. first to adopt White Space innovation & define rules
- Other countries around the world racing to define White Space rules
  - United Kingdom
  - Canada
  - Finland
  - Singapore

- Radio vendors & chipset manufacturers are designing & launching innovative products
- Today, white space is REAL and will EXPAND rapidly
KTS Wireless Product Overview
KTS Agility White Space Radio (AWR)

AWR Kit

Antenna (directional)
3-4 ft Cable (N to TNC)

AWR

Pole Mount Kit

Ethernet mating connector

Kit-packed
KTS Agility White Space Radio (AWR)

Key Product Highlights:

• Attributes:
  – Broadband Data Rates up to 3.125 Mbps
  – Non-line of site (NLOS) capable
  – Frequency Range: UHF 470-698 MHz
  – Includes Element Management Software

• Base Station & Client Specifications:
  – Up to 26 dBm EIRP, with transmit power control
  – Sensitivity -90 dBm @ 3.125 Mbps
  – 3.5” x 1.5” x 7.5”, 1.2 lbs, N Connector
  – 12-24 VDC, 30W (TX), 10W (RX), PoE
  – Ethernet with bridging
Typical AWR (UHF) Link Ranges

<table>
<thead>
<tr>
<th>Data Rate (mbps)</th>
<th>1/2 Rate FEC</th>
<th>Sensitivity (dbm)</th>
<th>Range (Miles) at 473 MHz</th>
<th>Range (Miles) at 695 MHz</th>
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1. Determine network type
   a. Point-to-point or Point-to-multipoint configuration
   b. Hub radio & antenna placement
      • Need internet connectivity
      • Determine hub antenna location
   c. Power availability
   d. Identify WS channel availability

2. Determine location of spoke radios
   a. Estimate distances
   b. Antenna location
   c. Power availability
   d. Note obstructions

3. Tailor to application requirements
   a. Bandwidth
   b. Response time
   c. Distance

Things to consider…

Typical White Space Network
Other Potential Applications & Use Cases
Telemetry Solution for SmartGrid & M2M Environments

- Efficient solution for monitoring & triggering of critical machinery
  - In a difficult RF environment with moving equipment & metal/solid fixtures & structures
  - Communications link with better NLOS coverage
  - Ethernet-IP-enabled with more bandwidth capability (6 MHz channels support broadband data rates)
  - Flexible deployment as point-to-point or point-to-multipoint networks
  - Additional unlicensed, UHF spectrum
Wireless Perimeter Security Solutions for Retail/Manufacturing/Office Facilities

- Enhanced perimeter security solution with wider visibility
  - Low cost alternative to fixed cabling for security cameras
  - Communications link with better NLOS coverage
  - Ethernet-IP-enabled with more bandwidth capability
  - Flexible deployment as point-to-point or point-to-multipoint networks
Wireless Networks for Inventory & Asset Tracking at Distribution Facilities

- Efficient inventory & asset tracking solution
  - In a difficult indoor RF environment with moving equipment & metal/solid fixtures & structures
  - Real-time data exchange

![Diagram of wireless networks for inventory & asset tracking at distribution facilities.](image)
Target Market: Vertical Industries

- **Oil & Gas**
  - Real-time low latency data transfer
  - Security surveillance & video monitor
  - Remote network monitoring

- **Utilities**
  - IP-enabled telemetry & M2M automation
  - Security surveillance & video monitor
  - Remote network monitoring

- **Distribution**
  - Field automation to back-office system
  - Video surveillance & perimeter security
  - Asset tracking solutions

- **City & Muni’s**
  - Public Safety & video monitoring
  - Public Internet Access
  - Traffic monitoring & management

- **Enterprise**
  - Field automation to back-office system
  - Video surveillance & perimeter security
  - Asset tracking & back-haul solutions
White Space Ecosystem
Spectrum Management Platform &
Radio Solutions
Spectrum Bridge – Our Role in TVWS

Connecting & Managing Access to Spectrum & Bandwidth

Radio Partners

White Space PLUS

TVWS Platform

Spectrum Bridge provides access to available TVWS channels, equipment and vendors providing real-time TVWS solutions.

White Space PLUS is a network planning tool used to manage WS devices.

Service Providers

Enterprises
Cities & Municipalities
Service Providers
Network Operators
Benefits of White Space PLUS for network management

White Space PLUS helps mitigate channel interference

- Tools to detect & overcome interference caused by overlapping use of channels

White Space PLUS optimizes the performance of a radio network

- Receive automatic **Ranked Channel** list for each device
- Determine real-time **Noise Floors** for available TVWS channels in your area
- Set Preferred Channels for your devices
- Set channel preference on devices
- View ranked channel list
- Manage devices from the web
- Receive notifications of devices in the area
- Receive alerts of potential channel conflict

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Exclusively Available to Microphone Users
Available to Microphone Users and TVBDs
Sales Support Resources

• Identify Industry Sales Opportunities
• Pre-sales Support
• Engineering Support
• Ongoing Research Projects
• Website Resources
  – Tessco Intranet – [WWW.TESSCO.COM]
  – KTS Website - www.ktswireless.com
  – Spectrum Bridge’s - ShowMyWhiteSpace.com

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