



Fixed Wireless access TVWS Canada – CANWSP

TVWS has been talked about for many years as an option to reach those hard-to-get customers at the network edge. Due to regulatory hurdles and no database, TVWS didn't materialize until now.

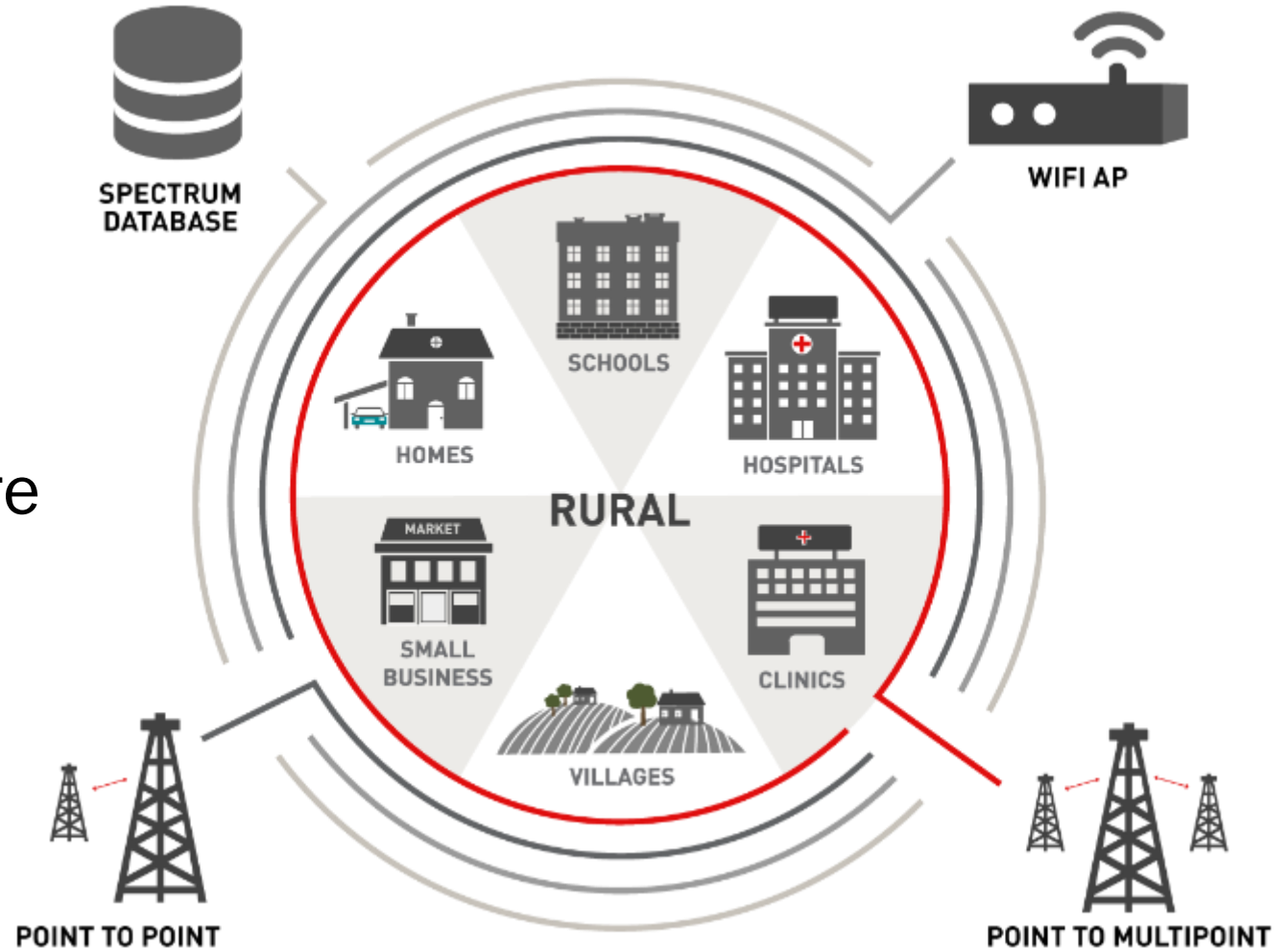
Learn what you need to know to successfully deploy in this spectrum.



Introduction

TVWS was not successful
in the past...

The industry has learnt from
these missteps and the future
looks bright.



What is TV Whitespace?

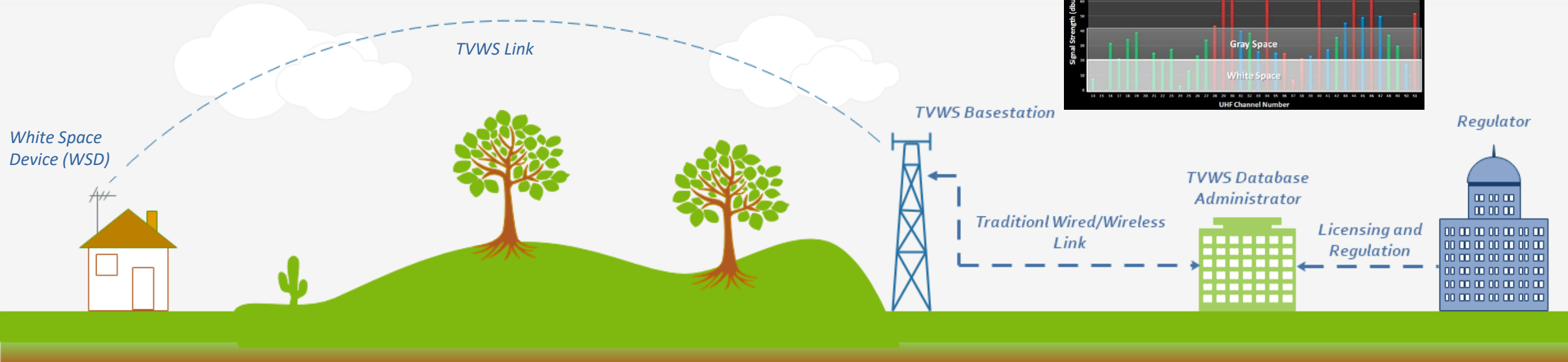
Based on cognitive radio technology to use the white space between TV stations

Use Database Administrator called a WSDB with devices called White Space Device (WSD)

Radio must consult the online database BEFORE transmitting.

The TV channel and operating transmit power is based on geographical coordinates and antenna height.

The system is designed to protect the TV stations NOT the WSD



ISED Releases New Specifications (Issue 3)



ISED Approves a New Database Manager – RED Technologies

Important development, without database administrator TVWS cannot be leveraged

Whitespace Databases for Television Bands

Issue 2 of DBS-01

Application Date	Applicant	Application Outcome	Approval Start
December 6, 2020	RED Technologies	Approved	February 24, 2021

Issue 1 of DBS-01

Application Date	Applicant	Application Outcome	Approval Start
July 1, 2016	Key Bridge Wireless LLC	Approved	October 10, 2017

Source: <https://www.ic.gc.ca/eic/site/ceb-bhst.nsf/eng/tt00150.html>

What does TVWS offer for Canada?

A new spectrum that can support non line of site connectivity.

Alternate to heavily used unlicensed spectrum, 900MHz, 2.4GHz and 5GHz bands

Up to 138MHz of available spectrum with the ability to support 24MHz channel sizes to provide high speed connections

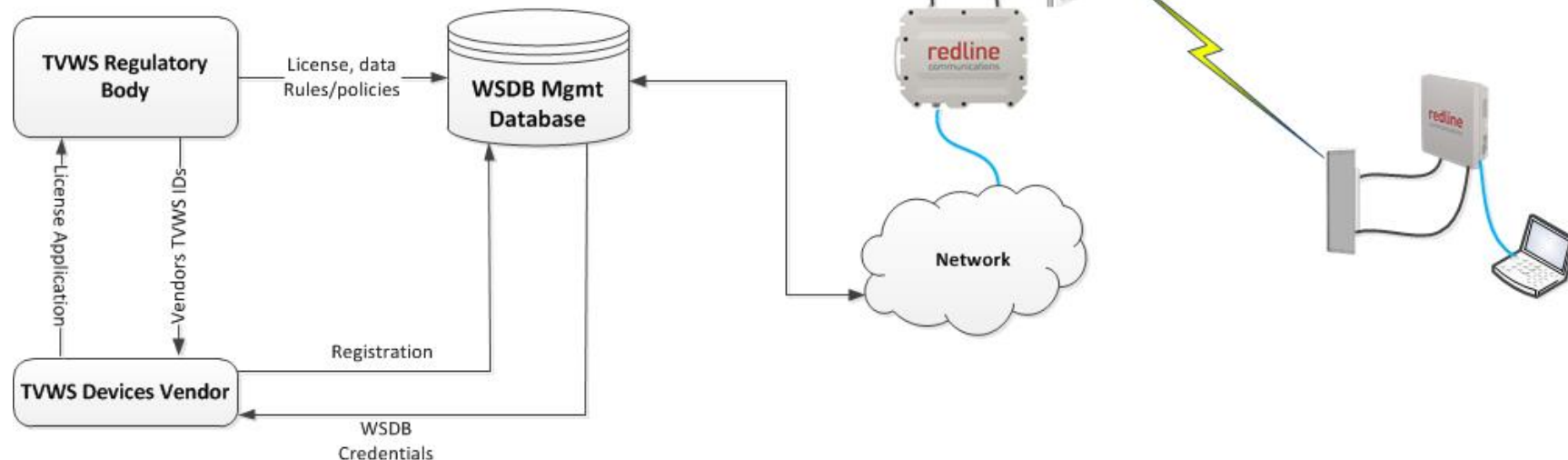
A great rural play for underserved communities and industries.

- Internet Access residential
- Distance education
- SCADA Communication
- Video Surveillance
- Backhaul

How Does the Database work with TVWS Radios?

Before Deployment:

Network administrator or integrator will need to register radio serial number with database



During Operation:

- TVWS radio refresh registration every 24hours
- If WSDb is not available, TVWS radio will reconnect once every 4 hours
- Over 12 hours WSDb Administrator will contact ISED regarding issue

First Deployed:

1. TVWS radio sends a registration request to WSDb via secure connection. Registration request includes radio S/N, coordinates, antenna height, antenna gain.
2. Registration provides a list of available channels and transmit power restrictions for that geographical location
3. Radio enables transmitter

Interference Challenges - Mitigation

Homework before deploying

- Before deploying check location using RF planning tools offered by each database vendor. These tools are in-sync with ISED and will help to determine the number of channels available and the TX power allowed in a particular site.

Highest point is not always the answer

- It is important to do RF survey at different heights to verify the status of the interference
- Installing the radios at lower heights may be the best option

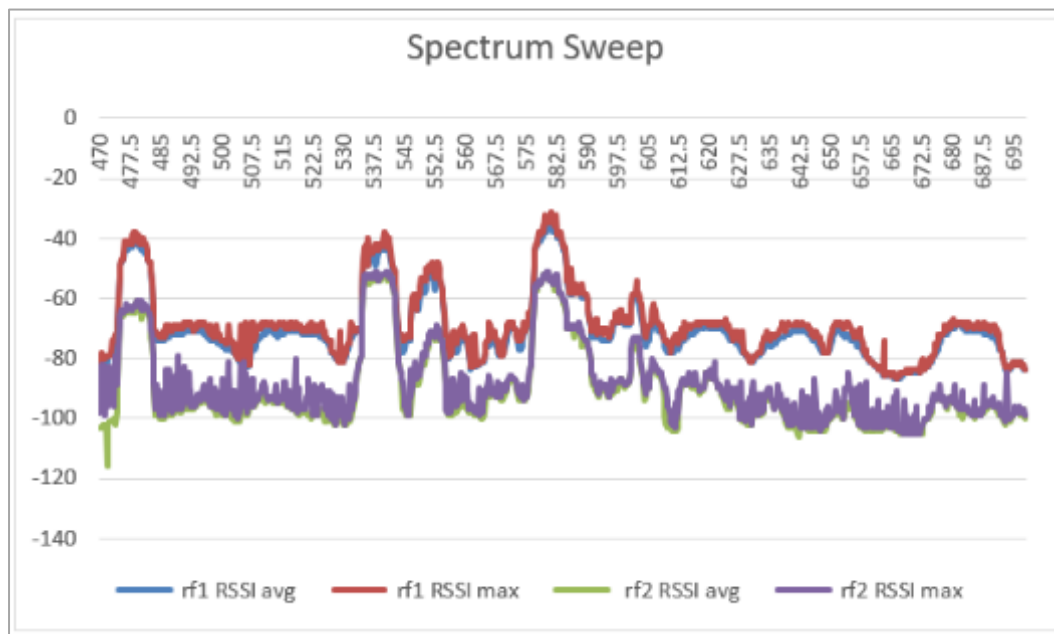
Synchronizing Radios in Multi sector deployments

- Use Fixed Frame in the radios with GPS synchronization to align the TDD frame.
- Improves spectrum efficiency by managing intra-system interference

Higher quality RF and antenna design

- Good antenna design will reject unwanted signals that could reduce link capacity

RF Saturation Example



- Example of noise coming from CN Tower with a radio installed in Muskoka Ontario region
- Typically occurs on the base station radio because the antenna is at a higher AGL than the remote end



- Drone video RF spectrum analyzer showing RF saturation at different heights

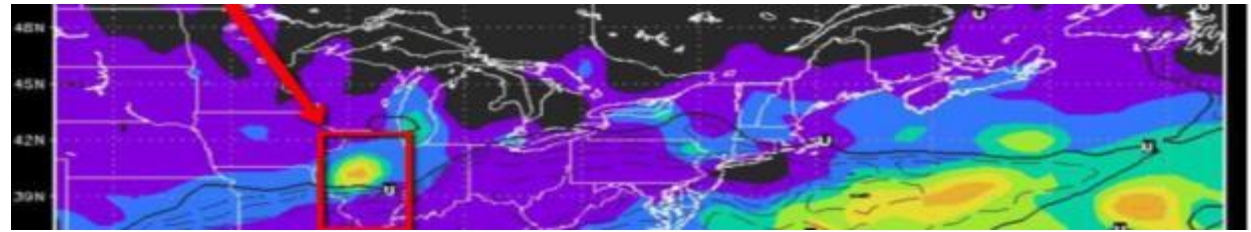
<https://youtu.be/ZLHNDbhiWFA>

RF Ducting Example

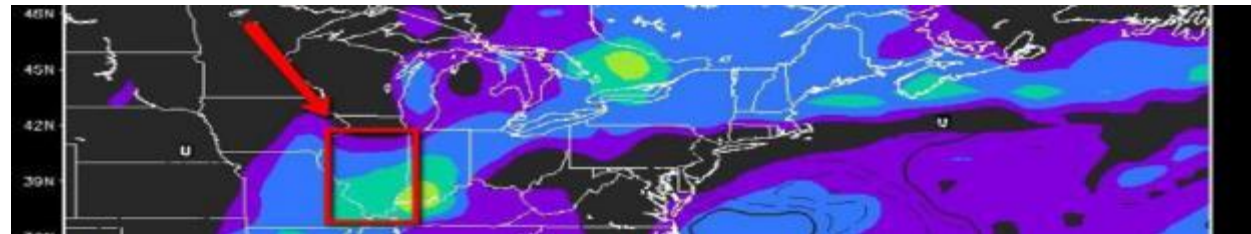
- The areas noted in the forecast example have the necessary atmospheric conditions to produce tropospheric bending of VHF, UHF and/or microwave radio waves.
- Tropospheric bending extends the range of radio & TV stations well beyond their normal limit and thus increases interference amongst stations as well.
- The colder it gets, as when transition into fall/winter, the intensity of ducting dissipates.
- <http://dxinfocentre.com/tropo.html>

0	1	2	3	4	5
NIL SIG	MARGINAL	FAIR	MODERATE	HIGH	STRONG

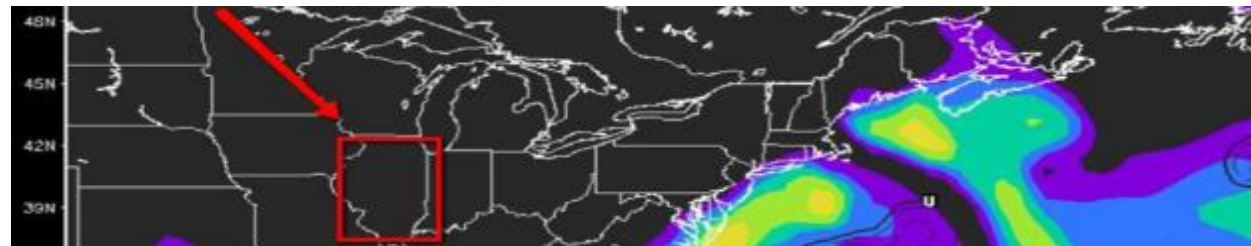
July 22, 2019 – Illinois rural area – Strong ducting



October 9, 2019 – Illinois rural area – Fair/High ducting



October 14, 2019 – Illinois rural area – ZERO ducting



Database and Radio Integration

- Ideally, you want minimal configuration work in the radio Web interface as the interaction with the database simplifies shared spectrum use.
- In summary you should:
 1. Run spectrum sweep as with any other band
 2. Identify the spectrum you want to use
 3. Match it to the corresponding channels that are available

WSDB Status	
WSDB Status	
ID	QC8-RDL3000RMF
WSDB URL	paws-usa.wavedb.com
Location	42 28 10.0900 North, 83 05 45.9350 West
Server Connectivity Status	SUCCESS
Registration Response Timestamp	Tue, 02 Mar 2021 19:23:46 GMT
Registration Status	SUCCESS
Channel List Response Timestamp	Fri, 05 Mar 2021 19:28:49 GMT
Channel List Response Status	SUCCESS
Number of Available Channels	8
Selected Channel	26 - 26 [545 MHz]
Refresh Time	10 min, 48 sec
Expiry Time	1 day, 7 h, 21 min, 58 sec
Allowed EIRP per 6 MHz	16.00 dBm

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

Database Service and Deployment



Equipment are ready to use
with licenses embedded
from the equipment
provider



ISP pays for the DB
services on a monthly
basis per base station



Redline professional
service is ready to help
with abundant experience

Products on the Market

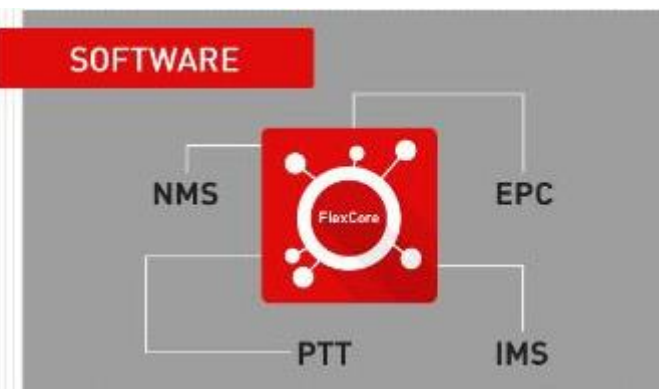
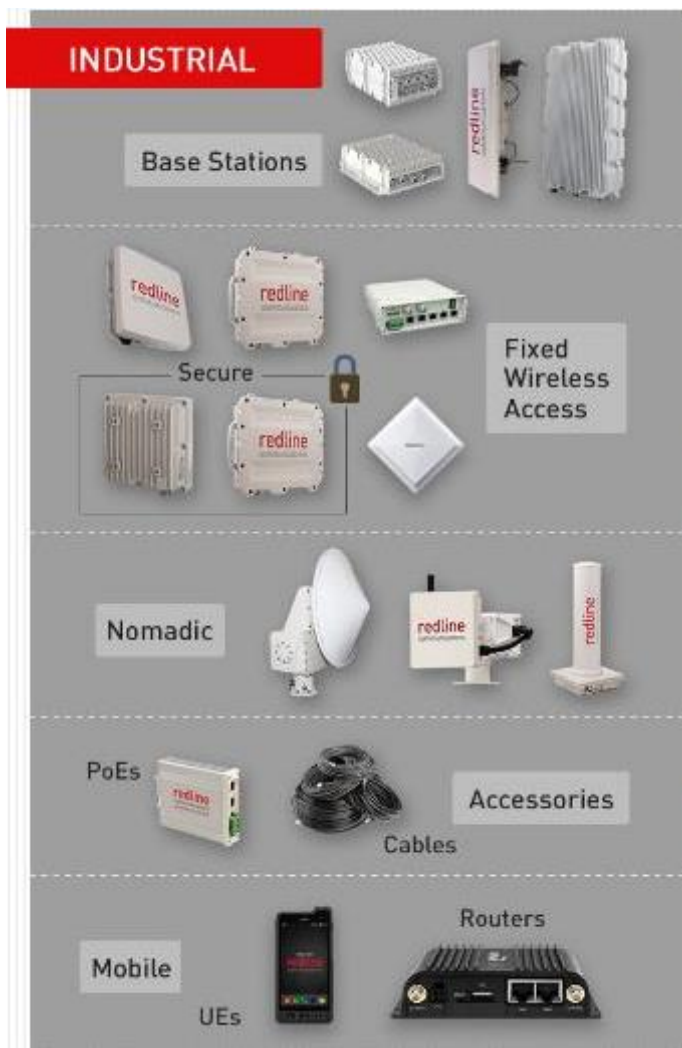


Redline		Vendor X	Vendor Y
Technology	OFDM + 2x2 MIMO A&B	OFDM + 2x2 MIMO	OFDM + dual CA aggregation
Channel Size MHz	3.5 / 6 / 12 / 18 / 24	6 / 12 / 24	6 / 7 / 8 (dual CH 10 MHz)
Modulations & coding	UL & DL BPSK to 256 QAM 7/8	BPSK- QAM256	QPSK - 256 QAM
Adaptive Coding & Modulation (ACM)	Optimized for through-put	Yes	Not published
Rx Sensitivities (dBm) @ 10 MHz Channel Size	-96 (BPSK); -70 (256QAM)	Not published	-96 (QPSK); -71 (256 QAM)
Data Throughput UBR	160Mbps	150Mbps	81Mbps
Latency PMP	VF	Not published	15ms typical
	FF		
	3ms typical		
	36ms w 10ms frame size		
Encryption	AES-128 or AES-256 ¹	AES-128	Not published
Authentication	Remote Unit: ECDSA Cert User Access: RADIUS	Not published	to be updated
VLAN	802.1q, Q-in-Q, 802.1p	802.1Q, Q-in-Q, 4094 VLANs	to be updated
QoS Queues	4 Queues on Ellipse	4 queues	Not published
Antenna	External	External and Integrated	External
Power Consumption 600MHz	15.6 Watts	27 Watts	42 Watts

Parting Thoughts

- TX is not as important when the environment is RX limited due to the received interference
- Yes, there are challenges but Redline has been developing TVWS solutions for over 15 years as the world leaders in TVWS radio technology

Redline's Product Portfolio



Thank you for your time. Questions?



Redline Communications

302 Town Centre Blvd.,
Markham, ON L3R 0E8 Canada

Tel: +1.905.479.8344

Fax: +1.905.479.5331

Toll Free in North America:
+1.866.633.6669



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