

# Shared Spectrum Overview



March 27, 2019

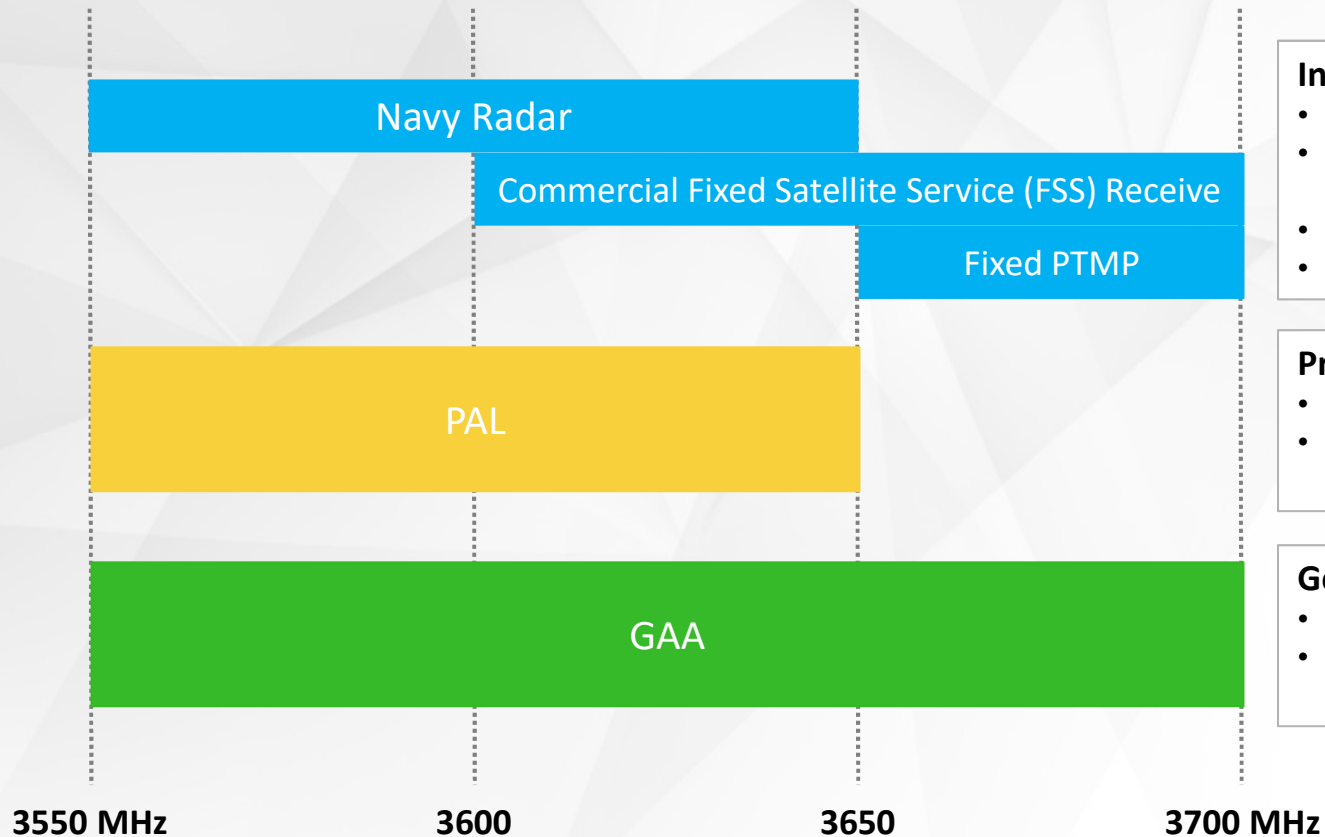
# Federated Wireless Company Overview

- Neutral enabler of industry
- Founded in 2012
- Offices in Arlington, VA (HQ), Boston, MA and Silicon Valley
- Founding technologists from Virginia Tech, DoD, and DARPA
- The leader in shared spectrum
  - Founder and Co-Chair WInnForum
  - Co-founder and Board member CBRS Alliance

\$75M invested  
to date



# CBRS Band in the United States



## Incumbents

- Protected from lower tier users
- Navy periodically uses 10-20 MHz in select locations along coasts
- 17 in-band FSS stations
- Fixed PTMP will transition to CBRS

## Priority Access License (PAL)

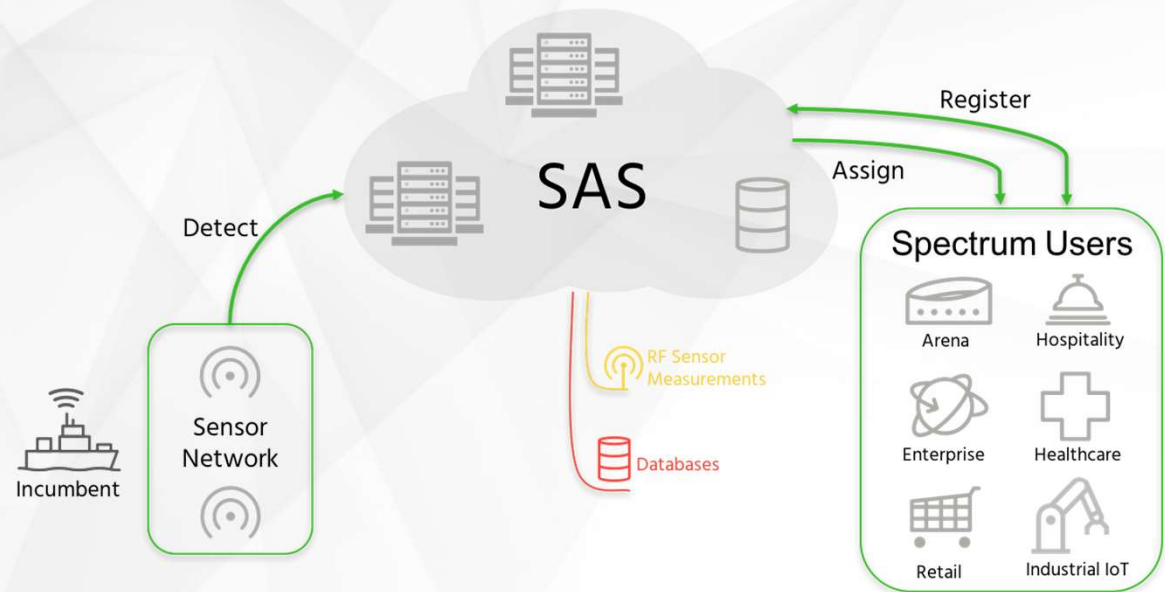
- Use-or-share priority over GAA
- Licensed via auction, 10 MHz blocks, up to 7 licenses per county

## General Authorized Access (GAA)

- GAA can use any spectrum not in use
- Must protect higher tier PAL and incumbent users

# How the CBRS Spectrum Access System (SAS) Works

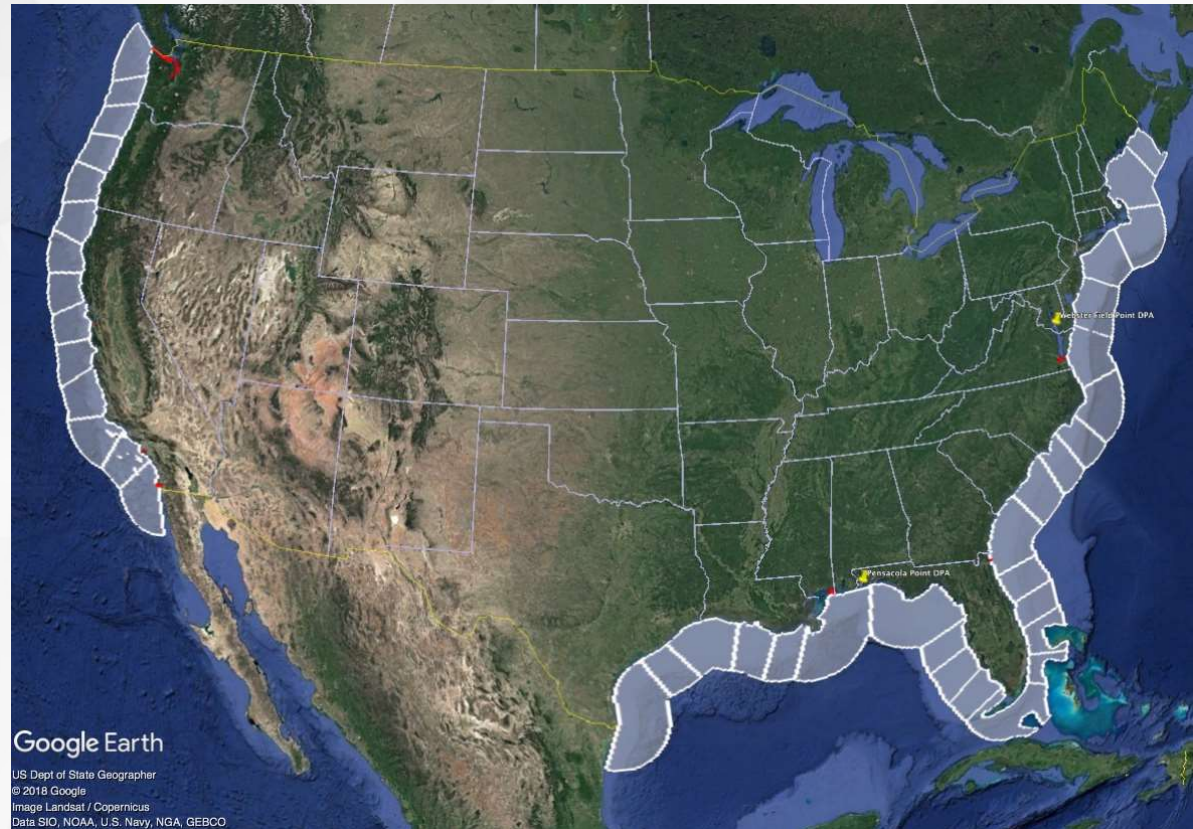
- Detects incumbents
- Dynamically allocates spectrum to users
- Predicts RF propagation
- Provides interference protection
- Cloud-based for scale



Federated Wireless Spectrum Controller

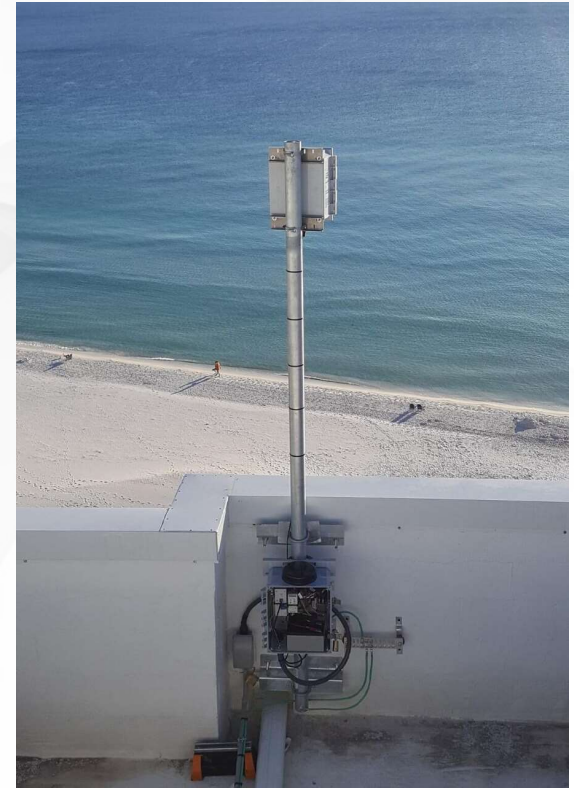
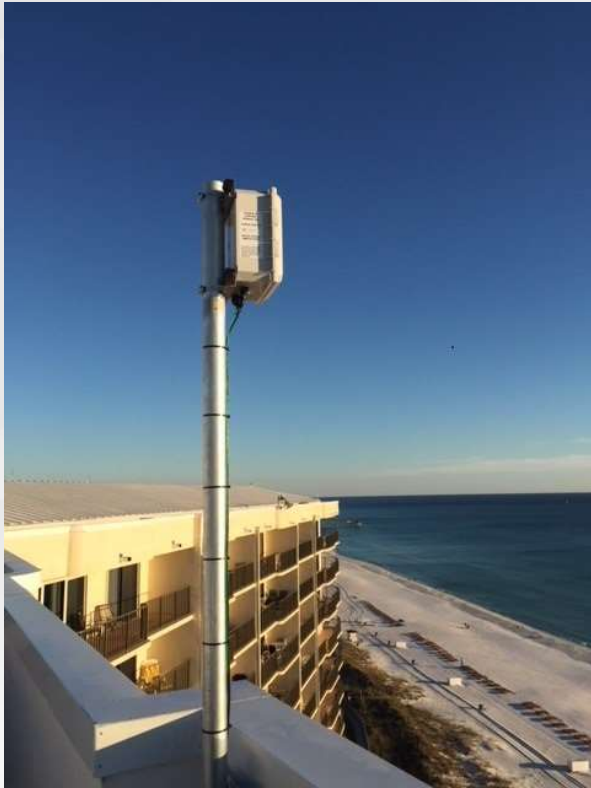
# Protection of Federal Incumbents

- Offshore regions are divided into “Dynamic Protection Areas” (DPAs)
- Each DPA is monitored by one or more Environmental Sensing Capability (ESC) sensors
- When federal incumbent activity is detected in a DPA, the entirety of the DPA is protected from aggregate interference to a pre-defined level
- Devices that may impact interference in the DPA are reconfigured if on move-list and using impacted channel(s)
- DPAs may be used to protect some inland sites





# Bringing the ESC Network to Life



# CBRS Alliance Massive Ecosystem: 120 & Growing

## Board Members



## Full, Adopter and Advisor Members



# Citizens Broadband Radio Service Devices (CBSDs)

## Category A CBSDs:

- Indoor
  - Low power (30 dBm)
  - Self-installed
- 
- TDD-LTE Band 48 (5G NR specs underway)
  - Dozens of Carrier Aggregation (CA) combinations
  - Contiguous or non-contiguous CA operation over the entire CBRS band
  - Requires connection to Federated Wireless Spectrum Controller and must be integrated

## Category B CBSDs:

- Outdoor
- High Power (47dBm)
- Professionally installed



**Ericsson DOT 5216**



**Nokia Flexi Zone**



# CBRS End User Device Ecosystem

## Smartphones



Samsung Galaxy S10



Pixel 3

## Enterprise class devices



Laptops\*



Rugged Tablets,  
scanners

## Fixed CPE



## IOT Gateways



## Plug-In UE Vendors



Video Bridge



USB Dongle



Mi-Fi Device

## Chipset / Module Vendors



Sequans Cassiopeia Module



Sierra Wireless



Qualcomm Snapdragon X20/24  
LTE Modem

# Radio Partners on Federated Platform

**Accelleran**  
Small Cells, Done Right



**Juni**

**ALTIOSTAR**  
NETWORKS™



**NOKIA**

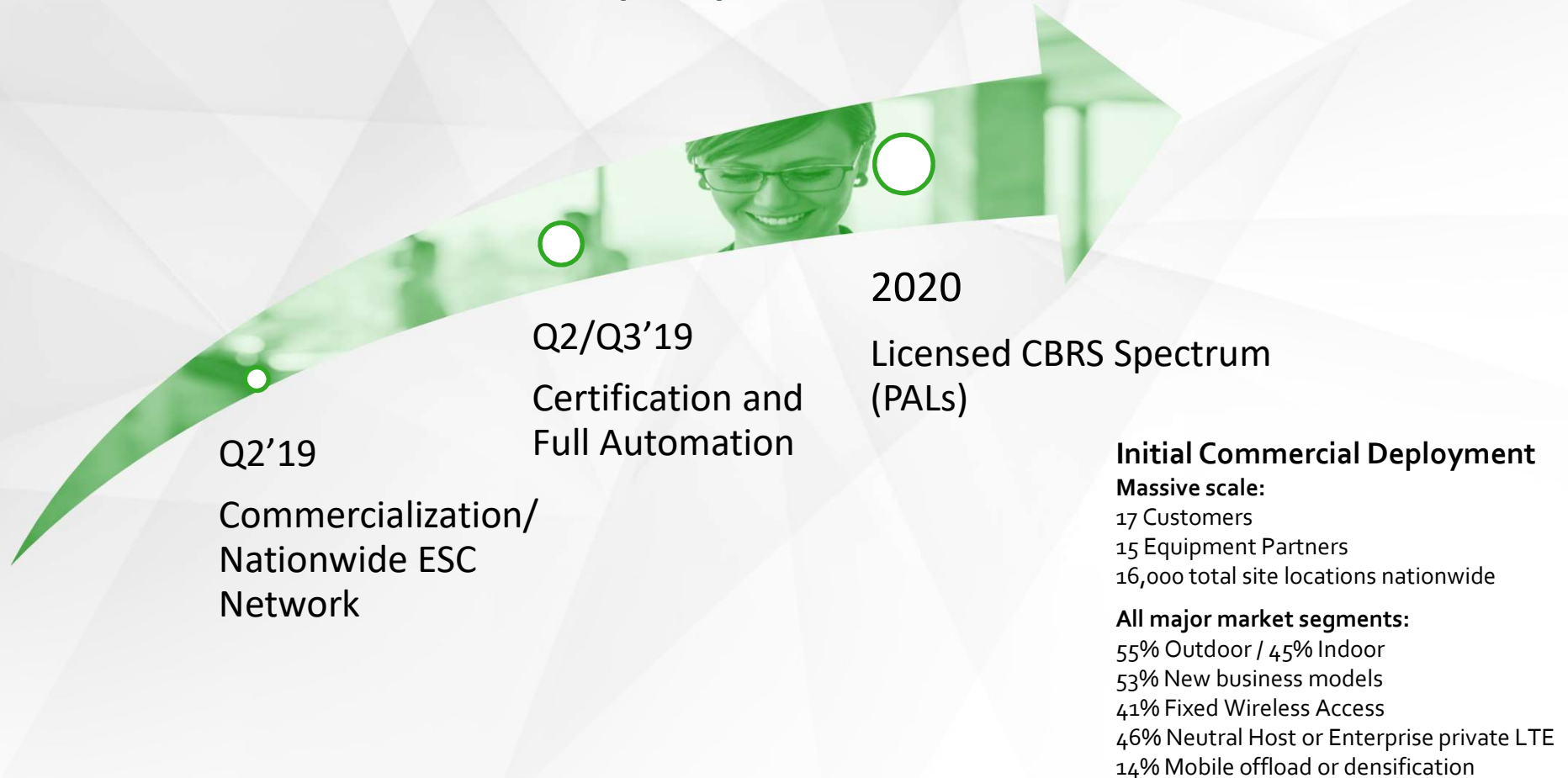
**SIEMENS**



**SAMSUNG**

**SERCOM**

# CBRS Commercial Deployment 2019/2020



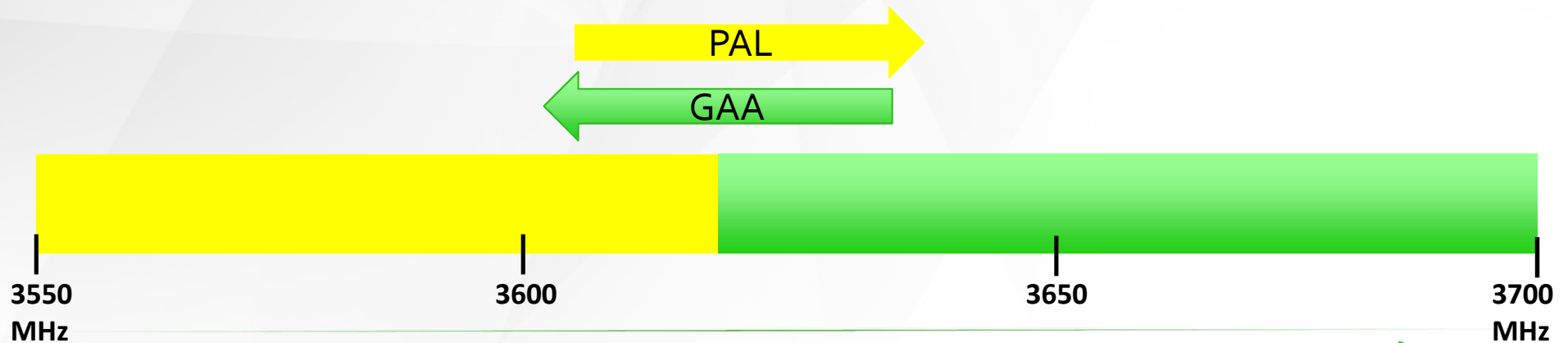
# CBRS PAL and GAA Users

## Priority Access Licenses (PALs)

- Auction in early 2020 (expected)
- Seven 10 MHz licenses per area
- County based license areas
- Limit of 4 per licenses in any area
- 10 year term with renewal expectancy
- Must connect to a SAS
- Not licensed a specific 10 MHz block
- Must move if directed by SAS (Navy)
- Use-or-share priority over GAA

## General Authorized Access (GAA)

- No auction – first commercial deployments in mid 2019
- Must connect to a SAS for spectrum assignment
- Can use any spectrum not in use by incumbents or PALs
- Must protect higher tiers
- Can access PAL spectrum on use-or-share basis





# Shared Spectrum Commercial Use Cases

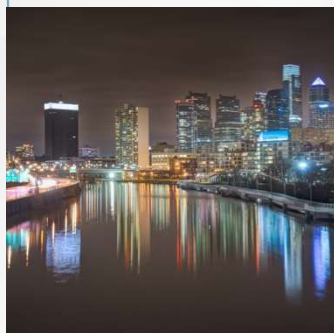
## Mobile Operators

- Network Densification
- Capacity
- 5G Solutions
- Carrier Aggregation



## Cable Operators

- Last mile
- Wireless MVNO Offload
- Hotspots
- Smart Home



## Neutral Host

- Airports
- Apartments
- Corporate campuses
- Arenas



## WISPs

- Rural deployments
- Capacity and speed
- Broadband offerings



## In-Building

- Private LTE
- Wi-Fi Offload
- Industrial IoT
- Ports
- Universities

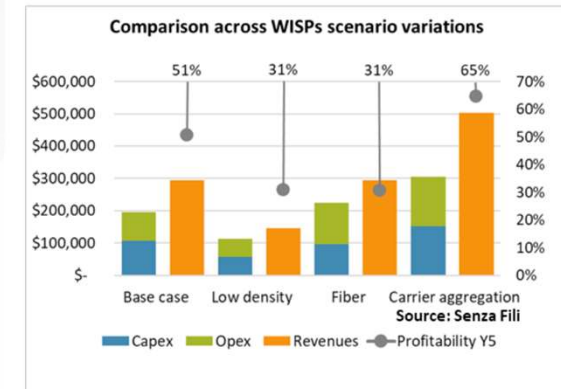
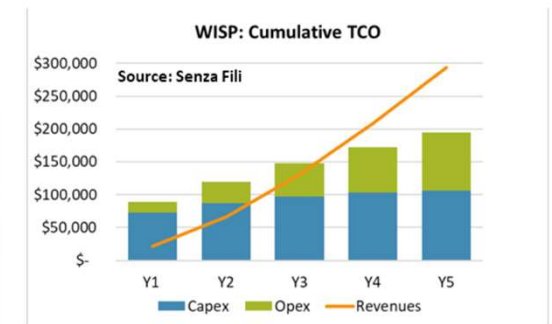
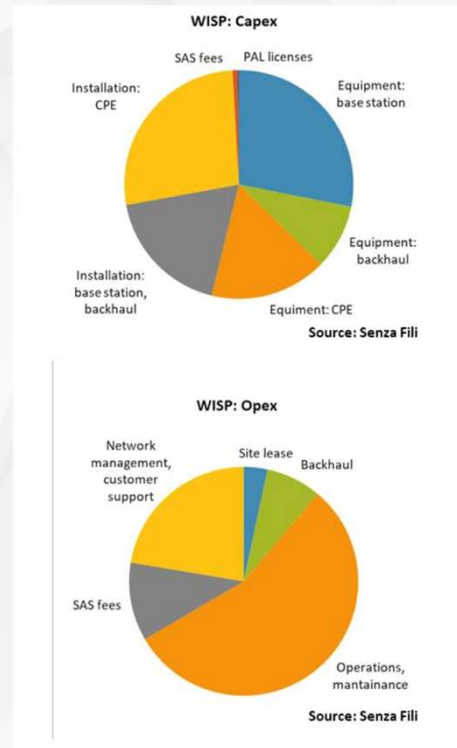


# CBRS Fixed Wireless Economics

“The business case is attractive...”

“In our model, WISPs can expect to become profitable by Year 3 and have a 51% profitability by Year 5.”

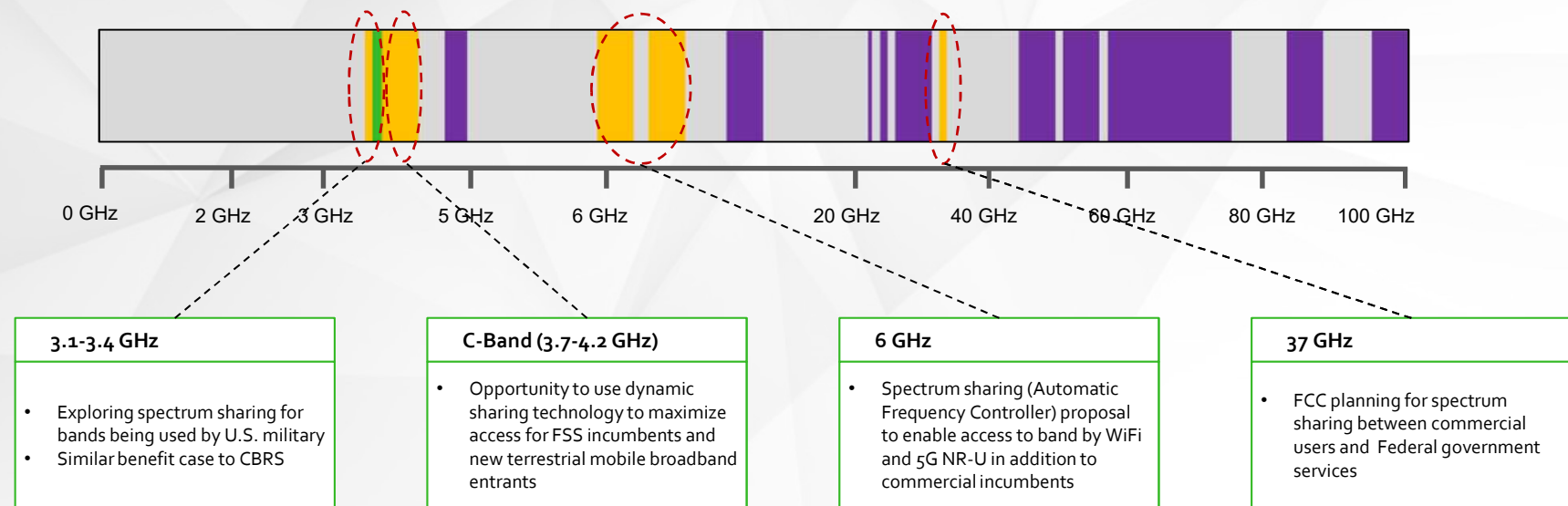
“The TCO for WISPs is comparable to the one for the current legacy use with the Wireless Incumbent Access (3.65-3.7 GHz), but OnGo gives them access up to 150 MHz of new spectrum in the highly valuable 3.5 GHz band”



Source: “The total cost of ownership (TCO) for fixed OnGo in the 3.5 GHz CBRS band”, Monica Paolini, Senza Fili

# Spectrum sharing for other bands

## Other bands under consideration for dynamic sharing in U.S.



# Other countries exploring spectrum sharing



## United Kingdom

- Considering sharing in 3.8-4.2 GHz, 1.8 GHz and 2.3 GHz bands, plus unused portions of existing mobile bands



## Singapore

- Exploring use of dynamic spectrum sharing for the 3.7-4.2 GHz band



## Australia

- Considering use of dynamic sharing models for the 3.3-3.4 GHz band

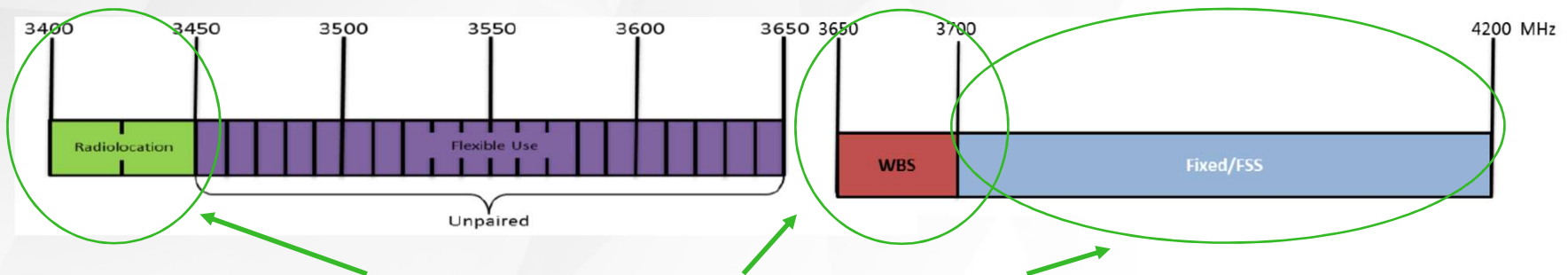


# Spectrum sharing in Canada



## ISED 3 GHz consultation

- ISED has an open proceeding aimed at:
  - Permitting flexible use of the 3500 MHz band (3450–3650 MHz); and
  - Changing the allocation and licensing scheme for the 3800 MHz band (3650–4200 MHz)
- Specific proposals include:
  - Add primary mobile allocation to 3450–3475 MHz and eliminate radiolocation from 3450–3500 MHz
  - Re-channelize and re-license (via auction) 3450–3650 MHz
  - Open 3400–3450 MHz and 3700–4200 MHz for flexible use on a shared basis
  - Optimize 3650–3700 MHz through use of a database model, such as a SAS



Opportunity to implement dynamic shared access

