Spectrum Needs for audio Programme Making & Special Events (PMSE)

Prakash Moorut
Global Head of Spectrum & Regulatory Affairs, Shure
moorutp@shure.com

December 6th, 2022

Outline

- Audio Programme Making & Special Events (PMSE)
  - Contributions to the Society & Economy
  - Spectrum Band & Needs
  - Unlocking Spectrum
  - Impact of Mobile Industry
- Key Take-Aways

“India’s creative economy may drive the next wave of growth”

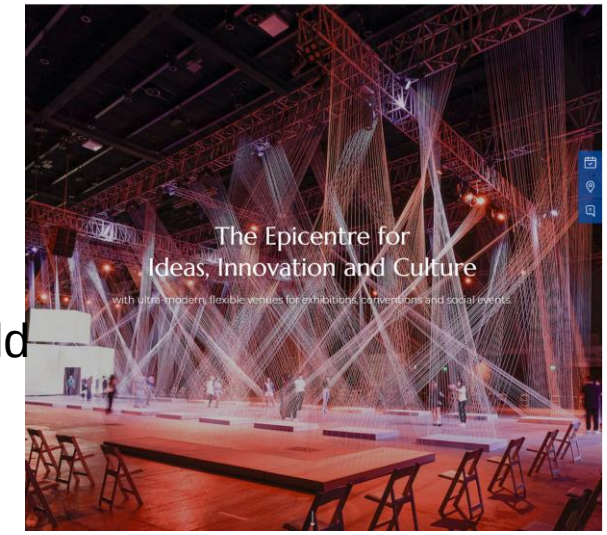
- India’s creative economy accounts for an overall market size of about $36.2 billion.
- Media and entertainment undoubtedly represent India’s largest cultural exports.
- The arts and the creative industries are crucial to social development, civic pride, economic well-being, and the vitality of a country.
- The creative industry is the second largest employer in the formal and informal economy after agriculture in India with a workforce of over 200 million.

“As the recently concluded Cannes film festival celebrated **India as the Country of Honour**, it offered a great opportunity for us to display **our potential to be the future content hub for the world**”.

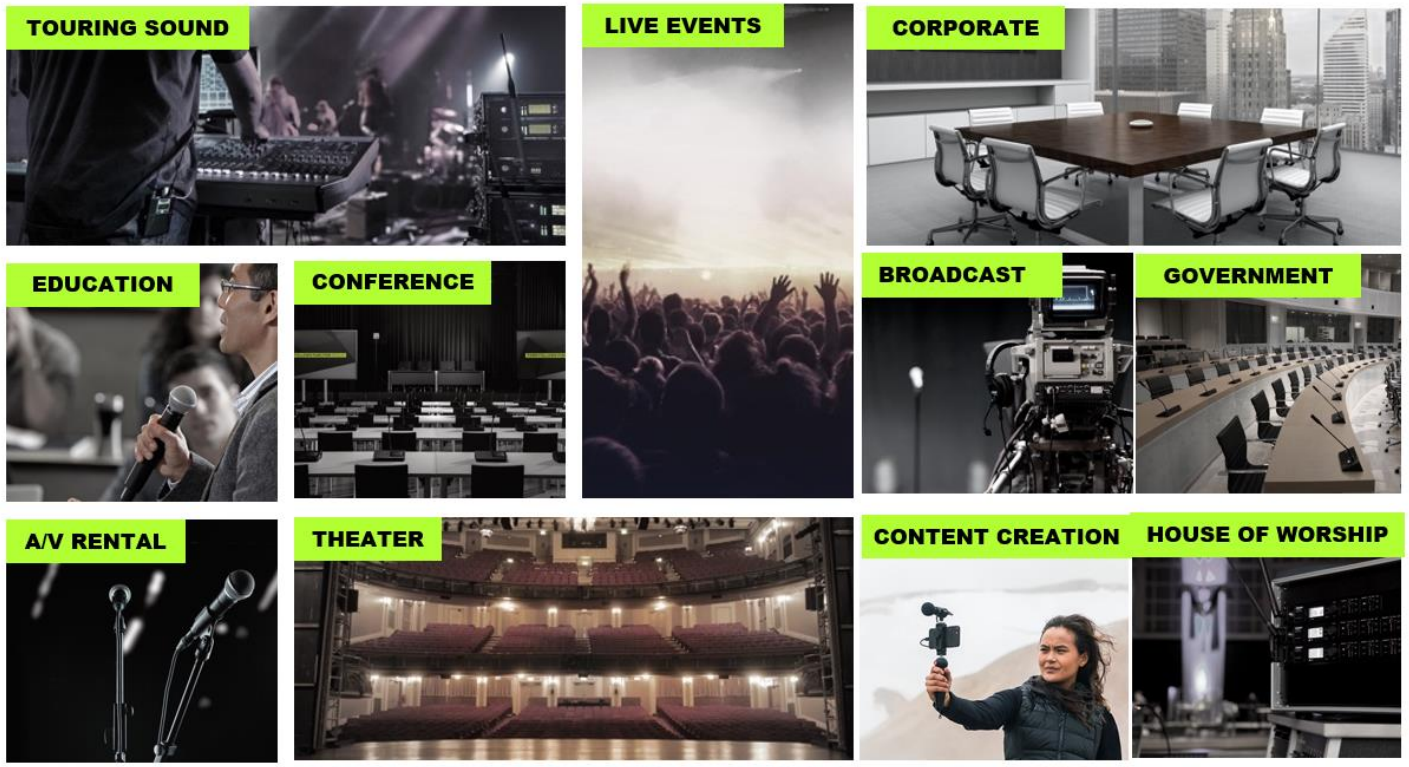
The Hindu Businessline – Deepika Padukone @ Cannes film festival 2022

Shure...97 years manufacturing innovative audio products

- **Shure Incorporated** is an American audio products corporation.
- Founded by Sidney N. Shure in Chicago, Illinois, in 1925.
- Designs and manufactures innovative Programme Making & Special Events (PMSE) equipment.
- **PMSE devices include:**
  - **wireless microphones**
  - **in-ear monitoring systems**
  - **talk-back systems**
  - **wireless video cameras**
  - **scenery control systems**



Jio World Centre



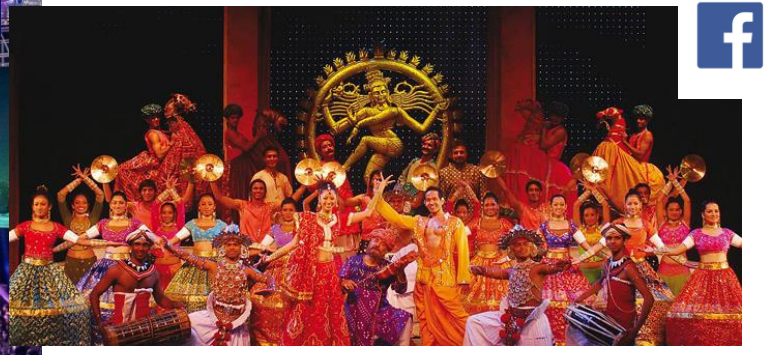
In collaboration with Reliance group, Shure recently installed one of the largest top tier audio PMSE solutions in India at Jio World Centre

Audio PMSE: Everywhere, by anyone and at anytime

Governmental Events

Electronic News Gathering

Live Music



Theater

Content Production

Content Consumption on New Delivery Platforms

Demand for PMSE applications is increasing, driven by traditional audiences, mobile phone consumption and new delivery platforms.
E.g., see Netflix Live Action - Production Sound Best Practices

Typical Audio PMSE Spectrum Band & Needs

- European studies: approximately **96 MHz are sufficient for the daily use of audio PMSE in the UHF band below 1 GHz***
- Average spectrum needs range from**:
  - **42 MHz** for small events to **115 MHz** for large events.
  - **174 MHz** for major events

Bodyback transmitters

TV-UHF(Below 1GHz) Band Characteristics

- **Favorable propagation**
- **Low body absorption effects**
- **Interference-free operation**
- **Predictable behavior of TV Broadcasting service**

The 470-698 MHz range is the core band of audio PMSE, available and in use worldwide, sharing spectrum with TV

Lamy Report* SRF Report**

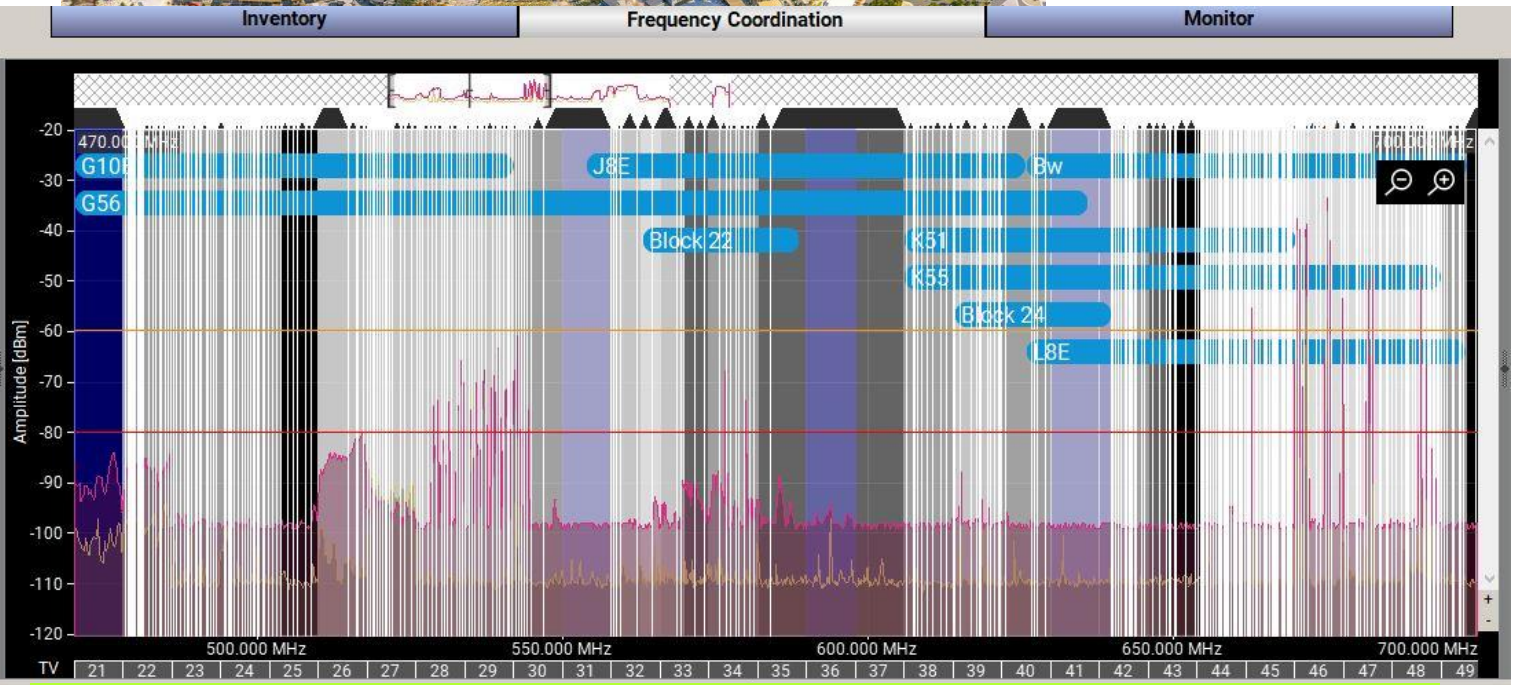
Examples: UAE EXPO 2020 & Paris 2024 Olympic Games

Film shows, conferences, cuisines and daily cultural performances at Indian pavilion

Not enough spectrum for PMSE in TV-UHF band for Paris Olympic Games because of heavy TV usage so that spectrum planning document states:

"Paris 2024 strongly requests the stakeholders involved in the Games ***to use a wired communication system wherever and whenever possible,*** *in particular for microphones and cameras. The radio spectrum* ***shall*** *be used* ***only*** *when the wired communication system cannot operationally be used."*

1240-1260 MHz & 1350-1400 MHz for wireless mics in addition to 470-698 MHz (shared with TV)



Almost all of 470-710 MHz range was used at UAE Expo (TV is not using most of the spectrum)

Shared Spectrum Is Enabling Many Use Cases Worldwide, including PMSE

Traditional Wireless
- Network densification
- Capacity
- 5G solutions
- Carrier aggregation

Cable & Consumer
- Last mile connectivity
- MVNO offload
- Hotspots
- Smart home

Neutral Host
- Airports
- Apartment buildings
- Shopping malls
- Arenas

PMSE
- Wireless Cameras
- Wireless Microphones
- In-Ear Monitors
- Conferencing Systems

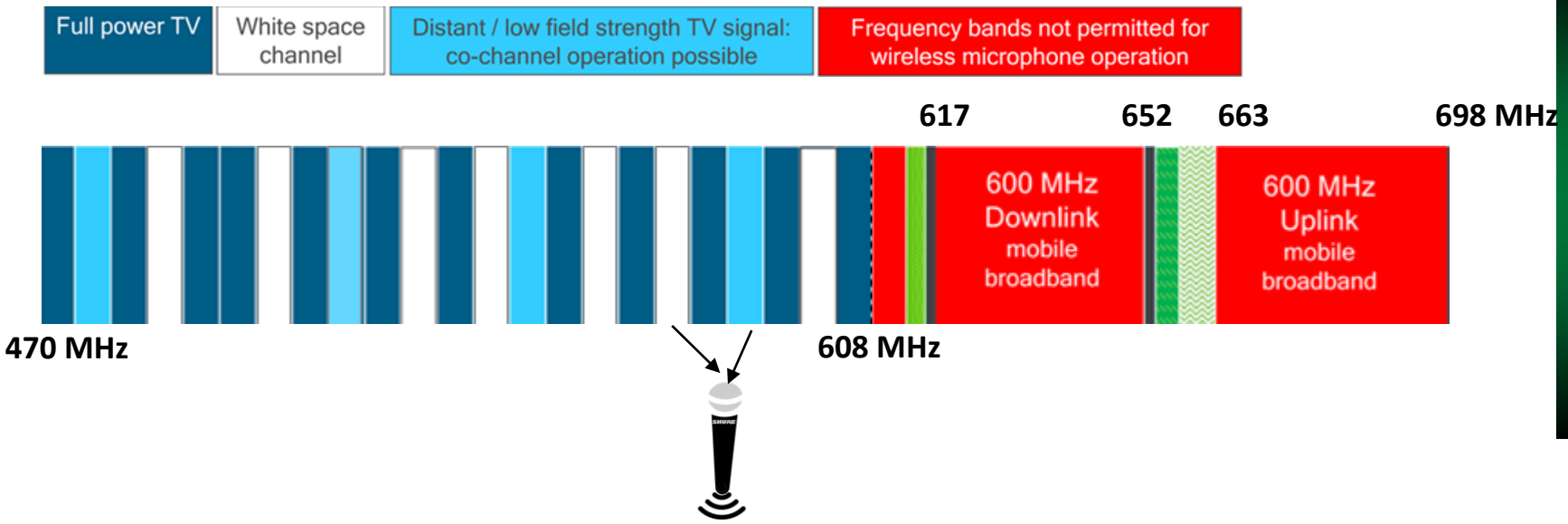
Private Networks
- Industrial IoT
- Ports
- Universities
- Live Events Venues

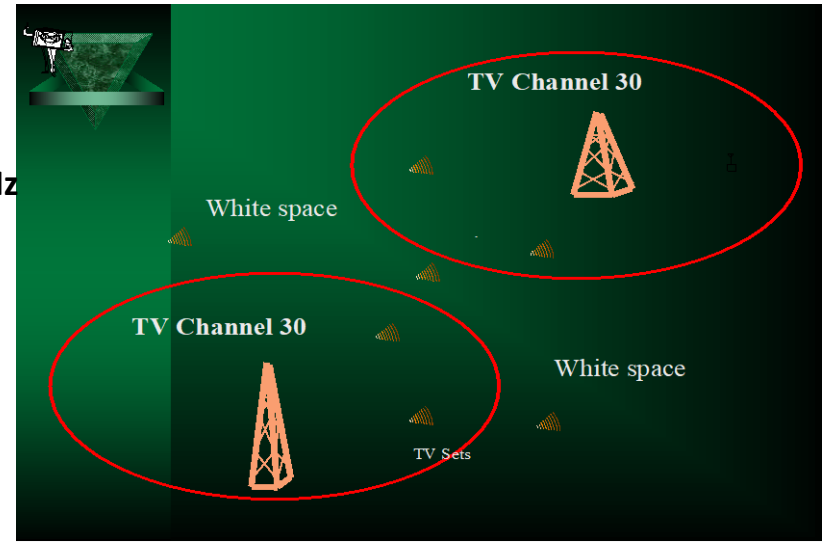
Fixed Wireless
- Rural deployments
- Capacity and speed
- Broadband offerings

- See slides 17-21 (courtesy of Federated Wireless, a market leader in shared spectrum)
- Nov 17th letter of support for shared spectrum from industry
- Dec 13-15 Wireless Innovation Forum (virtual) Summit (link)

Audio PMSE Sharing Spectrum with TV- US example

- 600 MHz was auctioned to mobile operators in 2017.
- PMSE has been sharing spectrum with broadcasting successfully for the last 60 years.
- Wireless mics use channels which do not have TV (vacant TV channels).
- Wireless mics are allowed outside TV station service contour.





Even harder to find spectrum in TV-UHF band for major events like Super Bowl since the 600 MHz was auctioned to mobile operators. Need to obtain Special Authorization to use the mobile band for 2022 Super Bowl at the stadium.

Additional pressure from Mobile Industry "Eating Away" Spectrum for PMSE

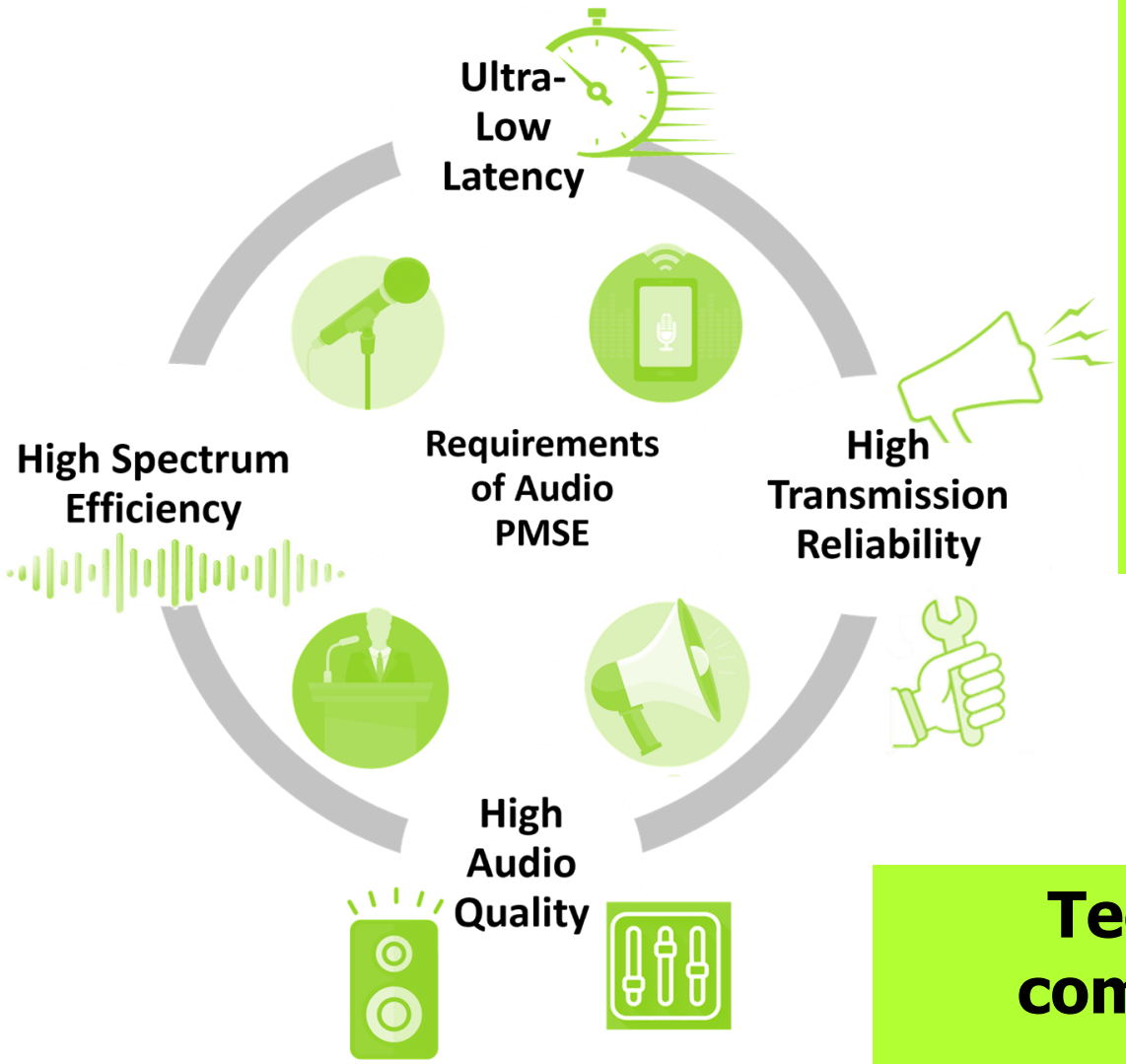
PMSE lost 800 MHz, 700 MHz previously to mobile. Now, we are at a breaking point with 600MHz:

- **US 600 MHz: (617-652MHz) & (663-698MHz)**
- **Asia-Pacific Telecommunity 600 MHz: (612-652MHz) & (663-703MHz)**

Country	Band Plan	Time
India	APT Band Plan	600MHz auction in 2022 (no takers), later down to 526 MHz?
Mexico	US Band Plan	600MHz auction in 2022
UAE, Egypt, Saudi Arabia	US Band Plan	2024?
Hong Kong	US Band Plan	600MHz auction in 2021 (no takers)
Israel	470-502 MHz?	2022
EU	TBD	After 2030? (UAE 2023 World Radio Conference Agenda Item 1.5)

May 2022 snapshot of known plans. Other countries will likely follow.

Audio PMSE Technology Evolution



- **Current <u>5G technology does not support</u> high quality and low latency audio transmission requirements***
- **Business case for 5G-based audio PMSE is TBD**
- **Developing Wireless Multi-Channel Audio Systems (WMAS)**

*5G is being studied in 5G-Media Action Group (5G-MAG), etc.

Technology evolution cannot completely make up for lack of spectrum

Key Take-Aways

PMSE is an important service for cultural life and content production.

PMSE contributes to the economy of India.

Audio PMSE needs access to the TV-UHF Spectrum (470-698 MHz).

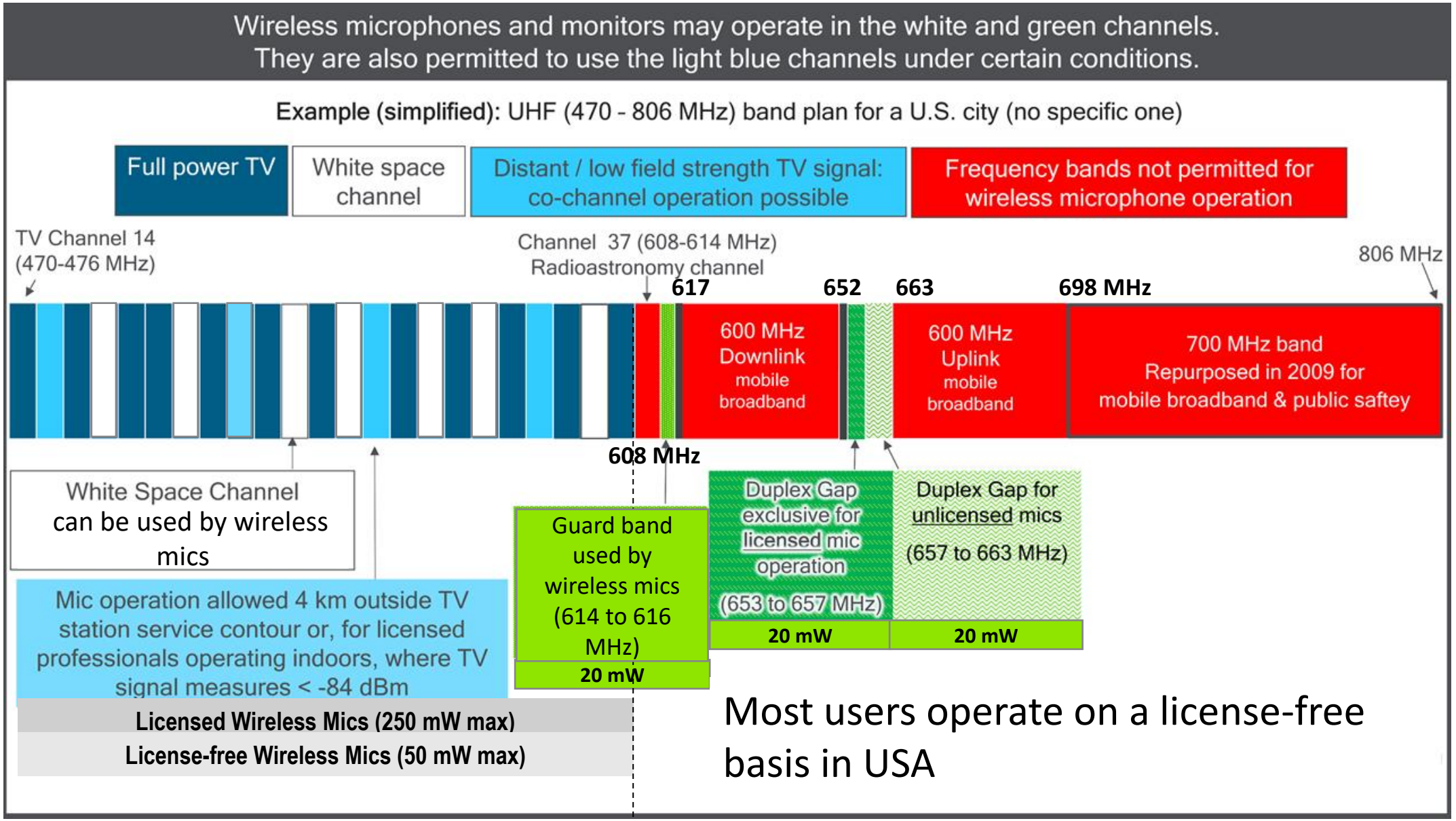
- **Spectrum needs for audio PMSE should be an integral part of the spectrum roadmap of India**
- **Shure joined the ITU-APT Foundation of India**

SHURE

Thank You

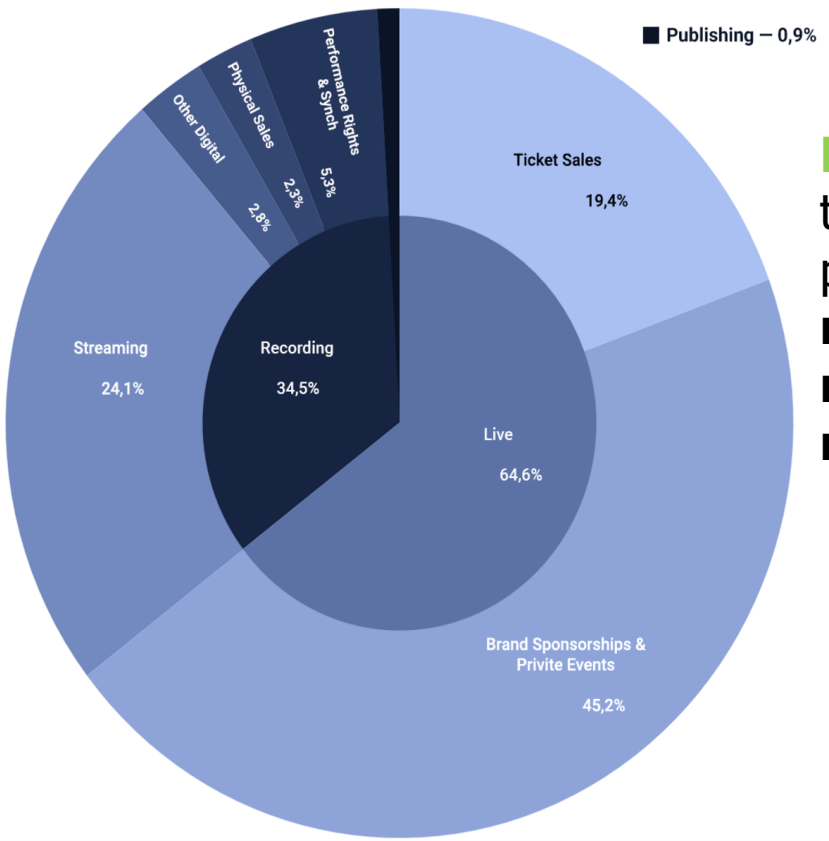
moorutp@shure.com

Example of USA 470-698 MHz



Most users operate on a license-free basis in USA

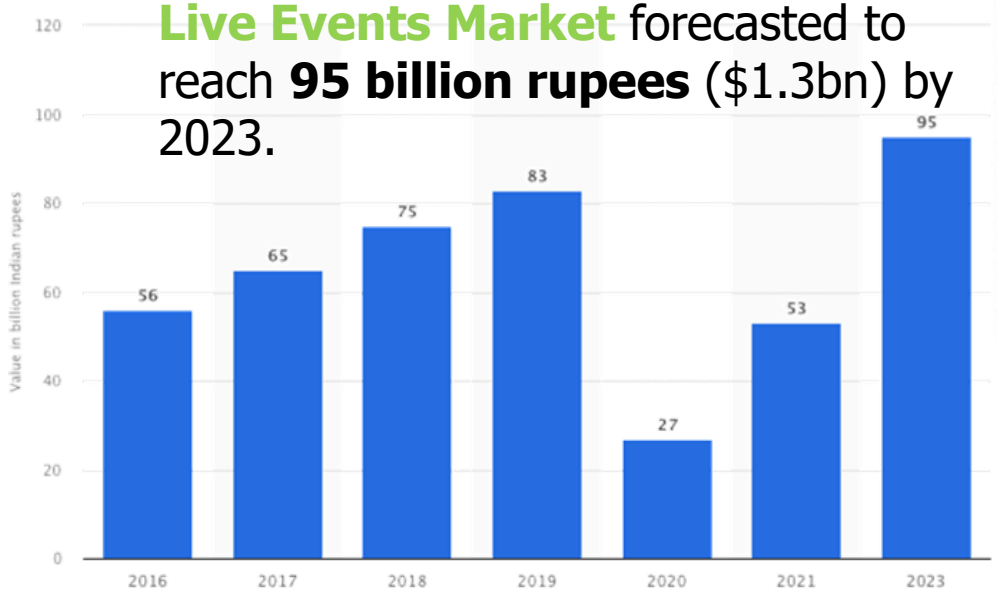
India Music Industry, Live Events, Film and Online Video Services (OVS) Markets



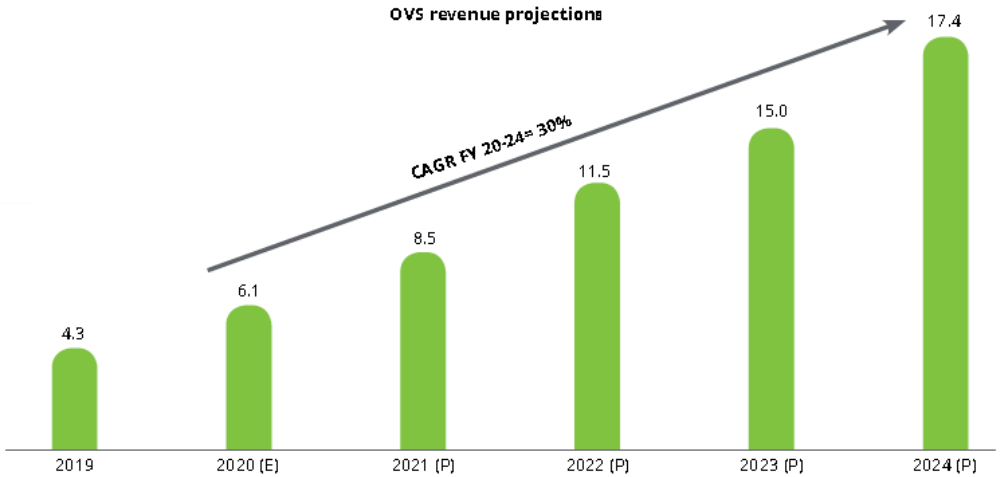
India music market across three main sub-industries (Live, Recording & Streaming)

Live Sector: at 64% is the **largest segment** producing circa **$280 million (out of $443 million estimated music market).**

Live Events Market forecasted to reach **95 billion rupees** ($1.3bn) by 2023.



Value of the live events market in India (in billion rupees) from 2016 to 2023



OVS industry market size and growth

(INR '000 cr where 4,300 crore in 2019 = $600million approx)

PMSE contributes to the society and economy of India

Indian Music Industry Revenue by Source, 2018 - Sources: IFPI, PwC, VISION 2022, IPRS, Deloitte India 2019

Unlocking Spectrum

Shared Spectrum

Shared use Ex:

- **Global:** TV-UHF Band
- **US:** Citizen Broadband Radio Service (CBRS): 3-tier sharing framework
- **Germany:** Local license
- **UK:** Shared Access License

Coordination evolving to new Spectrum access technologies:
Spectrum Access System (SAS)
Automated Frequency Coordination (AFC) system

Spectrum Access Schemes

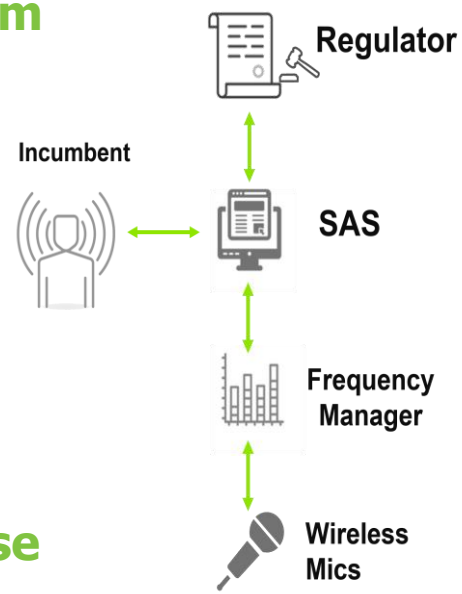
Unlicensed Spectrum

Ex: 2.4GHz, 5GHz, 6GHz Wi-Fi

Licensed Spectrum

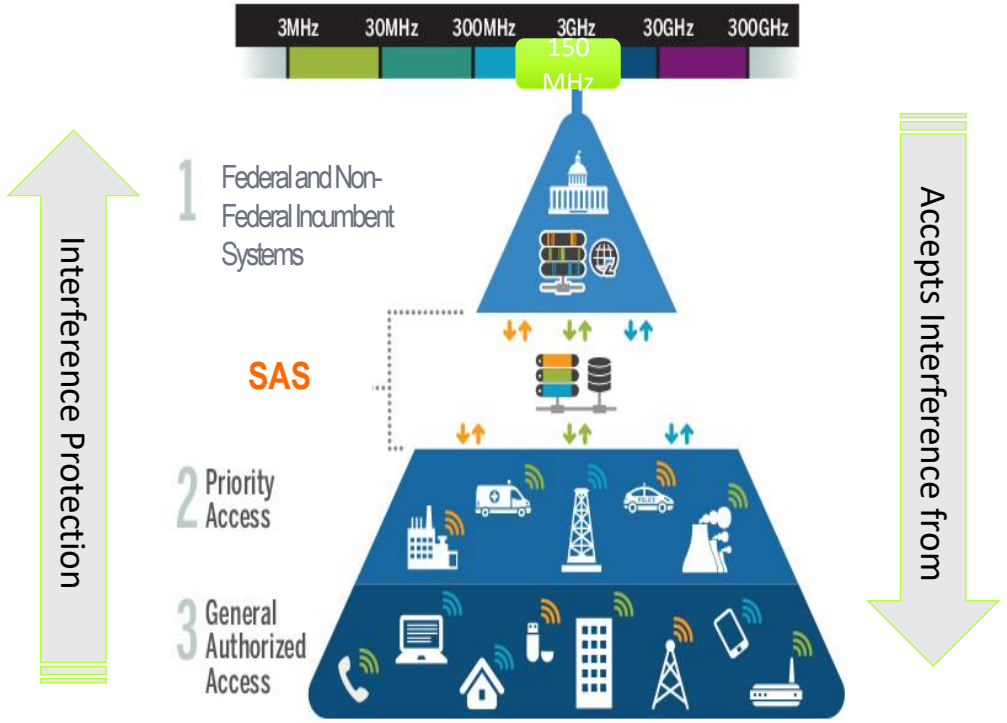
Exclusive use

Ex: Mobile Industry



US Citizens Broadband Radio Service (3.55-3.7GHz)

- Tiers 2 & 3 are regulated under the new *Citizens Broadband Radio Service* (CBRS)
- *Citizens Broadband Radio Service Devices* (CBSDs) are the fixed base stations/access points operating under this new service
- CBSDs can only operate under the authority and management of a centralized *Spectrum Access System*
  - SAS manages interference to incumbents by Tiers 2 and 3, interference among Tier 2 devices, and interference from Tier 3 into Tier 2.
  - SAS may also manage co-existence within Tier 3



Slides 16-20 are courtesy of Federated Wireless, a market leader in shared spectrum.

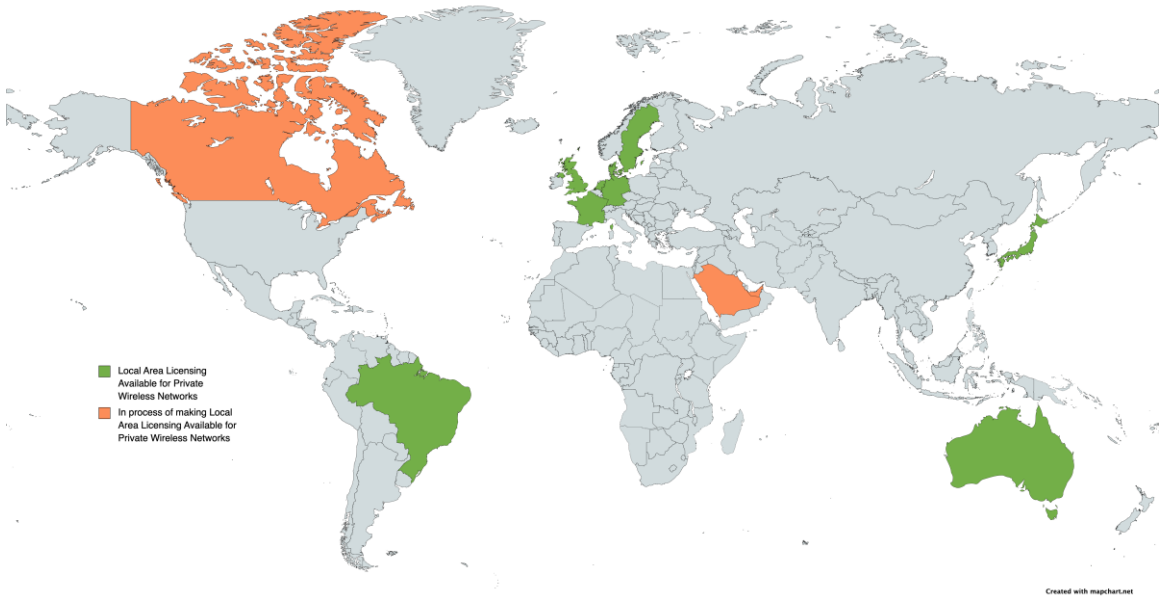
Private Wireless International Expansion

Bands that each country has already made available for verticals and/or local licenses:

- Germany 3.7 – 3.8 GHz
- Netherlands 3.4 – 3.45 and 3.75 – 3.8 GHz
- Sweden 3.72 – 3.8 GHz
- France 3.8 – 4.0 GHz
- Denmark 3.74 – 3.8 GHz
- UK 3.8 – 4.2 GHz
- Brazil 3.7 – 3.8 GHz
- Japan 4.6 – 4.8 GHz
- Australia 3.7 – 3.8 GHz (remote areas), 3.8 – 4.0 GHz

Countries in the process of making local licenses available:

- Canada 3.90 – 3.98 GHz
- Saudi Arabia 4.0 – 4.2 GHz
- UAE 4.0 – 4.2 GHz



U.S. 6 GHz Band

Unlicensed Access to 1200 MHz of Occupied Spectrum via Sharing

- FCC adopted new rules to allow unlicensed use in the 5.925-7.125 GHz (6 GHz) band
- Use of an Automated Frequency Coordination (AFC) shared access system for **standard power** and **outdoor** devices to enforce protection of incumbent users
- Preserve & protect incumbent users
  - Microwave links: MNOs, Utilities, Public Safety and Transportation
  - Broadcast Auxiliary Service
  - Cable Television Relay Service

Fixed Microwave Links

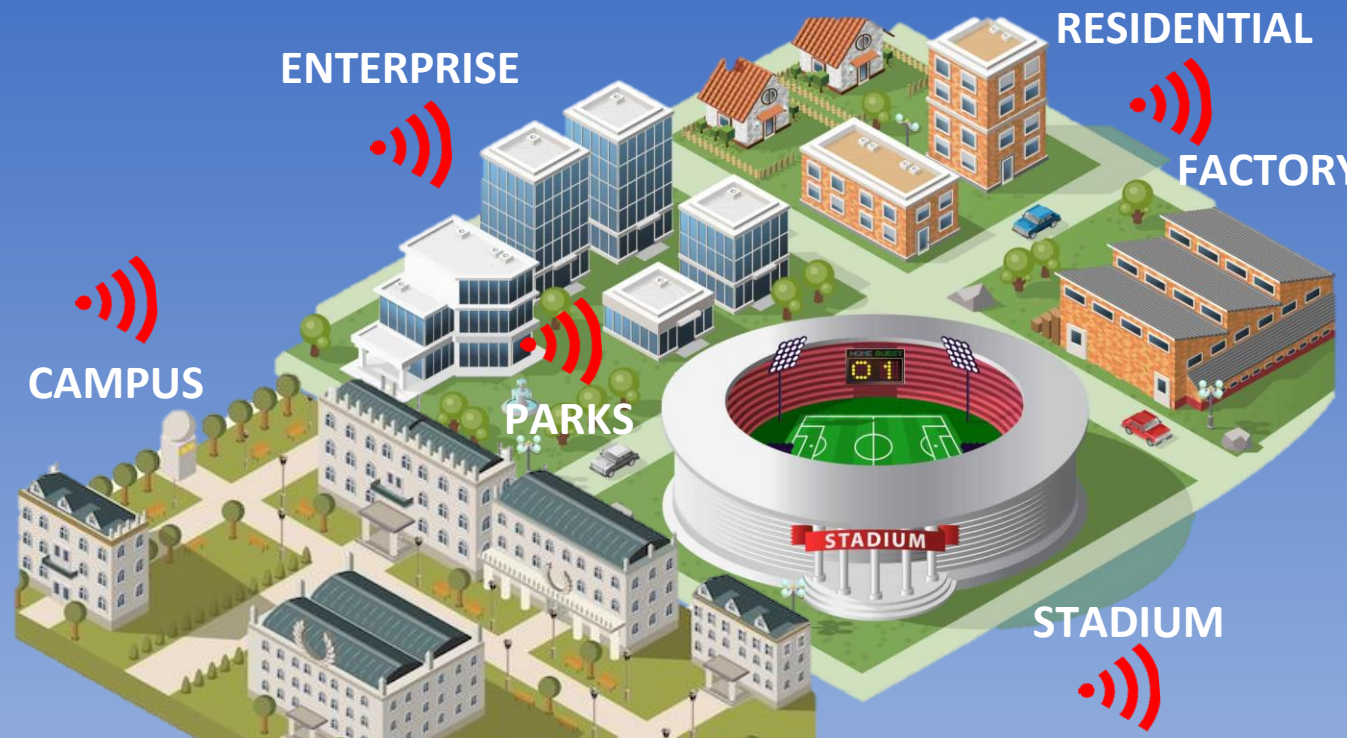
Mobile Broadcast Auxiliary Services

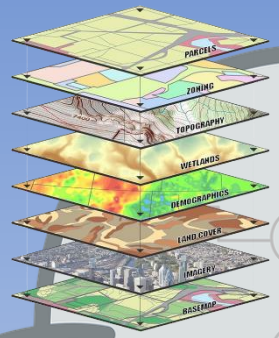
6 GHz Band Incumbents

Cable TV Relay Service

AUTOMATED FREQUENCY COORDINATION

Supports multiple use cases and bands





Calculation Database

Regulator update

Incumbent Database

Computation Engine

AFC System

5G Basestation

Wi-Fi Access Point

Users

Wi-Fi 6E with AFC

International Opportunity

- Significant momentum on sharing of 6 GHz band
- Consistent regulations are important to achieve global scale