Utility Spectrum Report – Q1 2024

Licensed Spectrum Options for Electric, Gas & Water Utilities

Narrowband

- Part 22 VHF (150 MHz)
- Part 22 UHF (450 MHz)

Wideband

- AMTS (217-220 MHz)
- Upper 700 MHz A Block (Band 103)

Broadband

- 1670-1675 MHz (Band 54)
- 3.55-3.70 GHz (CBRS – Band 48)

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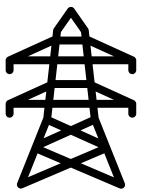
Heterogeneous Spectrum Layering

- ✓ Focus on building a path to the future through clever augmentation of existing investments to expand and extend current wireless networks.
- ✓ It is a strategy that can be achieved through investment in traditional narrowband systems.
- ✓ Can work in lieu of, or in tandem with, broadband PLTE by incrementally and reliably supporting the need for higher capacity wireless networks and continuing to benefit from investments in their valuable assets of narrowband and wideband systems.

Lockard & White, Wireless Networks for Electric Utilities: A different way to think about the increasing demand for wireless (2023)

Licensed Narrowband / Wideband Spectrum Comparisons		Licensed Narrowband / Wideband for Multi-Frequency Networks			
		Part 22 VHF (150 MHz)	AMTS (217-218 / 219-220 MHz)	Part 22 UHF (450 MHz)	Upper 700 MHz A Block
Comparison Metrics	Propagation	Unsurpassed	Unsurpassed	Excellent	Excellent
	Capacity	Varies	Excellent	Varies	Unsurpassed
	Data – Fixed	Supported	Wide Use	Limited	Wide Use
	Data - Mobile	Limited	Moderate Use	Wide Use	Supported
	LMR/Voice	Wide Use	Wide Use	Wide Use	Supported
	Backhaul	Limited	Wide Use	Limited	Wide Use

Licensed Broadband Spectrum Comparisons		Licensed Broadband for Multi-Frequency Networks		
		Upper 700 MHz A Block	1670-1675 MHz	CBRS (PALs)
Comparison Metrics	3GPP Standardization	b103 (NB-IoT only)	b54/n54 (4G/5G)	b48/n48 (4G/5G)
	Propagation	Excellent	Excellent	Fair (Power Restrictions)
	Contiguous Channel Width / License	1 | 1 MHz (FDD)	5 MHz (TDD)	10 MHz (TDD)
	Throughput	Fair	Good	Excellent
	In Building Penetration	Excellent	Good	Fair



Mission-Critical Utility Applications

Applications facilitated by private networks enabled by narrowband / broadband frequencies

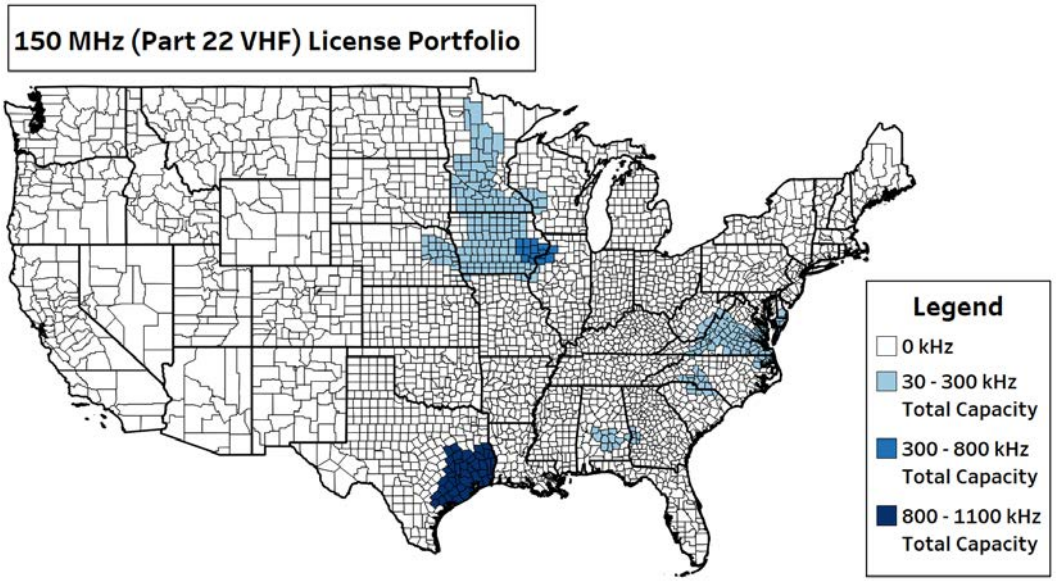
Key Mission-Critical Utility Applications

- ✓ Mobile or Fixed Data Services (4G LTE & 5G NR)
- ✓ Advanced Metering Infrastructure (AMI)
  - ➢ Direct to Meter
  - ➢ Backhaul
- ✓ Distribution Automation (DA)
- ✓ Supervisory Control And Data Acquisition (SCADA)
- ✓ Industrial Internet of Things "IIoT"
- ✓ Field Area Network (FAN)
- ✓ Land Mobile Radio (LMR)

Additional Utility Applications

- Distributed Energy Resources (DER)
- Fault location, isolation, and service restoration (FLISR)
- Line fault sensors with rapid line shutdown to prevent wildfires
- Video monitoring of assets
- VoLTE / Push-to-Talk (PTT)
- Substation monitoring and control
- Synchrophasor Networks and Phasor Measurement Units (PMUs)
- Replace expensive/cancelled legacy leased wireline links
- Microgrid management
- Smart poles
- CCTV (NERC/CIP) security monitoring
- Smart Grid monitoring and control
- Demand Response (DR)
- Volt VAR (Advanced Voltage Control)
- Reclosers
- Capacitor Banks
- Data Analytics & Business Intelligence
- EV stations
- Network, Device & Asset Management
- Machine to Machine "M2M"
- Vehicle tracking and maintenance
- Demand Forecasting data collection
- Asset tracking
- In rural areas, ISP service for customers with limited or no options
- Mobile wireless smartphone service for utility staff – increased coverage area and increased control and reliability
- Broadband Internet Services

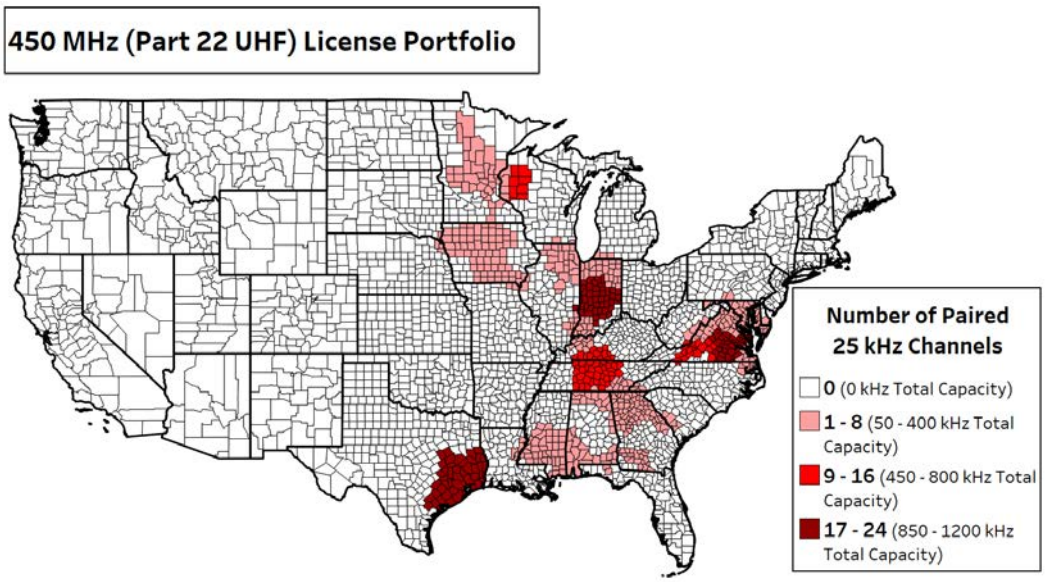
Part 22 VHF (150 MHz) Spectrum Availability



Propagation	Unsurpassed
Capacity	Varies
Data – Fixed	Supported
Data – Mobile	Limited
LMR / Voice	Wide Use
Backhaul	Limited
Key Applications	LMR / Voice

Part 22 VHF (150 MHz) band channels provide **excellent propagation** and are allocated primarily for **LMR / voice applications** using industrial-grade radio options. Used by many utilities to **support field operations**

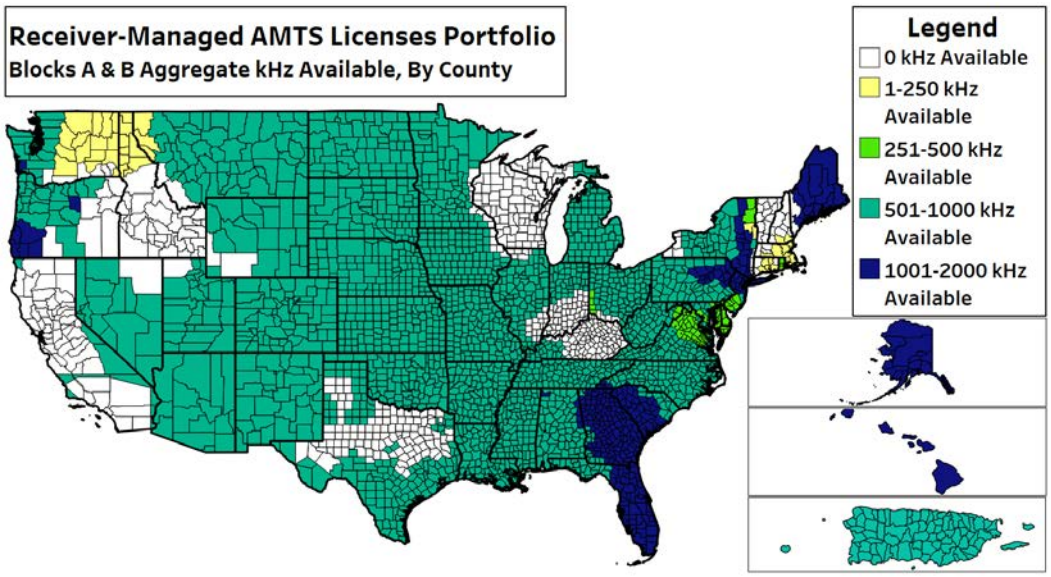
Part 22 UHF (450 MHz) Spectrum Availability



Propagation	Excellent
Capacity	Varies
Data – Fixed	Limited
Data – Mobile	Wide Use
LMR / Voice	Wide Use
Backhaul	Limited
Key Applications	LMR / Voice, Mobile Data

Part 22 UHF (450 MHz) band channels provide **excellent propagation** and are allocated primarily for **LMR / voice applications** and are utilized for **mobile data applications** using industrial-grade radio options. **DMR, TETRA, and data solutions** are also supported.

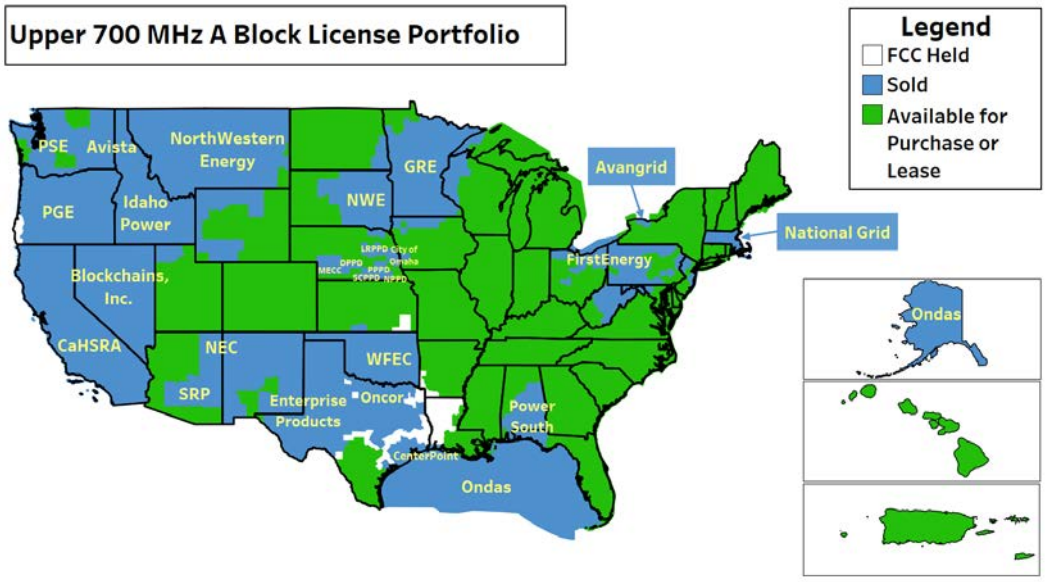
AMTS (217-218 / 219-220 MHz) Spectrum Availability



Propagation	Unsurpassed
Capacity	Excellent
Data – Fixed	Wide Use
Data – Mobile	Moderate Use
LMR / Voice	Wide Use
Backhaul	Wide Use
Key Applications:	LMR/Voice, SCADA, DA, FAN, UAV, PTC

Automated Maritime Telecommunications System "**AMTS**" band spectrum provides **excellent propagation** and may be used for **voice and data applications** using industrial-grade radio options. AMTS is in use by dozens of UCII organizations across the United States. Common applications include **LMR** and **fixed wireless data.**

Upper 700 MHz A Block Spectrum Availability



Propagation	Excellent
Capacity	Unsurpassed
Data – Fixed	Wide Use
Data – Mobile	Supported
LMR / Voice	Supported
Backhaul	Wide Use
Key Applications:	LTE-NB-IoT (Band 103), SCADA, DA, FAN, UAV

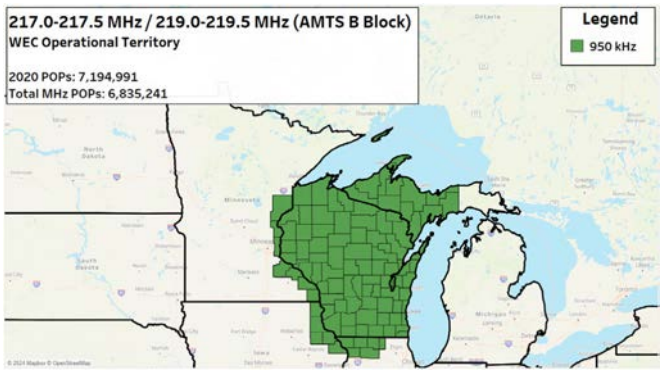
Upper 700 MHz A Block band has been adopted by **20+ utility users** across 1/3rd of the US. The **excellent propagation** characteristics of the band make it ideal for **fixed data applications** using industrial radios. **NB-IoT** is supported for distances of up to and in excess of 25 mi.

WEC Energy

AMTS B Block

Mission Critical Data

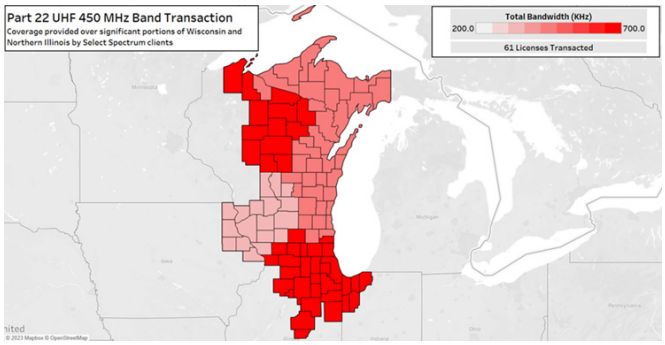
WEC Energy secured 220 MHz AMTS through Select Spectrum to serve as a multi-frequency, comprehensive **data network solution** for **SCADA** and other use cases such as **monitoring/operations** of their gas and electric **utility network**.



Part 22 UHF 450 MHz

Mobile Mission-Critical Voice & Data

WEC Energy secured Part 22 UHF 450 MHz band spectrum licenses through Select Spectrum, collectively **covering nearly 100 counties** in **WEC's service territory** and **~9.8M POPs**, supporting mobile data.

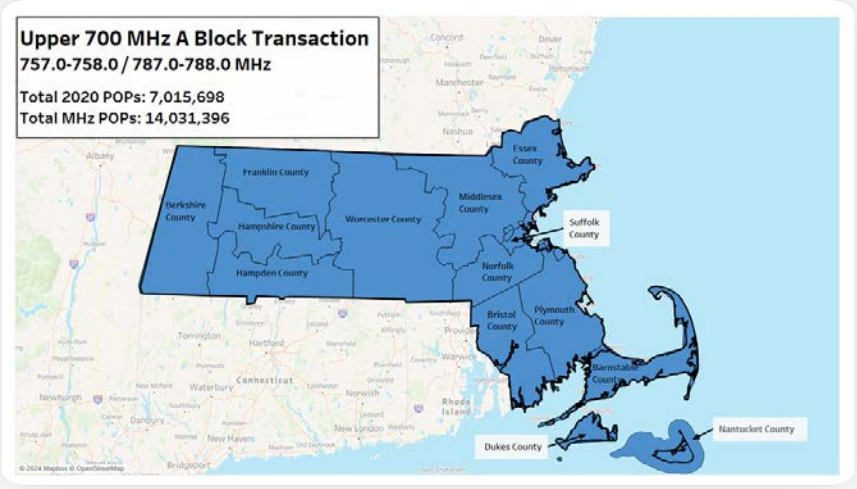


National Grid

Upper 700 MHz A Block

Mission-Critical Voice & Data

National Grid secured Upper 700 MHz A Block band spectrum licenses through Select Spectrum to provide **additional bandwidth** to support **voice backhaul, SCADA, telemetry, and other data applications**; covering Massachusetts.



450 MHz (Part 22 UHF)

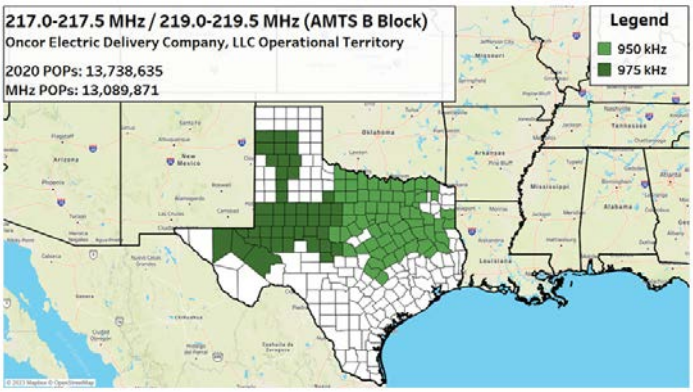
Mission-Critical Data

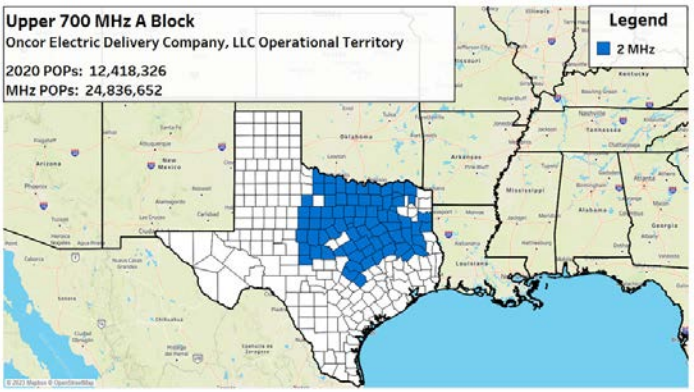
National Grid also holds Part 22 UHF 450 MHz band spectrum licenses . These licenses are primarily used as the basis for National Grid's **Land Mobile Radio** network.

Utility Multi-Frequency Case Studies

Oncor Electric (AMTS / Upper 700 MHz A Block | Avangrid (AMTS / Upper 700 MHz A Block)

Oncor Electric Delivery





AMTS B Block

Field Area Network (FAN)

Oncor Electric secured AMTS B Block spectrum licenses through Select Spectrum to support the expansion of Oncor's **FAN radio system** to monitor/control **substations** and **switching stations** and provide **backhaul communications** for Oncor **Smart Grid and Distributed Automation systems.**

Upper 700 MHz A Block

Mission-Critical Data

Oncor Electric secured Upper 700 MHz A Block spectrum licenses through Select Spectrum, for **internal communications** and **network monitoring capabilities** to facilitate the **operation / maintenance of its electric grid.**

Avangrid

AMTS B Block

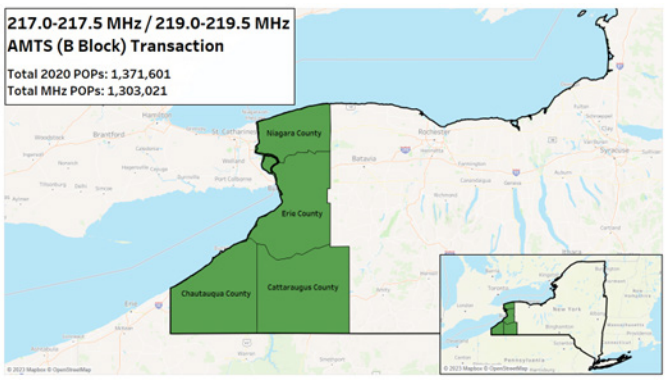
Mission-Critical Voice

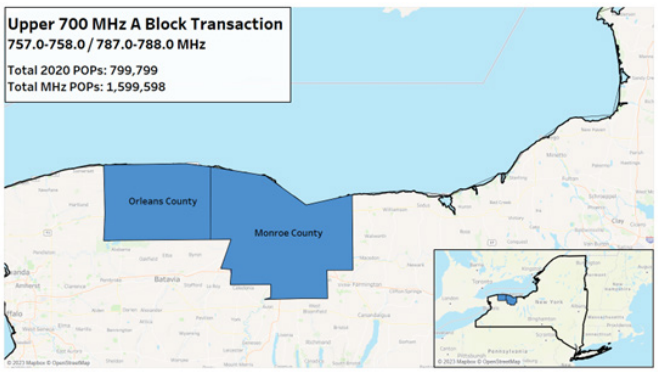
Avangrid secured AMTS B Block spectrum licenses through Select Spectrum for NYSE&G, its subsidiary, to provide **wireless radio coverage** in New York. This includes monitoring / operations of their electric and natural gas utility network.

Upper 700 MHz A Block

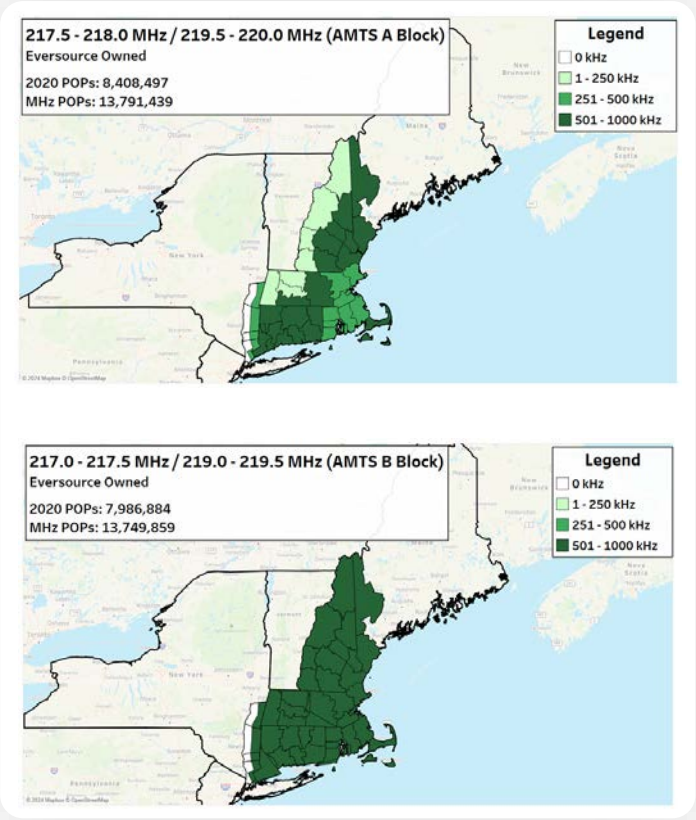
Mission-Critical Data

Avangrid secured Upper 700 MHz A Block spectrum licenses through Select Spectrum for RG&E, its subsidiary, to promote the **safe and effective operation** of their electric and natural gas **energy infrastructure**.





Eversource



AMTS A Block

Mission Critical Data

Eversource Service secured AMTS A Block spectrum licenses from Select Spectrum to support expanding **SCADA** use to meet rising demand for **real-time grid updates**, driven by the increasing connection of **green energy providers** to the medium voltage grid.

AMTS B Block

Mission Critical Voice

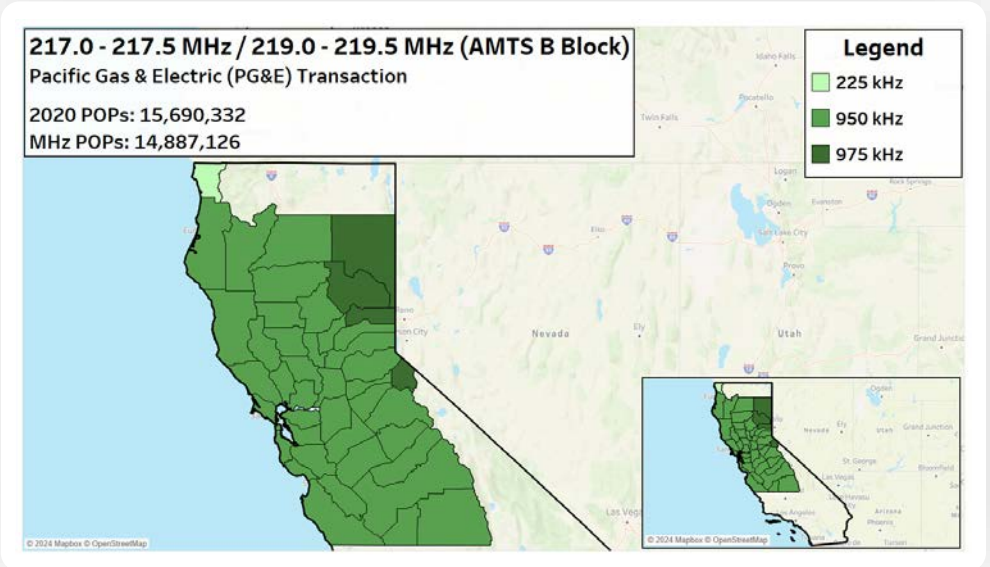
Eversource Service secured AMTS B Block spectrum licenses through Select Spectrum for **multi-site mobile radio services, SCADA, and grid control** to enhance **safety** and **minimize downtime** through remote switching, reducing manual truck rolls for **power restoration.**

Pacific Gas & Electric (PG&E)

AMTS B Block

Mission-Critical Data

PG&E secured AMTS B Block spectrum licenses through Select Spectrum for the expansion/enhancement of their **SCADA network** that connects, monitors, and controls their electric generation and transmission network. The transaction covered 44 counties and 14.8M POPs, and **enhanced PG&E's existing 900 MHz mesh network's capabilities**.

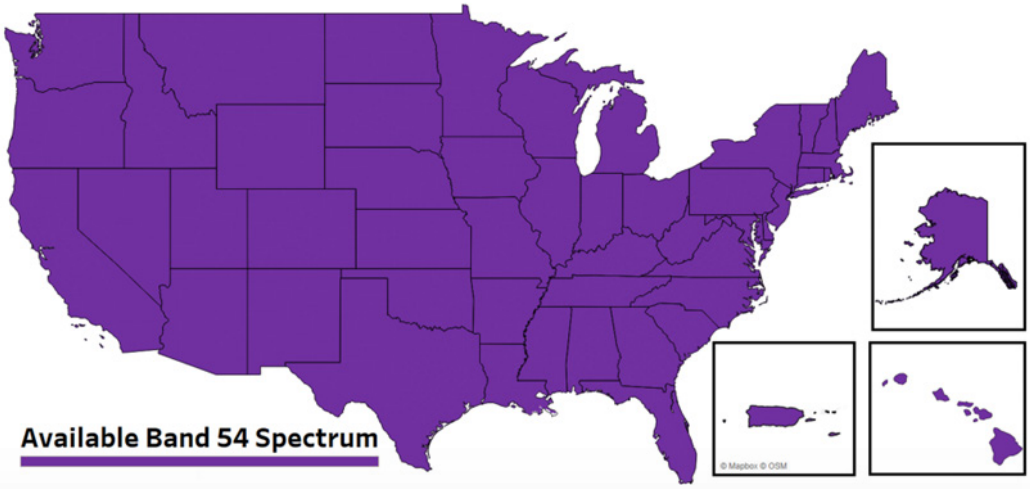


Band 54 (1670-1675 MHz) Spectrum Availability

Licensed Broadband | 3GPP Standardized for 4G-LTE, 5G-NR, LTE-M and NB-IoT

Carrier-grade, **dedicated use spectrum** for **mission-critical utility applications** is available today. Inquire today with **Select Spectrum** to obtain a quote for **Band 54** in your operating areas.

Exclusive use TDD spectrum in the lower **mid-band** frequency range is **ideal** for using as standalone or **in conjunction with Band 48 / Band 103** to provide network reliability and deliver the security that your organization depends on**.**



Example Mission-Critical Band 54 Use Case

Electric – Direct to Meter:

Direct to Meter allows for **direct communication** between the central AMI system and individual meters without intermediary devices or relays.

Enables utilities to **access meter readings and other data in real-time or near-real-time, facilitating quick decision-making**.

- ✓ **Future Proof** Network- **4G and 5G**
- ✓ **5 MHz TDD** Channels with **Flexible Uplink/Downlink** Ratio
- ✓ May **combine** with other Frequencies **(Band 41, 48 & 78)**
- ✓ **No Risk** of Interference with LMR Operations
- ✓ **Supports Wide Range** of Desired Applications
- ✓ Generous **Power Limits** with **Excellent Propagation** Characteristics

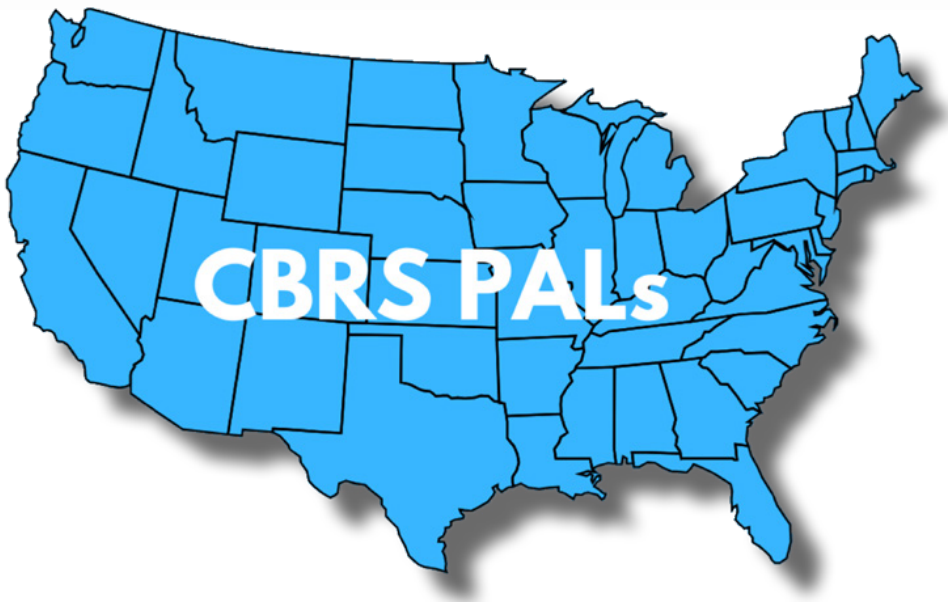
Band 54 is immediately available **nationwide.** Inquire to learn more about how your organization can access **Band 54** spectrum rights.

Band 48 (3.55-3.70 GHz) Spectrum Availability

Licensed Broadband | Priority Access Licenses (PALs) Ideal 4G-LTE and 5G-NR Deployments

Carrier-grade, **dedicated use spectrum** for **mission-critical utility applications** is available today. Inquire today with **Select Spectrum** to obtain a quote for **CBRS Priority Access Licenses (PALs)** in your operating areas.

Dedicated use PAL channels are ideal for using as standalone, in conjunction with additional licensed frequencies and/or the CBRS General Authorized Access (GAA) shared tier to provide **network reliability and deliver the security that your organization depends on.**



Example Mission-Critical CBRS PAL Use Cases

Substation Video Monitoring secures electrical infrastructure. CBRS PALs provide an **economical, interference-free connection vital for real-time security**.

Indoor/Outdoor Small Cells enhance coverage in multi-frequency **Private 4G/5G** networks through **10-40 MHz** of mid-band bandwidth, **boosting network quality through reduced congestion**.

PALs are available **nearly nationwide** through the **Spectrum Marketplace**. Visit the Select Spectrum website or **inquire to learn more about** our streamlined process to CBRS PAL spectrum rights.

Spectrum Rights Acquisition Process

1) **Inquiry** & Information Exchange
2) Price **Quote**
3) **Evaluation** and Diligence
4) **Negotiation**
5) Signature of **Definitive** Spectrum Rights Acquisition **Agreement**
6) Federal Communications Commission **(FCC)** Application Filing and Approval **Process**
7) Network **Deployment**