

# New NB-IoT Band: Upper 700 MHz A block

## *Discussion Document*

Puloli, Inc.

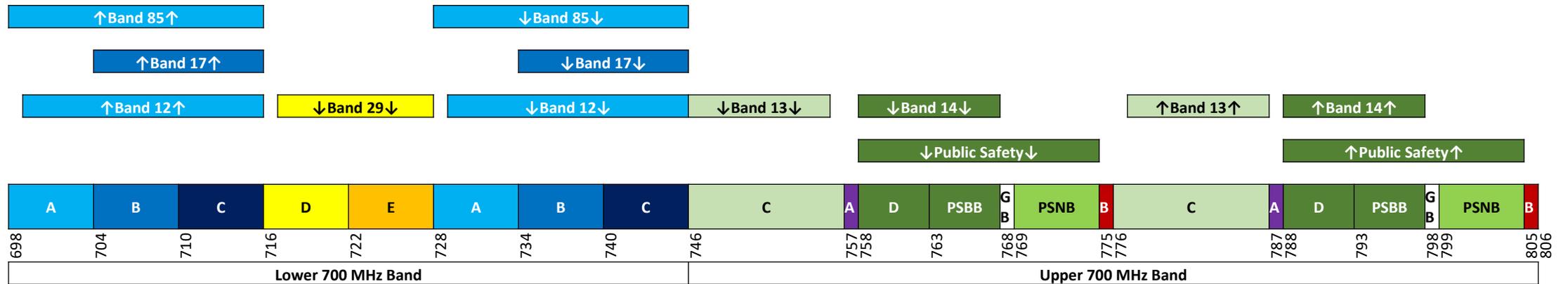
Supported by

Utility Technology Council, First Energy, WFECC, Idaho Power, Puget Sound Energy,  
Power South

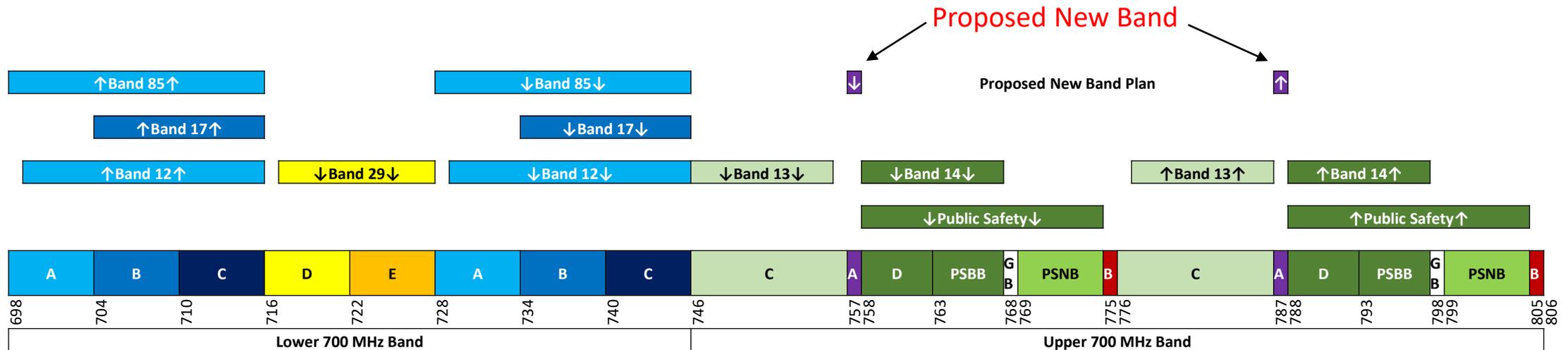
# Overview

- **Spectrum**
  - 1+1 MHz band in the Upper 700 MHz A Block (UL 787-788 MHz / DL 757-758 MHz) in the USA
- **Strong utility industry interest & market need**
  - 20+ US utilities and other entities own the spectrum; currently proprietary technologies deployed
  - NB-IoT demonstrated as suitable technology with a live standard-complaint production network and devices in operation for 2 years
  - Supported by many utility companies, industry trade associations (UTC), and research institutions (EPRI)
- **Proposed Plan**
  - Solicit RAN4#100-e feedback on 3GPP standardization of this band as a new standalone NB-IoT band
  - Open to other options (evaluated extensions of Bands 13, 14, and 13+14)
  - Submit Work Item Document and Liaison Statement from utilities, UTC, and EPRI to RAN#93-e
- **Benefits the entire 3GPP ecosystem**
  - Brings utilities into 3GPP roadmap and opens up brand new market opportunity for the whole ecosystem
  - Meets 3GPP's goals of efficiently addressing needs of critical infrastructure industries and related verticals
  - Better coexistence with neighbors

# Existing 700 MHz band plan in the USA



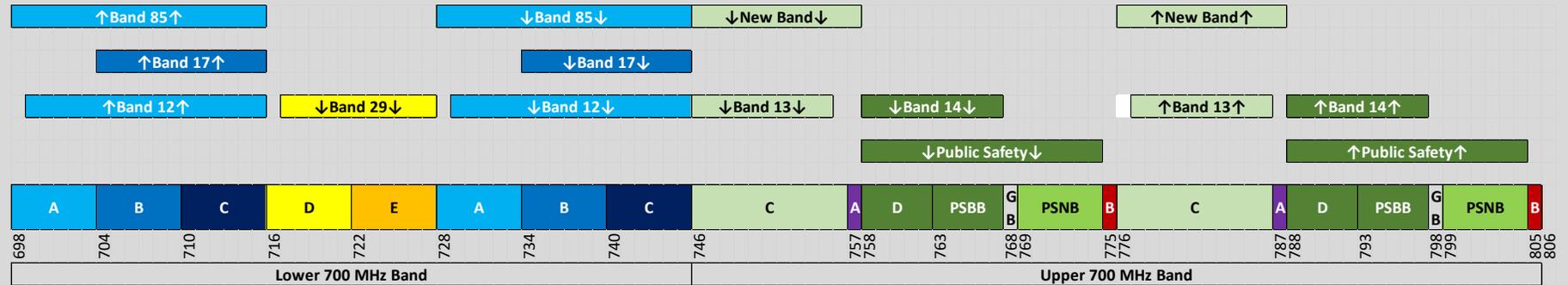
# New standalone NB-IoT-only band



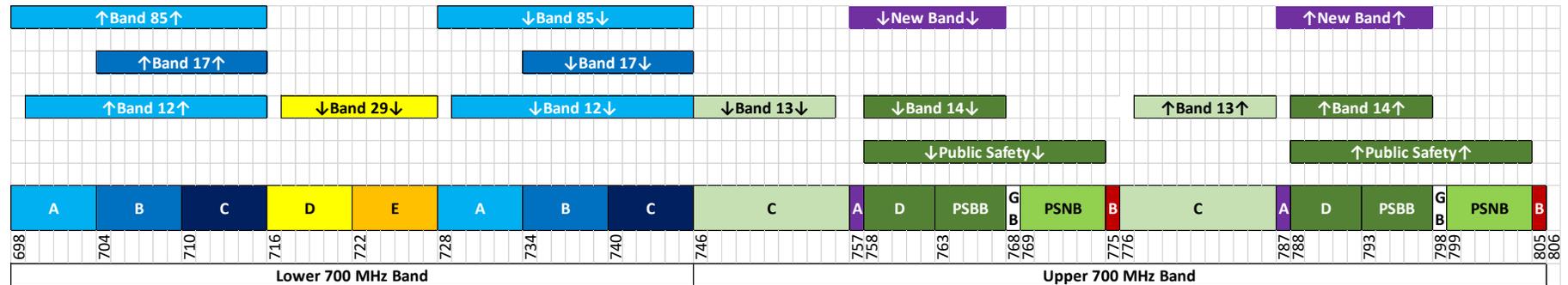
- Suitable for NB-IoT mMTC applications
  - Ideal for private networks for utilities in the US
- No complex spectrum ownership issues
- No mixed regulatory requirements
- Successfully demonstrated in the field using FCC compliant network and UE (multiple vendors)

# Other options considered

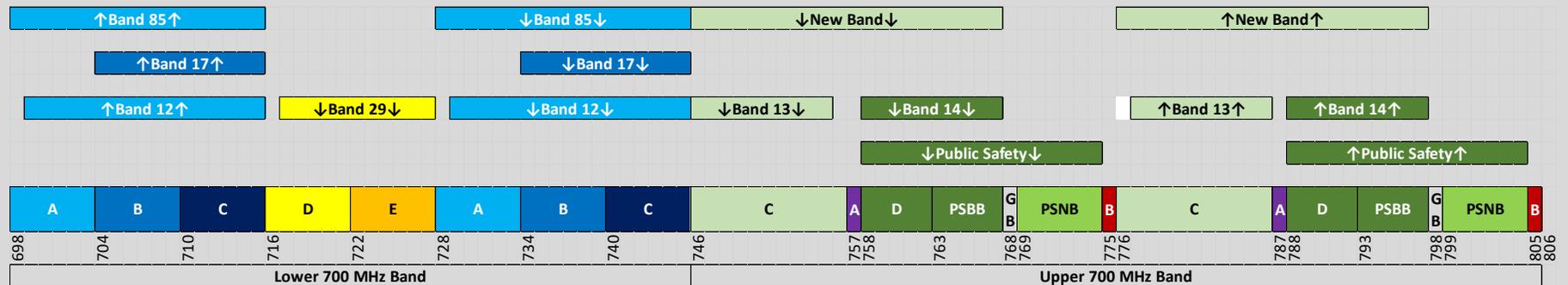
Option II  
(Band 13 Extension)



Option III  
(Band 14 Extension)



Option IV  
(New band  
Band 13 + 14)



# Strong utility interest and market need

- 20+ US utilities own this spectrum today with many more showing strong interest
  - Until recently, proprietary technologies were the only option
- NB-IoT recognized as suitable technology
  - Utilities traditionally prefer standards-based technologies, whenever available
  - Feasibility of NB-IoT already proven in this spectrum (see slide #8)
- “Shovel-ready” projects waiting for 3GPP band support
  - Utility use-cases such as metering, sensors, SCADA, and many others
- Estimated >\$1B market opportunity for NB-IoT vendors within first 5 years\*
- Supported by many utility companies, Utility Technology Council (UTC), Electric Power Research Institute (EPRI)

# Benefits to 3GPP ecosystem

## Brings utilities firmly into 3GPP technology roadmap

- Allows better positioning against competing technologies (LoRa, SigFox, etc.)
- Ensures harmonious coexistence with neighbors
- Sets the utility industry oncourse for 5G adoption in eMBB, mMTC, and URLLC

## Opens up large market opportunity for the ecosystem

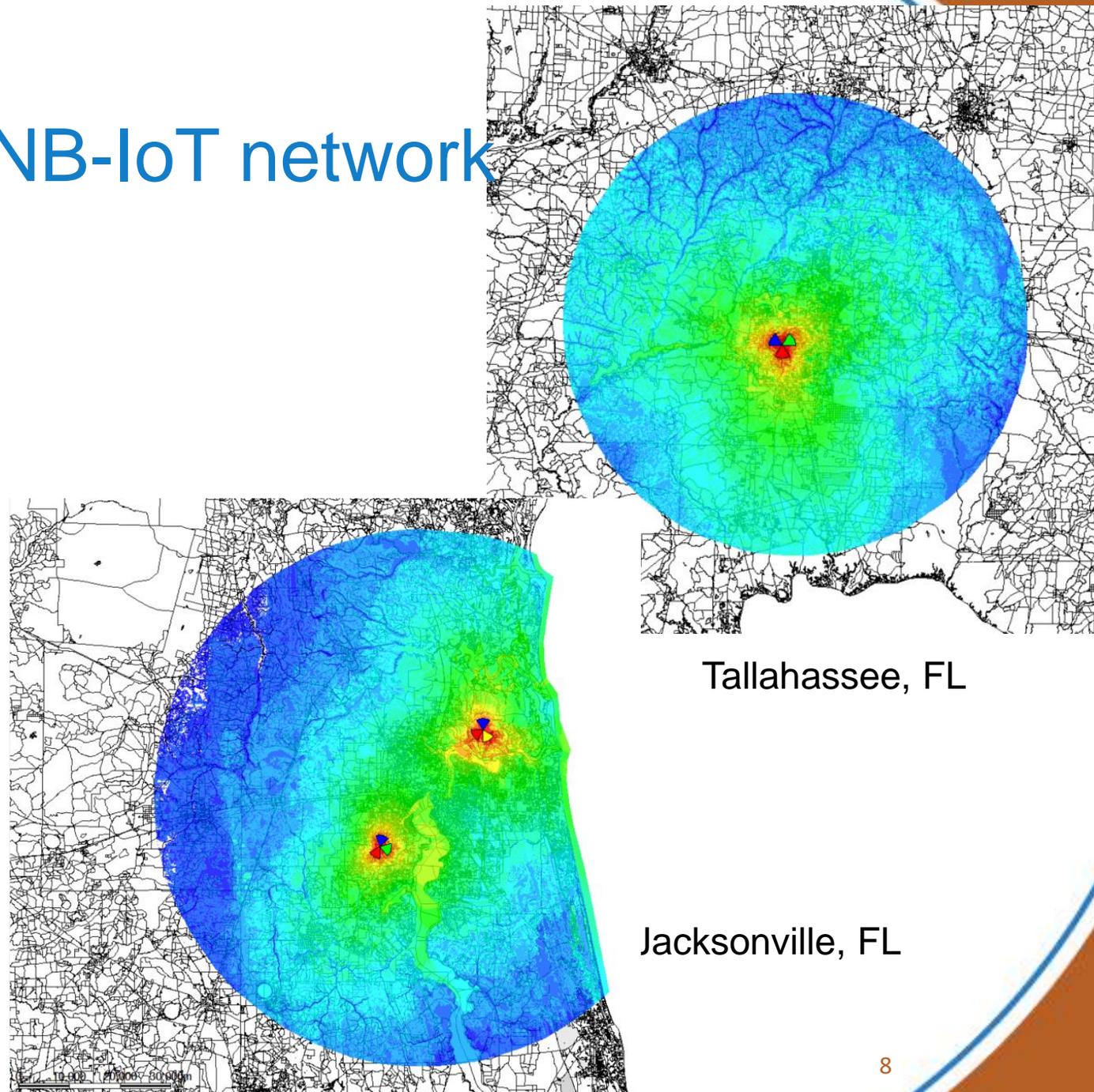
- Migrate proprietary systems to NB-IoT for metering, SCADA, environmental monitoring, machine health
- Large market opportunity for infra vendors, operators, IoT device vendors, applications, SIs

## Demonstrates 3GPP's willingness to work with industry verticals

- Perfectly aligned with 3GPP's theme for Rel. 16 and beyond
- Blazes the trail for other 3GPP technologies (Rel. 16 and beyond) into utility space

# Early success: Private NB-IoT network

- In production since June 2019
- In North Florida with JEA (local utility)
- Deployment
  - Upper 700 MHz A Block
  - 3 sites covering 1.6M POPs
  - Stand-alone mode
- Full 3GPP NB-IoT stack
- FCC certified network equipment and UE devices from leading vendors



# Unique aspects of stand-alone 1+1 MHz NB-IoT band

- All E-UTRA bands defined by the 3GPP to-date are 1.4 MHz or wider
  - This Upper 700 MHz A Block is 1 MHz paired FDD
  - No 1+1 MHz band has been defined to-date
- Study the impact on TSs in incorporating a 1+1 MHz band
  - Fully functioning production NB-IoT network using leading vendor equipment gives confidence in the underlying feasibility
  - Impact analysis on TSs will be proposed as a study item in the WID to the RAN#93-e
- Study the impact on TSs in creating a stand-alone NB-IoT-only band
  - Impact analysis of creating an NB-IoT only band will be proposed as a study item in the WID to the RAN#93-e

# Unique aspects of Upper 700 MHz A Block

- The 2<sup>nd</sup> Harmonic of the UL falls in the GPS band
- Proper RF filter design is required to reduce the 2<sup>nd</sup> harmonic
- Several vendors products have been successfully certified against the GPS related regulatory requirements

Signal	Range (MHz)	
	Start	End
GPS	1559	1610
DL	757	758
UL	787	788
DL -2nd Harmonic	1514	1516
UL -2nd Harmonic	1574	1576

# Band edge emission

- The emission requirements for Upper 700 MHz Block A are defined in CFR §27.53 (c) & (f)
- By keeping a 100 kHz exclusion at each edge of the band, Puloli and other vendor products were successfully certified by the FCC
- Same approach has been adopted by the 3GPP recently

# Recent successes as reference

- Band 85
  - DL: 728 – 746 MHz / UL: 698 – 716 MHz in 700 MHz band
  - Extending 1+1 MHz (DL: 728 – 729 MHz / UL: 698 – 699 MHz) previous guard band to Band 12 (DL: 729 – 746 MHz / UL: 699 – 716 MHz) for NB-IoT services
  - Similar characteristics as this proposal
- Bands 87 & 88
  - Independent bands in 410 MHz spectrum
  - 5 MHz channel bandwidth
  - Supports 1.4 / 3 / 5 MHz LTE + NB-IoT / LTE-M