Rechannelizing Public Safety Spectrum to Meet the Growing Demand for Wireless Data:

Improving Efficiency and Capabilities
And Providing for Competition
While Providing a Building-Block for
True Interoperable Networks

A Presentation for the FCC

November 2005

Background

- State and Local Public Safety have been allocated 24 MHz in the upper 700MHz band (764-776/ 794-806) that will be cleared pursuant to current legislation.
- This spectrum was channelized years ago to support voice and wide band (limited) data services.
- Technologies advancements have surpassed the capabilities of the current channel plan.
- To meet the broadband requirements of the public safety community, the wideband data channels in 700 MHz should be rechannelized to permit exclusive deployment of a commercial broadband technology providing for:
  - Improved efficiency and capabilities
  - A competitive environment for network deployment and device procurement
- Dedicated 700MHz broadband networks are a building block for truly interoperable public safety communications networks.

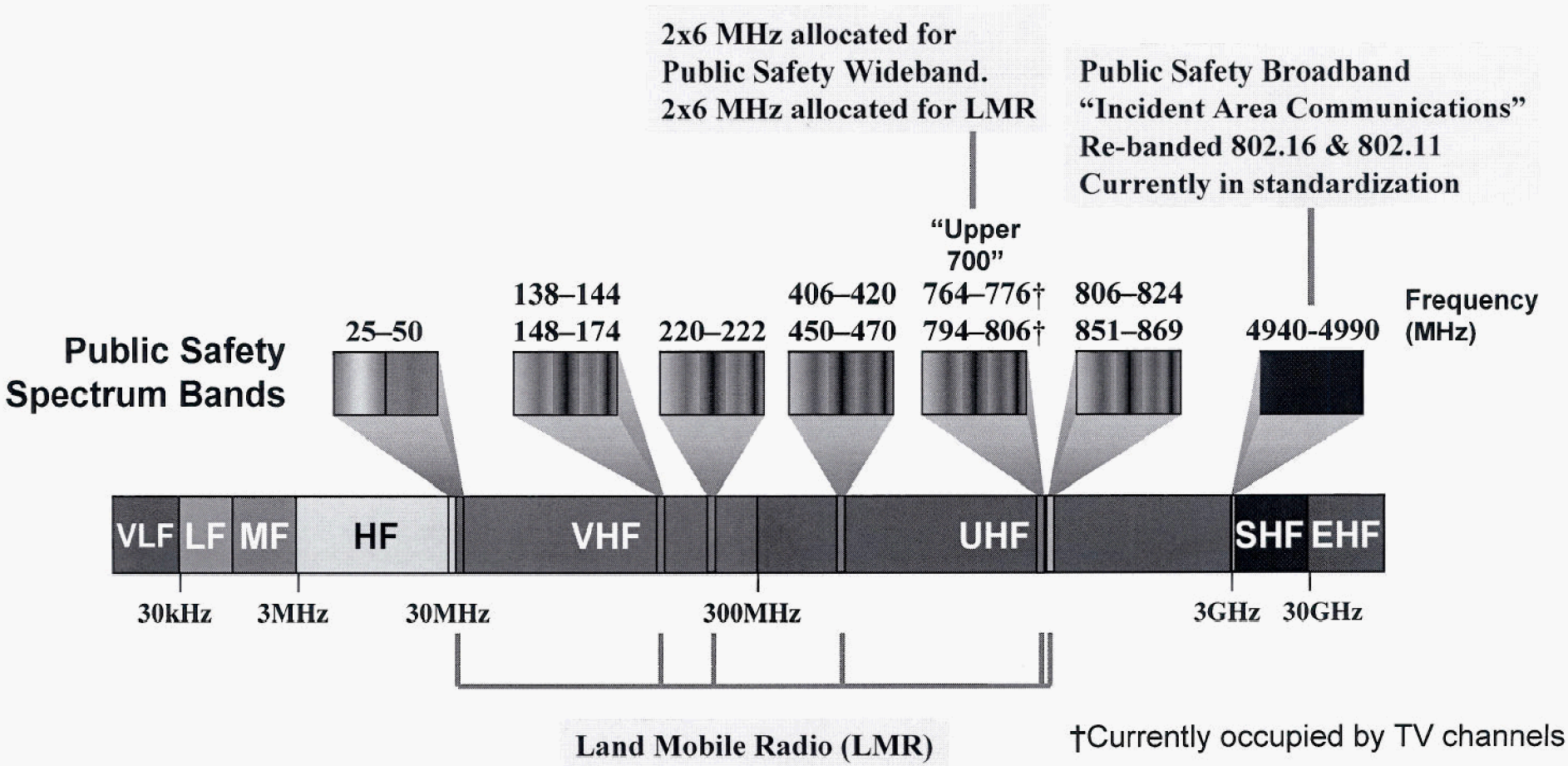
The Spectrum Challenge

Existing public safety spectrum in the US precludes use of <u>all</u> standard (and proven) 3G technologies

- Spectrum policy established prior before the digital wireless revolution
- Current spectrum policy locks US in to niche technology
  - Small vendor community
  - User device costs will limit (or prevent) widespread deployment of wide area high speed data
  - "Bad guys" and teenagers have access to more powerful tools than those protecting the homeland

Re-definition of existing public safety spectrum is critical to leveraging commercial wireless technologies/ infrastructure

US Public Safety Spectrum Allocation



†Currently occupied by TV channels

Total Allocations:

State and Local Public Safety: 97.2 MHz nationwide

Federal Public Safety: 24.5 MHz nationwide

High-Speed Wireless Data increasingly important to Public Safety / Homeland Security operations

- Commercially-proven, high-speed mobile data capabilities are critical to enhancing mission capabilities in both a *timely* and *cost-effective* manner
  - Mission- critical needs driven by multi-media applications include:
    - Real time Video
    - Images
    - Automated Dispatch
    - Multimedia Alert
    - Rea time monitoring and data transmission for everything from sensors to emergency health and disaster recovery incidents.

Public Safety's wide band spectrum in 700 MHz must be rechannelized to accommodate the commercial broadband technologies that support these functions.

Network Considerations Also Critical

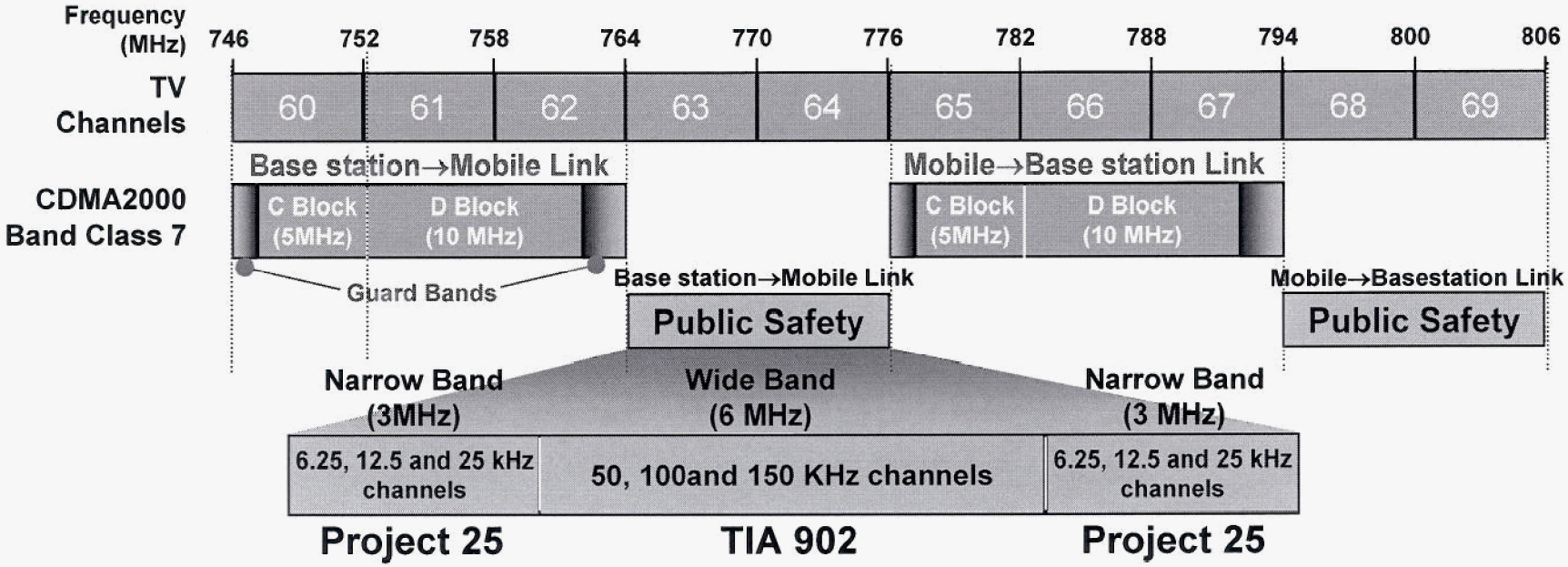
- Spectrum is not the only key to the development and deployment interoperable communications
- Network elements are equally important
- New standardized technologies like the IP Multimedia Subsystem (IMS) can play a critical role in allowing disparate devices to communicate seamlessly in a secure environment

Conclusions

- Re-banding public safety's 700 MHz wide-band channels to exclusively accommodate a broadband commercial wireless technology is sound public policy because it will:
  - Increase per-user throughput
  - Improve overall capacity
  - Foster increased efficiency and capabilities; and
  - Allow for competition
- Public safety's broadband needs can be best addressed in today's environment by rechannelizing the "wide band" portion of the 700MHz "public safety" spectrum to provide for deployment of three (3) 1.25 MHz carriers surrounded by 1.12 MHz guard bands on each side to protect NB services from BB services and vice versa.
  - Single block of 3 carriers can be reused by every jurisdiction
  - Supports higher per user data rates and bandwidth public safety applications (video)

BACK-UP

Upper 700 MHz Spectrum (US)



Re-channelization of the Wideband portion of the current public safety 700 MHz spectrum would make more spectrum available in both public safety and commercial bands.

For example, rechannelized, this spectrum could support deployment of 3 cdma2000 carriers.

TIA902 vs. cdma2000

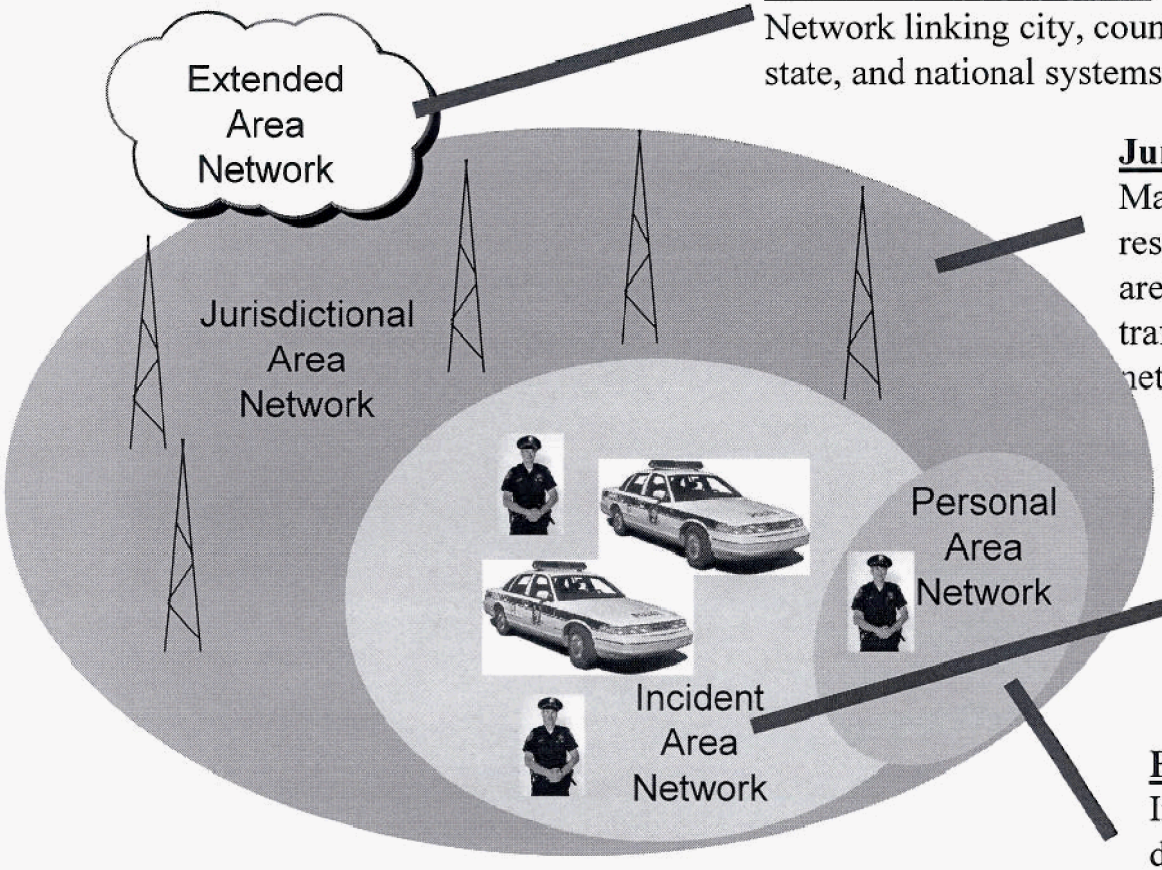
TIA902	cdma2000
Peak supported user rate: 690 kbps TIA902's low peak rates limit the applications that can be deployed. Rate not high enough over large portion of cell to support high resolution video	**Peak supported user rate: 3.1 Mbps** Support of high resolution video (>500kbps) for multiple users simultaneously
Channels can not be re-used in neighboring cells (frequency reuse factor >12 required to support high data rates) Deployment of TIA902 requires careful frequency planning/coordination to mitigate co-channel interference. Large re-use factor limits the number of channels that can be assigned within a jurisdiction.	**Same channels used in adjacent cells/sectors (frequency reuse factor = 1).** No frequency planning required Same channels used throughout the network

TIA902 vs. cdma2000

TIA902	cdma2000
Niche market Single vendor (Motorola) -> high priced devices and network equipment	**High Volume Commercial Market** 48 terminal vendors, 13 infrastructure vendors -> low cost devices and network equipment
No evolution path to next-gen services Locks public safety into state of the art as it was in the 1990s By the time TIA902 is deployed (2009 is a likely earliest date), it will be out of date	**Evolution driven by commercial market** Standards evolve to incorporate new innovations in devices, smart antennas, applications. Backward compatibility maintained over evolution path

Public Safety Communications Network*

*"Statement of Requirements for Public Safety Communications & Interoperability," SAFECOM Program, Department of Homeland Security, Version 1.0, March 10, 2004



Extended Area Network:
Network linking city, county, regional, state, and national systems.

Jurisdictional Area Network (JAN):
Main communications network for first responders. Responsible for all non-incident area voice and data traffic. Handles any IAN traffic that needs access to the general network. Provides connectivity to the EAN.

Incident Area Network (IAN):
Temporary network created for a specific incident.

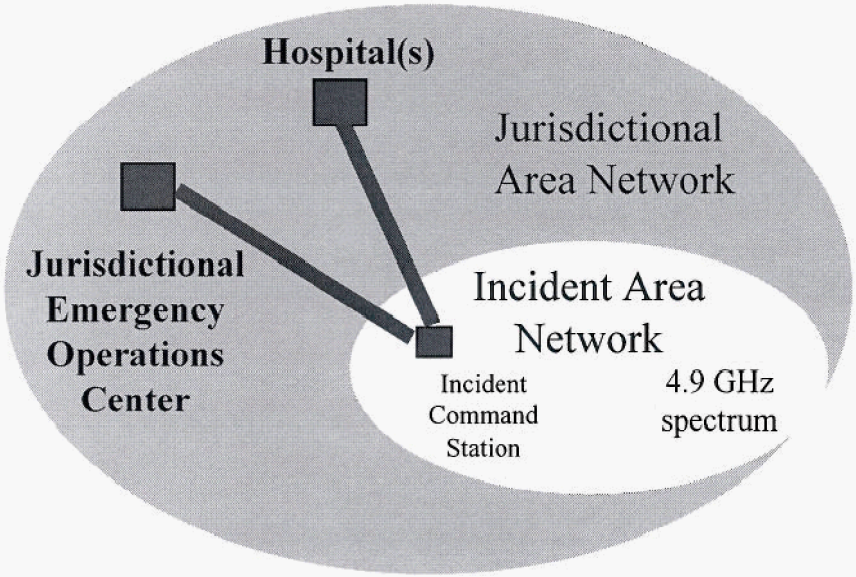
Personal Area Network (PAN):
Inter-device communications for devices carried by first responder (e.g., health monitor, hazardous materials sensor, breathing apparatus)

Public Safety Broadband Needs: Incidents

Most broadband communication confined to Incident Area Network

- Images, video to/from incident command station
- Images, video between on-scene personnel
- Firefighter health, status, location

Likely carried on Public Safety 4.9 GHz Spectrum



Some incident area traffic carried on Jurisdictional Area Network

- Images, video to/from incident command station (Maps, surveillance, on-scene photos, …)
- Victim telemetry (EKG, vitals)
- Text alerts (situational awareness)
- Database Access (Hazmat, …)

Mission Critical traffic carried on dedicated Public Safety Wideband 700 MHz Spectrum. Commercial wireless data service for non-mission critical applications.

Jurisdictional Area Network Broadband Data Carrying capacity

Transaction type	Transaction Load which could be supported by 3 cdma2000 carriers in Public Safety 700 MHz
High Resolution Image	~5 images/minute @ 2.2 Mbyte/image (5.1 megapixel camera)
Low Resolution Image	~280 images/minute @ 40 kbyte/image
High Resolution Video	~3 simultaneous realtime video feeds @ 500 kbps mpeg video
Low Resolution Video	~30 simultaneous realtime video feeds @ 50 kbps mpeg video
Text Alerts	~22,500 alerts/minute @500 bytes/alert
Database Queries	~2,250 Database queries/minute @ 5 kbytes/access
Patient data streaming	~15 simultaneous patient data streams (EKG, ...) @ 100 kbps/stream

Incident scenarios in SAFECOM SoR illustrate Incident and Jurisdictional Area Network data needs

Most data-intensive scenarios for JAN:

- Terrorist Car Bomb (video transmission, imaging, remote patient monitoring)
  - 1 simultaneous video transmission from incident area to Emergency Operation Center, limited distribution of images (maps, building plans), text alerts
- **TIA-902 will not support public safety's needs for mission-critical video.**
  - **Commercial broadband technologies needed to support public safety data application needs.**

Public Safety Operations: Wide Area Data Services Needs

High resolution image transfer (Maps, building plans, evidence, …)
Low resolution image transfer (Mugshots, surveillance, …)
Text messaging (between individuals, alerts from commanders/dispatchers, …)
Multimedia text messaging ("Be on the lookout," Amber alerts, …)
Textual database access (License plate queries, hazmat, patient records, …)
High resolution video (Surveillance, remote medicine, …)
Firefighter health/status update (Heart rate, remaining air, …)
Streaming patient data (EKG, BP, …)
Low resolution video
Location
Email
Web

Uses of these data services by Fire, EMS, Law Enforcement detailed in SAFECOM SoR

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