

# Discussion of 700 MHz Spectrum Policy Issues For Public Safety in King County

## Executive Summary

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### Introduction

This white paper evaluates potential impacts of the Federal Communications Commission's (FCC) policy directions toward implementing a 700 MHz nationwide interoperable public safety broadband system on local governments. In particular we evaluate two issues; 1) how to address public safety's acknowledged need for broadband spectrum and the controversy over the Commission's allocation of D-Block spectrum, and 2) the threat that the "flexible use" of the 700 MHz narrowband spectrum for both broadband and narrowband operation will make certain current county radio resources unusable. A key finding of this evaluation is that proposed policy changes and likely technology changes within the next five to ten years are likely to have a direct impact on King County's investments in radio communications for public safety and transit. Specifically, these changes will impact both replacement and end-of-life timelines. We provide recommendations on next steps that the County should take to monitor and respond to these continuing developments.

There is a serious, polarized debate about whether public safety has enough spectrum available under the current allocations for both broadband and narrowband uses or whether it should also have the "D-Block". The D-Block is composed of the 10 MHz of spectrum intended for a commercial broadband provider. It is immediately contiguous to the public safety allocation of 10 MHz of broadband spectrum in the 700 MHz band. Since contiguous spectrum is more economical to develop than non-contiguous spectrum (because the same equipment can use it with no modification to radios), and because there is no other 10 MHz band immediately identifiable that would be available to public safety, public safety hopes to succeed in lobbying Congress and the FCC to turn over the D-Block to them.

In the case of narrowband public safety 700 MHz spectrum, this band was created specifically to address the shortage of spectrum for voice communications in the other public safety bands. The identification of the 700 MHz band created spectrum resources contiguous to the existing 800 MHz which allowed development of standards-based interoperable equipment capable of operating over multiple bands for the first time in history.

A few definitions will help the general reader to better understand the discussion that follows. "Land Mobile Radio" (LMR) is the industry label for the two-way voice radio systems that are typically used by police, fire, transit, transportation and others with large mobile fleets or widely deployed field personnel. "Long Term Evolution" (LTE) is the industry name for the latest generation of wireless cellular technology. LTE is also often referred to as 4th Generation, or 4G. "IP" is the acronym for Internet Protocol, the communications standard for computer-based networks. "Project 25" or P-25 is the name for a public safety communications standard that has been in development for over 20 years.

### The FCC Position on Public Safety Spectrum Needs for Broadband

The FCC released a position paper in August 2010, in response to public safety arguments that it needs the D-Block to be reallocated from commercial use to public safety use. In this white paper, the Commission claims that its technical analysis shows that a nationwide broadband public safety network

constructed with just the 10 MHz of broadband spectrum currently held in reserve for the PSST ***will be adequate, and that the D-Block auctions to provide this spectrum to commercial providers should proceed.***

## **Broadband from Flexible Use and New Technologies**

T-Mobile recently (August 2010) submitted a white paper to the FCC (Roberson and Associates) providing “***additional technical analyses of the effects of auctioning the 700 MHz D-Block.***” According to the summary of their paper, the analysis conducted shows that “the capacity and throughput provided by a 5+5 MHz LTE network in the 700 MHz public safety broadband spectrum is sufficient...to meet immediate public safety broadband spectrum needs” as long as the network is designed to use both the 700 MHz and 4.9 GHz public safety allocations. Further, “consideration of the total amount of narrowband voice spectrum available to public safety, taking into account the significant increases in voice capacity that will be realized in the future due to narrowbanding in the VHF and UHF bands, and the reconfiguration of the 800 MHz band, prompt the discussion of a future ***re-purposing of a portion of the 700 MHz public safety narrowband spectrum for broadband use.***” (emphasis added)

Just a month later, the FCC released a Notice of Inquiry (NOI) asking for comment on “the feasibility of allowing for flexible use of the 700 MHz public safety narrowband spectrum”. Specifically the FCC seeks “to explore whether allowing public safety the option of using 700 MHz narrowband spectrum for broadband services would be operationally feasible and technically compatible with existing and future public safety narrowband operations.” The FCC notes “as a procedural matter” that this Public Notice does not propose any change to the current rules governing the 700 MHz narrowband spectrum; its purpose is to gather information in order to develop a better understanding of ***options for future evolution of the 700 MHz narrowband spectrum*** that the Commission could make available for the public safety community.”

The FCC specifically invited comment from the States and Regional Planning Committees (RPCs) of each region on a series of questions posed in the Notice, on planned usage of the narrowband 700 MHz spectrum. The FCC asks for comment on whether there are funds committed to planned deployments of 700 MHz narrowband systems, whether public safety jurisdictions are planning to deploy both 700 MHz broadband and narrowband systems in the same geographic area, and whether these systems will combine infrastructure, network operations or other resources. The Commission also asks whether flexibility to “shift spectrum from narrowband to broadband use over time” would benefit jurisdictions.

## **Analysis of the Issues for Public Safety**

### **LTE is not a substitute for LMR**

An analysis of the record on both the “Flexible Use” notice and the public safety broadband policy arguments suggests that the FCC may be positioning, along with the carrier industry, to promote an all-IP, all LTE future for public safety ***in advance of technology*** being available to deliver. Commercial LTE networks are only now being rolled out in a few markets, and there is no real experience with them yet. To consider LTE to be a potential “perfect substitute” for LMR today is a repudiation of priority for interoperable public safety communications systems now and in the near future. The LTE standard does not support voice communications, push-to-talk, one-to-many communications, talk-around, dispatch, multi-band uses, or interoperability with P-25 radios or any LMR technology. Public safety's need for reliable voice coverage in all areas where they operate, including wilderness search and rescue missions, wild fires, inside high rises, in underground tunnels and garages, and a multitude of other harsh

environments necessitates network operability in all these situations. Today, the only communications technology that is reliable for this type of operation is LMR, and there is a shortage of channels for its use.

Public safety hopes to develop robust broadband networks using LTE technology alongside and in many cases in tandem with its digital LMR networks. However, today's LTE technology does not support LMR equipment, or provide the voice communications capabilities needed for public safety and transit operations. Furthermore there is no evidence that the LTE Advanced standard will be revised to include these functions.

### **More, Not Less Narrowband Need is Evident**

Statewide 700 MHz allocations and General Use 700 MHz allocations will be fully licensed and fully used, at least in the most populated areas. Regional Planning Committee (RPC) Band Plans that have been approved by the Commission in almost every region, and a check of their licensing data base shows hundreds of licenses granted or in process. These include both statewide and regional narrowband systems. In the King County area, the 700 MHz band is the only band available for expansion and new systems requiring multiple channels for simulcast narrowband systems.

### **New Narrowband Capacity is Overstated**

Narrowbanding in the VHF, UHF and 800 MHz bands will increase the number of available expansion channels in the future but far less than the quadrupling that some companies are predicting. New 12.5 kHz channels (and eventually new 6.25 KHz channels) will be created in theory, once the narrowbanding process is complete in the VHF and UHF bands, but very few of them will actually be usable to create new capacity for narrowband voice operations. The assumption that the narrowbanding process in the VHF and UHF bands will produce a 4:1 increase in voice channels once the transition is made to 6.25 kHz channels does not take into account the realities of frequency coordination, shared spectrum, and prohibited contour overlap in the UHF and VHF bands. Nor does it consider the situation in the U.S.-Canada Border Zone, where half the spectrum is licensed in Canada and it is therefore very difficult, if not impossible, to license those channels at elevated sites that can provide wide area coverage.

### **Flexible Use Creates Financial Uncertainty**

The Flexible Use Notice potentially introduces substantial loss of certainty about the future of the narrowband allocation, which will lead to a "chilling effect" on investment, and further paralysis for network development. The concept of creating some undefined future option for "flexibility to "shift" spectrum from narrowband to broadband use over time" might be an attractive idea in a future where the narrowband channels have become a fallow wasteland with no reasonable expectation that they would be needed. But this simply isn't a true representation of the band's status.

### **Flexible Use Cuts Off System Expansion Options**

If the number of narrowband channels is decreased in the band, existing and planned systems may not be able to simply add channels when demand grows—an entire re-investment strategy may be necessary to create additional capacity. If some or all of the narrowband allocation is re-purposed to broadband, present system owners face a completely revised future path for upgrades and expansion. Uncertainty now exists on the end-of-life calculations for existing investments in this band. Where equipment could be depreciated for 14 years or more in reasonable financial plans up until now for LMR systems, we may be looking at earlier than planned technology obsolescence due to regulatory changes

that mandates a system life-span with a hard end at 2016. However, given the uncertainties described above, it is not at all clear whether any viable alternate products will be available by 2016.

### **Flexible Use Threatens Interoperability in the Band**

The negative impact of allowing flexible use of all or a portion of narrowband spectrum on nationwide narrowband interoperability could be substantial. Flexible use of the public safety narrowband spectrum can have a negative effect on regional, statewide, and nationwide interoperability. If there are agencies or municipalities in different parts of the country, or even in different parts of a state or 700 MHz Region, that opt for a broadband network while other agencies continue to operate on narrowband networks, there will be problems when these agencies or municipalities need to provide mutual aid assistance during emergencies. If different 700 MHz Regions adopt different approaches to “Flexible Use” and end up with different sets of 700 MHz narrowband interoperability channels, then any possibility of interoperability between or among different Regions would be either eliminated or seriously limited.

### **Flexible Use Creates Certain Interference**

Broadband cannot coexist with narrowband uses because interference and degradation of narrowband radio performance is certain. The technical reasons are discussed in detail in Appendix A to this document.

## **Conclusions**

### **1 It remains unknown if public safety will prevail in both the D-Block argument and federal funding for public safety broadband networks.**

The FCC is unlikely to back down on its position that public safety has enough spectrum, and instead needs more efficient network architectures and equipment. Congress’ ability to push forward law to mandate the allocation and federal funding seems more unlikely with the new Congress. It may be likely that a delay in policy on this issue will continue, while a push will be made by the FCC to address and define roaming and prioritization standards for public safety on LTE networks. This policy push will be useful to public safety regardless of how the D-Block argument resolves, because prioritization and roaming standards for LTE will be extremely important for public safety anyway. Waiver recipients building LTE networks in the PSST spectrum need prioritization and roaming standards defined for the operation of their own networks. While these might only address prioritization and pre-emption issues between and among public safety agencies, the standardization of an approach is essential to interoperability and efficiency on LTE networks. Whether the network includes D-Block spectrum or not, the definition of prioritization and pre-emption should not be left to individual network providers, and will define the efficacy of the networks in emergency operations mode, when contention for spectrum can be expected.

Public safety has generally taken the position that, to build LTE networks with the coverage and capacity needed in rural and wilderness areas, the PSST 10 MHz will not be sufficient. They claim a need for the D-Block to allow high-power, high-site placements, rather than low-site, dense cell architectures generally used in the cellular industry. This system design would allow more coverage more economically, but it also requires more spectrum. One possible policy outcome is a partnership between public safety and a commercial D-Block licensee that pools spectrum from both blocks, and shares infrastructure to allow the development of these types of architectures in more rural areas. Such an outcome would rely heavily on defined roaming, prioritization and pre-emption agreements between

public safety and commercial network owners.

**2 In the short term, Flexible Use is at best a premature discussion, and at worst a full assault on public safety's ability to develop standards-based interoperable push-to-talk networks.**

It is certain the record created in the Flexible Use inquiry will establish the fact that public safety is using the 700 MHz public safety narrowband allocation, and actively involved in building networks all across the nation. This spectrum is no longer a "greenfield" with potential for re-purposing. In many regions, including Region 43, and King County in specific, millions have been invested to create interoperable, standards-based public safety networks, under a regulatory regime that seemed certain, and with owner confidence that these networks could be upgraded, expanded and maintained for the next 20 years. The actions by the FCC to suggest that the 700 MHz band be re-apportioned for a third time, and that narrowband channels be curtailed or eliminated reveal a misinformed Public Safety and Homeland Security Bureau staff, and a full-press lobbying effort by wireless carriers to knock public safety radio users aside in favor of their commercial interest in developing scarce spectrum resources for other, more profitable uses.

**3 In the Long-Term Voice over Broadband may become the standard, and public safety and transit should begin preparing for this.**

Looking at least a decade into the future, it is likely that narrowband LMR will become a niche market of private networks rather than a system of systems for emergency response as was envisioned by DHS and APCO only five years ago. LMR is simply not as spectrally efficient as emerging cellular technologies, nor do manufacturers see enough of a future market, based on national spectrum policy for continued development of more affordable and more capable network systems. Those with investments in today's LMR technologies are facing a possible wholesale technology change in the next generation of systems. Loss of federal support for the development and mandate of P-25 systems in favor of adaptation of cellular network design and air-interfaces, and all-IP functionality is pretty clearly the direction suggested by this Commission's leadership and the carrier industry. LTE Advanced standards are currently being developed, and these will include voice applications, but it is unknown whether they will also include the one-to-many, dispatch and other types of operations that public safety and transit need, and, on a technical level, how those needs could be met by purely IP-based technology. Although there is a high demand for these types of applications, not only from public safety, but from other user communities including health, construction, energy and transit, these industries have not, so far, presented united front or identified a common set of requirements for their specialized voice communications needs. Strong advocacy will be needed to advance these. Though public safety is fighting on a number of fronts to retain narrowband LMR configurations while also fighting for licenses and funding on the broadband front, its message is getting diluted and dichotomized.

A smart strategy long term will be to continue to pressure for local control through RPCs of frequency planning and allocation in all public safety LMR, and continuous protection for "incumbent" 700 MHz narrowband networks, while understanding that the new world in the broadband allocations is about prioritization, preemption and public-private partnerships, and less about stand-alone overbuilding of public safety infrastructure. In the broadband arena, successful networks will be partnerships, serving multiple communities of interest (public safety, government, education, health, transit, energy) on a priority basis, with commercial consumer traffic mixed in the backbone network. Future network architecture for public safety users is all about applications; those that control priority and preemption; those that control security and authentication; and those that control roaming and push-to-talk voice.

Public safety and transit may need to be willing to rethink their operational requirements in terms of how they could be met by all-IP systems. To make progress in these areas, public safety needs to invest heavily in standards development, with industry partners and government, that govern the operation of all broadband networks in this country, much like the standards that govern 911 efforts on voice networks.

## **Next Steps**

It is certain that policy for the use and future allocation of public safety spectrum will change. Vigilance on both spectrum policy and technology development is highly recommended. The current public safety and transit advocacy groups' efforts are not effective enough or unified enough in standards and technology assessment areas. Their approach relies too heavily on anecdotal justifications for a blanket spectrum preference. Public safety advocates should rely more heavily on expert technology and research and development advisors and less on vendors and practitioner organizations than they have in the past. The landscape for public safety and transit communications will change rapidly, moving toward all-IP based networks, with digital voice applications. These users should:

1. Continue to develop expert information and technology assessment sources to monitor the technical and policy landscape and advise them more accurately on emerging technologies. Academic institutions, the Institute of Electrical and Electronics Engineers (IEEE), and policy organizations such as the Silicon Flatirons Center and the Aspen Institute are all informed institutions that public safety and transit organizations could benefit from.
2. Begin authoring a set of needs/requirements documents that address functionality and operability requirements of public safety and transit for IP based technologies such as LTE. Gain wide national acceptance and participation in such standards efforts.
3. Suggest revisions to the National Broadband Plan (NBP), the Intelligent Transportation System (ITS) plans, and participate actively and thoughtfully in FCC Notices of Inquiry to insure that the record on needs and standardized requirements is thorough, technically sound and not anecdotal.
4. Put local resources into contingency planning, strategic planning and needs assessments now, so that the options and opportunities are clear.