

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)
)

Technical and Operational Feasibility) PS Docket No. 06-229
Of Enabling Flexible Use of The)
700 MHz Public Safety Narrowband)
Allocation and Guard Band For)
Broadband Services)

COMMENTS BY KING COUNTY, WASHINTON ON THE
TECHNICAL AND OPERATOINAL FEASIBILITY OF ENABLING FLEXIBLE USE OF THE 700 MHz
PUBLIC SAFETY NARROWBAND ALLOCATION AND GUARD BAND FOR BROADBAND
SERVICES

We applaud the efforts by the Commission to seek innovative, creative, and efficient uses of frequency spectrum to enhance wireless communications. However, flexible use as currently envisioned is fatally flawed; it will not enhance communications, it will likely interrupt them. The day may indeed come when public safety could transition to broadband services for its communications, but that day is at least one more technical generation of infrastructure away. Because flexible use would fatally interfere with existing public safety communications, it would be a devastating decision to employ flexible use in the 700 MHz narrowband spectrum at any time in the foreseeable future (at least 15 more years).

The Commission seeks comment on eight issues related to flexible use: (1) current and anticipated use of the 700 MHz narrowband networks; (2) issues related to how flexibility would promote efficiency; (3) use of the guard band for flexible use; (4) impact of flexible use on 700 MHz narrowband interoperability; (5) how much of the narrowband and guard band spectrum should be made available for flexible use; (6) what role would 700 MHz RPC's play in implementation of flexible use; (7) what would be the impact of allowing flexibility on the development of broadband, narrowband, and dual-use equipment in the 700 MHz public safety spectrum; and (8) issues relating to the commission's rules to narrowband 700 MHz to 6.25 kHz bandwidth channels by December 31, 2016.

I. THE COMMISSION MUST PROTECT THE 700 MHz NARROWBAND SPCTRUM AND
PRESERVE ITS USE BY PUBLIC SAFETY ELLIGIBLE ENTITIES UNDER CURRENT

COMMISSION RULES. USE OF THE 700 MHz NARROWBAND SPECTRUM IS SUBSTANTIAL IN KING COUNTY AND WILL INCREASE IN THE FUTURE AS CURRENT NETWORKS ARE REACHING THE END OF THEIR USEFUL LIVES, OR MORE CAPACITY IS NEEDED, AND/OR NEW SERVICES ARE NEEDED.

Frequencies, regardless of band, are very difficult to come by in the Central Puget Sound Region, and especially in King County due to current system build outs and proximity to Canada. In King County there is virtually no useable spectrum outside the 700 MHz narrowband spectrum to build or expand current Land Mobile Radio (LMR) operations. The assertion that VHF and UHF narrowbanding functions are going to double (and ultimately quadruple) spectrum in those bands is technically true, but in practice will never be realized.

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 to Canada and it is therefore very difficult, if not impossible, to license those channels at elevated sites that can provide wide area coverage. A very optimistic guess is that maybe 20-25% of the VHF and UHF channels that now have prohibited channel overlap at 25 kHz will become clear (in terms of being able to be licensed at usable sites) when adjacent channel users have narrowed their channel bandwidth to 12.5 kHz. This is because nearly all of the "interstitial" 12.5 kHz channels created by the move to a 12.5 kHz channel bandwidth are already licensed at 12.5 kHz bandwidth; close enough to the existing 25 kHz channels that a new 12.5 kHz channel on the channel adjacent to the existing 25 kHz channel in the same location would have prohibited overlap. The circumstances are not likely to improve significantly with the transition to 6.25 kHz, especially since the likely transition in public safety systems will be to P25 Phase 2, which will continue to operate on 12.5 kHz channels with "6.25 kHz equivalent spectrum efficiency."

Therefore 700 MHz narrowband spectrum is generally the only frequency resource available for build out of new systems or expansion of current ones.

King County has made significant investment in 700 MHz LMR operations. Not only has it invested \$39 Million for a new transit radio system, it has also committed another \$36 Million in two other interrelated projects that are dependent upon and highly integrated with the radio system. These efforts began in 2000 and 2002 respectively. It should also be noted that 700 MHz was chosen because no other spectrum was available which would support our needs.

Looking forward the Central Puget Sound in general, and King County specifically, is currently studying how a next generation voice and data system would likely be constructed, governed, and

operated. Consulting efforts are currently underway which will result in recommendations for technical solutions, operations and governance of this system. Obsolescence of the current county emergency radio system is forcing this transition. As currently envisioned this will likely be either a single system covering King and two adjacent counties, or it will be built using a system of systems approach with highly integrated networks. In any event, it is very likely that given the proximity of the 700 MHz narrowband spectrum to the 800 MHz NPSPAC spectrum, a future system will consist of both 700 and 800 MHz. This future system will cover over 50 percent of Washington State's population and be used by over 35,000 subscriber units. Continued regulatory uncertainty will complicate our decision process.

II GIVEN THAT WIRELESS BROADBAND TECHNOLOGY IS NOT CURRENTLY SUFFICIENT TO REPLACE 700 MHz TODAY AND THAT BROADBAND AND NARROWBAND ARE NOT GOING TO BE ABLE TO COEXIST IN THE SAME GEOGRAPHY, BROADBAND'S INTRODUCTION INTO THE NARROWBAND SPECTRUM WOULD BE INEFFICIENT AND PROBLEMATIC.

Current LTE technology is not mature enough for public safety use as the sole means of emergency communications. We applaud the Commission and industry for the exciting new possibilities that LTE will bring to public safety wireless broadband data. However since the technology does not currently embody voice services nor is it envisioned to in the near future it is not practical to have LMR systems transition from narrowband operations to LTE or any other commercially available 4G wireless broadband offering.

Public Safety voice communications typically take place in one of three forms: Dispatch (one to many), User to User (one to one), or radio to radio simplex mode (talk around). The current LTE Standard which will be used in the first generation of systems deployed nationally will be the 3rd Generation Partnership Project (3GPP) Release 8. While releases 9 through 11 are under development, it is clear they will not be commercially available for deployment within the next three years. Since none of the releases currently adopted by 3GPP, or under development, have voice services defined in a way to fully support Public Safety, it is clear that we will not be able to transition to LTE for all our wireless communications needs. Until broadband technology advances to the point that allows dispatch and simplex calling, it will not meet the needs of first responders.

Interference is another major factor in the discussion about flexible use of the spectrum. It will appear as:

• direct interference to the public safety narrowband subscriber units by downlink signals broadcast from the broadband system's cell sites...In the case of a broadband system operating in the 700 MHz [narrowband spectrum] (under the proposed "Flexible Use" policy), there is potential for interference both from the desired "in-band" signals of the broadband system (if public safety narrowband subscriber units are in the same block of spectrum as the broadband system) and from

out-of-band emissions from the broadband system if the broadband and narrowband systems operate in different segments of the [narrowband spectrum] .

This interference will manifest itself in the form of noise in the receiver units. We find this unacceptable as it will desensitize the receiver front-ends and create to what looks to users as a loss of signal strength. This reduction in received signal strength will tax current systems beyond their design and produce significant coverage holes throughout our networks.

We further argue that allowing flexible use of the spectrum in regions that have no current narrowband spectrum in use is also unacceptable. In areas where agencies have not built out 700 MHz narrowband systems it is probable that due to constraints on frequency availability 700 MHz is the only spectrum which could be used to build interoperable networks.

III THE COMMISSION SHOULD NOT ALLOW FLEXIBLE USE OF THE 700 MHz SPECTRUM NOR SHOULD ITS RULES BE MODIFIED TO ALLOW USE IN THE GUARD BAND.

For all the reasons stated above the Commission should not change its rules to allow for flexible use of the 700 MHz narrowband spectrum. The premise of flexible use is tragically flawed. The possibility of out of band emissions (OOBE) from flexible use and or build out of broadband systems in the Public Safety Broadband Spectrum will be problematic at best.

With respect to out-of-band emissions, the FCC's Rules specify the current OOBE (Out of Band Emission) power limit for public safety broadband systems operating in the 763-768/793-798 MHz public safety broadband (PSBB) band segments as -46 dBm in a 6.25 kHz band segment within the [public safety narrowband spectrum] base station and mobile transmit bands (769-775 MHz and 799-805 MHz) . This is equivalent to a spectral power density of -84 dBm/Hz at the antenna terminals of the broadband base station. Assuming a transmitter output power of 40 Watts for the broadband base station, it is possible to calculate the spectral power density (in dBm/Hz) of the OOBE noise at the antenna terminals of a typical narrowband public safety subscriber unit operating in the vicinity of a typical broadband cell site as shown below in Table 1:

Broadband Base Station TPO +46 dBm (40 Watts)
OOBE Spectral Power Density at BB TX Output -84 dBm/Hz
Broadband Base Station Antenna System Net Gain +14 dBd
Free Space Path Loss @ 769 MHz -75 dB @ 950 feet from base station antenna
Narrowband Subscriber Unit Antenna Gain -9 dBd (Portable radio at head level)
OOBE Spectral Power Density at BB TX Output -154 dBm/Hz
Table 1- Broadband OOBE Spectral Power Density at Narrowband Subscriber Unit

Assuming that the narrowband subscriber unit has a Noise Figure (NF) of 8 dB, its thermal noise floor will be $(-174 + 8) = -166$ dBm/Hz. As shown in Table 1, the OOB noise has a power level 12 dB higher than the thermal noise floor. The composite sum of the thermal noise floor of the radio and the broadband OOB noise power is 153.7 dBm, which degrades the effective receive sensitivity of the narrowband subscriber unit by 12.3 dB.

As demonstrated above the existing OOB power limit for broadband systems is not adequate to protect narrowband subscriber units operating in the vicinity of a broadband system cell site when the broadband system operates in the 700 MHz PSBB band (763-768/793-798 MHz), which will be the band used by broadband systems implemented under the various waivers currently granted to local jurisdictions for use of the PSST 700 MHz spectrum. In order to protect narrowband systems, these systems will need to suppress their OOB levels significantly below the level specified in §90.543(e)(1) of the Commission's Rules.

In addition to this, receiver inter-modulation interference is likely to be experienced in narrowband subscriber units from broadband systems operating in the same frequency bands. The Radio Frequency pre-selectors used in narrowband operations are not capable of attenuating these signals, making the units especially susceptible to this type of interference, and again decreasing the sensitivity of the narrowband radios themselves.

For these reasons and other reasons stated in these comments, we assert that 700 MHz narrowband spectrum will be unusable if broadband operations are allowed in the band and ask that until such time as the broadband technology works sufficiently and could completely replace narrowband operations, that flexible use of the spectrum be prohibited.

IV FLEXIBLE USE WILL SET BACK EFFORTS TO INCREASE INTEROPERABILITY WITHIN THE 700 MHz NARROWBAND SPECTRUM

Some argue that public safety has been slow to build out narrowband capable systems in 700 MHz because there is no operational need to build out. Along with this perception, public safety has been actively seeking expansion of the spectrum from which it could build its own or use a commercially provided wireless broadband network. It would seem like the Commission's response to these issues is to consider the flexible use of the 700 MHz narrowband spectrum for broadband operations. The flaw in this thinking is the combination of both issues into a single issue. They are in fact two separate issues. Public safety organizations have consistently balanced end of system lifecycle issues against the regulatory uncertainty of the 700 MHz narrowband spectrum. Since King County has begun construction of its \$39 Million narrowband system, the frequency landscape has changed as a result of frequency realignment to create the Public Safety Broadband Spectrum. Regulatory uncertainty is an adversary to public safety and interoperable communications, and continuing an

uncertain environment will only handicap our ability to plan and implement effectively. Therefore we argue that the relative lack of build out in 700 MHz narrowband spectrum is due to a myriad of reasons, but not because of a lack of needed spectrum for voice operations.

Public Safety broadband networks are not likely to be built with the same density as commercial networks due to the cost of building those additional sites. Rather, it is more likely that adequate and sustainable throughput rates will be realized with the aggregate of total channel width (combining the 700 MHz upper block with the Public Safety Broadband spectrum for instance) not from density of cell sites within a given geography or region.

Because of the relative low use of narrowband frequencies today, voice interoperability can be built from the ground up in the 700 MHz spectrum, rather than having to retrofit systems. Even if the notion was to allow flexible use only in areas where Narrowband operations have not been established, it would be counterproductive against interoperability, because the interference issues noted will prevent narrowband from ever being implemented in these areas.

V NEITHER THE 700 MHz NARROWBAND SPECTRUM NOR THE GUARD BAND SHOULD BE MADE AVAILABLE TO BROADBAND FOR FLEXIBLE USE UNTIL SUCH TIME AS ALL NARROWBAND OPERATIONS HAVE CEASED.

Since it seems clear that these technologies are incompatible and will not be able to coexist in the same geography or in adjacent geographies at the same time, and both in-band and out-of-band emissions are sure to be sources of interference, it is also clear that neither shared spectrum nor guard bands should be flexibly used. We would qualify this statement with the concept that if broadband services are enhanced to the extent to fully support all voice needs and it was practical and affordable to deploy such systems to replace LMR, then the issue would be moot.

We would also question if shared use of the spectrum may be in conflict with frequency plans and treaties in place between the United States and Canada or Mexico as these issues may need to be addressed as well.

VI 700 MHz RPCs SHOULD REMAIN AS THE AUTHORITY FOR COORDINATION OF ALL FREQUENCY USE IN THE NARROWBAND SPECTRUM UNDER ALL CONDITIONS.

700 MHz RPCs have shown to be a valuable commodity in coordinating for effective use of both 700 and 800 MHz spectrum. We do not envision any need to move from this coordination model. Licensees at all levels should be required to have showings for use of channels within this spectrum and demonstrate that co-channel and adjacent channel interference will not be problematic as well as that their frequency use proposals are consistent with RPC Plans.

VII FLEXIBLE USE OF THE NARROWBAND SPECTRUM WOULD INHIBIT INTEROPERABILITY OF BROADBAND NETWORKS NOT ENHANCE IT

We are already concerned that devices will not be readily available to support commercial broadband and public safety broadband both. It appears as though Broadband devices manufacturers in the industry are indicating their intentions to segregate between band 13 and band 14 if left to their own plans. Opening the narrowband spectrum to broadband would most likely further segregate the device manufacturers without additional rule making from the commission, thereby decreasing interoperability, not increasing it. If fewer device manufacturers are making devices for public safety spectrum it is foreseeable that devices will be highly priced as the development costs will not be offset by high device sales as will be the case in the commercial market.

Device issues aside, coordinating authentication and authorization on these limited networks will also complicate the issue and create interoperability challenges. Additionally, it is not clear how Public Land Mobile Network (PLMN) ID limitations may impact systems that could be deployed both in the narrowband spectrum and the Public Safety Broadband spectrum. What is clear is that there are more questions than answers about how these broadband systems may be able to operate in several segments of the 700 MHz spectrum simultaneously.

VIII NARROWBANDING THE 700 MHz SPECTRUM TO 6.25 kHz BANDWIDTH CHANNELS IS A DISIREABLE END STATE UNDER CURRENT COMMISSION RULE.

As stated earlier continued change to the regulatory environment is counterproductive to both fiscal responsibility and continued efforts to build interoperability into future or existing LMR narrowband systems. We see no rationale that would support changes to the planned Narrowbanding of the 700 MHz spectrum to achieve 6.25 kHz spectral efficiency. Providing a predictable future is the only way that public safety agencies have any hope of making cost effective and operationally efficient decisions for their communications networks.

Sincerely,

/s/ David Mendel

King County Radio Communication Services