Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
The Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Communications Requirements Through the Year 2010	)))))	WT Docket No. 96-86

COMMENTS OF MOTOROLA, INC.

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SUMMARY

Motorola supports the proposed revisions to public safety 700 MHz band plan submitted by the National Public Safety Telecommunications Council ("NPSTC") which would allow public safety users the flexibility deploy either wideband or broadband systems based on their specific needs.

The existing 700 MHz public safety band plan was crafted to effectively meet the unique voice and data needs of public safety by providing a combination of 12 MHz of spectrum for narrowband channels and 12 MHz for wideband channels. To provide both flexibility and full interoperability, the Commission identified channels for general use, interoperability, and reserve spectrum. This combination provides licensees flexibility to deploy a variety of technologies to best meet their needs, within the constraints of the spectrum available, while ensuring support for common channels to provide the highest level of standards-based interoperability.

Since the adoption of the original band plan, there has been growing public safety interest in the benefits of data and video as a supplement to mission critical voice systems. Motorola supports providing flexibility to allow public safety agencies to aggregate wideband channels beyond 150 kHz to enable the deployment of broadband systems based on the needs of the particular public safety user or region. It is important to note, however that there are significant tradeoffs in choosing to deploy wideband or broadband technologies.

Public safety agencies operate in a wide range of environments, from dense urban population centers to sprawling suburban areas to sparsely populated mountainous regions, and require communications throughout all of these terrains. Accordingly, the requirements of a public safety telecommunications system vary greatly and there is not a simple, one size fits all communications system or configuration that meets public safety's wide variety of needs.

Systems must provide a balance among many factors including coverage, data rate, interoperability requirements, reliability, compatibility with current systems and cost. Given these variations, different users are likely to prioritize the tradeoffs among wideband and broadband differently. It is important that the Commission continue to provide the capability for wideband, as well as add the option for broadband.

In contrast to the plan submitted by NPSTC, Lucent's proposal limits public safety's technology choice to just broadband, providing users no flexibility to choose a best-fit solution. As indicated above, public safety's needs vary. In some situations, broadband technologies may be ideal to meet certain public safety agencies' needs; however, in other situations, wideband technologies may be more appropriate. Lucent's proposal advocates that the Commission modify the rules such that users have no option but to deploy broadband systems in the 700 MHz data spectrum. Motorola does not support such an approach because it ignores the reality of the differences between wideband and broadband systems.

The Commission has the opportunity to greatly advance the prospects for interoperable data communications systems by adopting the TIA 902(SAM) standard for the interoperability channels now – as systems are just beginning to be deployed. Failure to act now could lead to deployment of numerous incompatible systems based on proprietary technologies and make it costly, if not impossible for public safety to ever reach the highest, most effective level of interoperability. The TIA 902(SAM) standard is documented and published by both TIA and ANSI and provides the necessary and appropriate framework as an interoperability standard for public safety.

TIA 902(SAM) was chosen by TIA participants as the interoperability standard for 700 MHz wideband operations. In adopting this standard, multiple public safety agencies and vendors provided input, allowing the standard to be modified to meet both public safety and vendor needs. As a result, it is suitable for a wide variety of applications, including direct unit-to-unit communications, which are essential in areas where infrastructure has not been constructed or has been destroyed. In addition, it allows for wide area coverage, an essential element of any wideband standard. Accordingly, equipment can be used by a variety of agencies in multiple ways. Finally, Motorola has committed to royalty-free licensing of TIA 902(SAM)'s essential intellectual property rights for use on 700 MHz interoperability channels, thereby allowing multiple vendors to develop and market TIA 902(SAM) equipment in a more cost-efficient manner. For these reasons, the FCC should adopt TIA 902(SAM) as the interoperability standard for wideband operations in the 700 MHz band.

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Motorola, Inc. ("Motorola") hereby submits these comments in response to the Eighth Notice of Proposed Rulemaking in the above-captioned proceeding.[1] In this phase of this proceeding, the Commission is seeking comment on whether the channeling plan for the existing twenty-four megahertz of public safety spectrum at 764-776 MHz and 794-806 MHz ("700 MHz public safety band") should be modified to accommodate broadband communications systems.

As further discussed below, Motorola supports the proposed band plan submitted by the National Public Safety Telecommunications Council ("NPSTC"). This plan would modify the FCC's rules so that Regional Planning Committees ("RPCs") and the public safety users that they represent can choose to deploy either wideband or broadband systems based on their specific needs. The NPSTC band plan also incorporates guard bands, which are essential to provide interference protection to narrowband channels. Motorola opposes the recommendations

[1] *The Development of Operational, Technical, and Spectrum Requirements for Meeting Federal, State, and Local Public Safety Communications Requirements Through the Year 2010*, Eighth Notice of Proposed Rulemaking, 21 FCC Rcd 3668 ("*8th NPRM*").

submitted by Lucent, which would mandate the use of broadband technology and leave users with no flexibility in the selection of wideband or broadband systems.[2]

I. Introduction and Summary

Motorola believes that emergency first responders should have access to reliable and interoperable communications which meet their specific needs. To this end, Motorola submitted a preliminary plan in December, 2005, that provided a framework within which public safety entities could deploy broadband and/or wideband operations in the 700 MHz public safety band, depending on local requirements, while protecting narrowband operations from interference and continuing to provide an adequate quantity of spectrum for wideband interoperability.[3]

In February of 2006, NPSTC submitted a plan with attributes similar to Motorola's proposal.[4] Like the Motorola proposal, the NPSTC plan incorporated guard bands to help protect existing narrowband channels. The NPSTC plan also included the availability of wideband interoperability channels while providing flexibility to implement broadband systems. The NPSTC proposal, which was vetted throughout the public safety community, provides users with some additional flexibility in deploying broadband and wideband operations compared to Motorola's preliminary plan while still providing spectrum for wideband interoperability. Accordingly, Motorola supports adoption of the 700 MHz rechannelization proposal submitted by NPSTC.

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[2] *See id.* at ¶¶ 20-21.

[3] Letter from Steve B. Sharkey, Motorola, to Marlene H. Dortch, FCC, WT Docket Nos. 96-86, 05-157 (filed Dec. 9, 2005) ("Motorola Proposal"). *See also 8th NPRM* at ¶¶ 15 – 17.

[4] Letter from Vincent R. Stile, Chair, National Public Safety and Telecommunications Council, to Michael J. Wilhelm, FCC, WT Docket Nos. 96-86, 05-157 (filed Feb. 6, 2006).

II. Affording Flexibility To Implement Broadband And Wideband Operations Will Allow Public Safety Entities To Deploy Systems That Best Meet Their Needs.

The existing 700 MHz public safety band plan was crafted to effectively meet the unique voice and data needs of public safety by providing a combination of 12 MHz of spectrum for narrowband channels and 12 MHz for wideband channels.[5] To provide both flexibility and full interoperability, the Commission identified channels for general use, interoperability, and reserve spectrum.[6] This combination provides licensees flexibility to deploy a variety of technologies to best meet their needs, within the constraints of the spectrum available, while ensuring support for common channels to provide the highest level of standards-based interoperability.

Over the past few years, Motorola has made available for sale dual band digital mobiles and portables that can operate in both the 700 MHz narrowband channels and in the 800 MHz band. Over half a million of these radios have been shipped to date. These dual band mobiles and portables provide public safety with the option to include 700 MHz band capability when deploying new or upgraded 800 MHz units. Motorola also conducted a very successful trial of a wideband 700 MHz system with Pinellas County, Florida. The wideband trial tested the wideband technology in an actual public safety operational environment, providing high speed data and supporting video applications. Accordingly, technology is currently available for the band and there has been significant progress in seeding the base of dual band 700/800 MHz

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[5] One-half of the wideband allocation was designated by the FCC to be held in reserve in order to accommodate future needs for narrowband, wideband, or broadband that may be identified through the regional planning process or developments in technology.

[6] The FCC designated 12.5 MHz of spectrum for general use (which consisted of 7.7 MHz for narrowband use and 4.8 MHz for wideband), 2.6 MHz for nationwide interoperable communications (which consisted of 0.8 MHz for narrowband interoperability and 1.8 MHz for wideband interoperability), and 6 MHz for reserve (0.6 MHz reserved for narrowband; 5.4 MHz for wideband).

portable and mobile radios so that the 700 MHz band can be fully utilized to meet capacity and interoperability requirements as broadcast television stations are cleared from the band.

Since the adoption of the original band plan, there has been growing public safety interest in the benefits of data and video as a supplement to mission critical voice systems. Over the last year or so, public safety has also increased its focus on broadband technology as one of the potential solutions to provide data and video. Motorola has consistently supported the need for public safety to have access to spectrum for wide area broadband systems. While Motorola does not believe that the current allocation of spectrum is sufficient to fully meet the needs of public safety, we support providing flexibility to allow public safety agencies to aggregate wideband channels beyond 150 kHz to enable the deployment of broadband systems based on the needs of the particular public safety user or region.[7] It is important to note, however that there are significant tradeoffs in choosing to deploy wideband or broadband technologies.

Public safety agencies operate in a wide range of environments, from dense urban population centers to sprawling suburban areas to sparsely populated mountainous regions, and require communications throughout all of these terrains. Accordingly, the requirements of a public safety telecommunications system vary greatly and there is not a simple, one size fits all communications system or configuration that meets public safety's wide variety of needs. Systems must provide a balance among many factors including coverage, data rate, interoperability requirements, reliability, compatibility with current systems and cost. Given these variations, different users are likely to prioritize the tradeoffs among wideband and broadband differently. It is important that the Commission continue to provide the capability for

[7] If given this flexibility, the 700 MHz Regional Planning Committees and the public safety users who comprise those committees, would determine whether wideband and/or broadband technologies would be deployed in a particular geographic area.

wideband, as well as add the option for broadband. Therefore, Motorola supports the NPSTC proposal which offers RPCs and users the option to determine whether wideband or broadband technologies best meet their needs.

In contrast to the plans submitted by Motorola and NPSTC, Lucent's proposal limits public safety's technology choice to just broadband, providing users no flexibility to choose a best-fit solution.[8] As indicated above, public safety's needs vary. In some situations, broadband technologies may be ideal to meet certain public safety agencies' needs; however, in other situations, wideband technologies may be more appropriate. Lucent's proposal advocates that the Commission modify the rules such that users and RPC's have no option but to deploy broadband systems in the 700 MHz data spectrum.[9] Motorola does not support such an approach because it ignores the reality of the differences between wideband and broadband systems.

III. The Tradeoffs In Choosing Between Wideband And Broadband Systems Are Substantial

Motorola has developed extensive information regarding how various systems and technologies balance the different considerations public safety users face in choosing systems for deployment.[10] In our view, there are at least four areas where a user must consider the tradeoffs associated with the decision to deploy wideband or broadband technologies, or some mixture of both: 1) coverage, 2) data rates, 3) accommodation of multiple agencies, and 4) interoperability. The considerations associated with each of these factors are discussed throughout these comments.

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[8] Letter from Michael T. McMenamin, Lucent, to Marlene H. Dortch, FCC, Docket Nos. 05-157, 96-86, 3 (filed Dec. 2, 2005).

[9] *Id.* at 2.

[10] *See e.g.,* Letter from Steve B. Sharkey, Motorola, to Marlene H. Dortch, FCC, WT Docket Nos. 96-86, 05-157 (filed Oct. 27, 2005).

A. Coverage

In Motorola's experience, coverage is a critical consideration that factors into every public safety system deployment. Public safety responders must be able to communicate in remote or sparsely populated areas that are often not served by commercial systems. In comparing different data solutions, public safety users will need to balance data rates or throughput with the amount of infrastructure needed to provide coverage over the needed area of operation.

For mobile coverage, a broadband system will require approximately five times the number of transmit sites as a wideband system to provide equivalent reliability. In contrast, wideband systems using the TIA 902(SAM) technology could provide reliable mobile coverage using essentially the same number of transmitter sites as narrowband voice systems. The following table summarizes this impact based on specific technologies:[11]

Table 1: Wideband-Broadband Tradeoffs: Coverage

	Number of Transmitter Sites			
	P.25 Voice 12.5 kHz	**TIA 902(SAM) 50 kHz**	**TIA 902(SAM) 150 kHz**	**EVDO**
Medium-Sized City (50 square miles) Mobile Coverage	1	1	1	5
Medium-Sized City (50 square miles) Portable Coverage	2	5*	5*	7
Suburban County (500 square miles) Mobile Coverage	3	5*	6*	24
Suburban County (500 square miles) Portable Coverage	17	44*	45*	61

*Motorola has identified enhancements to TIA 902 system designs and protocols that will further reduce the number of transmitter sites needed to cover a particular and more closely match the number of transmitter sites needed for narrowband voice systems.

[11] *See* Appendix A for a description of the assumptions used to develop analysis.

This data shows users with an existing voice system are more likely to have the opportunity to provide wideband data by simply reusing their current voice system sites. While the difference is less drastic for portable coverage, it is still significant when the delta between needed data sites and existing voice sites is considered. The Commission should provide users the option to decide whether wideband or broadband is the best fit with their current communications system and most appropriate based on their communications needs and budget.

B. Data Rates

Another tradeoff that must be confronted when choosing between wideband or broadband systems is the data rates that can be achieved by either system. Broadband systems provide higher data rates than wideband systems because they utilize more spectrum bandwidth per channel. When considering data rates, it is important to remember that both wideband and broadband systems exhibit "peak" and "average" data rates. Peak rates, which are typically quoted in non-technical information, are generally the fastest rate that a user would experience in an ideal environment, *e.g.*, strong signal conditions with virtually no interference that would require transmission "retries." The average rate is the rate most likely to be experienced under normal conditions of signal strength, loading, etc.

The other technology factor is the rate of decline in data rates as the user moves away from the transmitting tower. EVDO is optimized for data rates very near a transmitter site but data rates drop off quickly as the user moves away from the tower. However, in order to minimize the number of sites (as mentioned above to reduce interference potential) the coverage per site needs to be optimized. This introduces another factor to consider – data rates near the coverage fringe which represent the lowest data rate of a system design.

In addition, systems exhibit an outbound rate and an inbound rate, which are not necessarily the same value. The outbound rate refers to the data rate of the information traveling the path from the base transmitter out to the mobile or portable unit. The inbound rate refers to the rate of the information traveling from the mobile or portable back to the base transmit site. Most broadband technologies used by public carriers are optimized for outbound (*i.e.*, transmissions to the cell phone), while TIA 902(SAM) was designed to provide a more balance communications system to accommodate the more common need of public safety responders sending inbound communications to a dispatcher. This is especially critical with inbound video transmissions.

The following table shows the inbound data rates expected from both wideband and broadband technologies. The accompanying graphic shows how data rates fall off at the fringe of a data transmitter's service area.

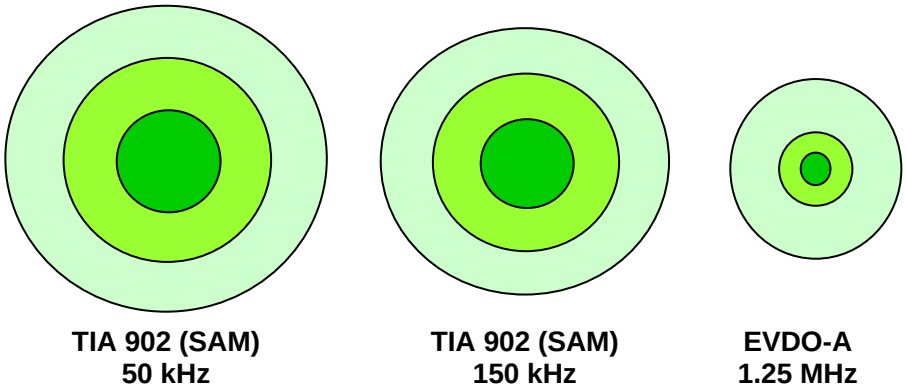

Table 2: Inbound (Uplink) Data Rate Performance

	TIA 902(SAM) 50 kHz	**TIA 902(SAM) 150 kHz**	**EVDO-A 1.25 MHz**
User Speed[1]	24k - 70k	80k - 280k	80k - 1,000k
Avg. Channel Throughput[2]	40k	150k	300-500k

Note 1: Assumes three users on one channel, spread across the service area
Note 2: N=1 for EVDO

C. Accommodation of Multiple Agencies

Typically, public safety agencies have needed to maintain some level of control over their communications systems. Most agencies own and operate their own system on channels licensed to that agency. In more recent years, larger statewide systems have been built to serve both the state and any multiple agencies who agreed to have their communications needs be met by sharing the state system. Some examples include the State of Michigan and the State of Utah, both successful 800 MHz systems. Given the limited amount of spectrum available, wideband channels will provide greater flexibility for accommodating multiple systems, while broadband deployments may be better suited to shared systems offering access to all agencies in a given area.

Therefore, as public safety users weigh whether to choose wideband or broadband systems, another factor that may come into play is the direction that the choice dictates with regard to individual versus shared control. Under the band plan that NPSTC and Motorola support, users would have the choice of up to 120 wideband channels of 50 kHz each or up to 3 broadband channels of 1.25 MHz each. As shown in the plan submitted by NPSTC, each broadband deployment requires a guard band on each side of the wideband channel(s) to protect nearby narrowband voice operations or adjacent wideband operations.

Considering the width of the broadband channel and the associated guard band required, deployment of broadband in a given area eliminates a significant number of wideband channels in that same area. Table 3 shows the number of wideband channels that would be eliminated given various broadband deployment options. Given that no more than 3 broadband channels can be accommodated in the currently available public safety spectrum, multiple agencies would need to agree on and plan the deployment and use of a shared system when broadband

technology is chosen. When wideband technology is chosen, agencies have more options to plan and operate under either a dedicated or a shared system. Table 3 also shows the relative number of general use wideband channels that would continue to be available, depending on various broadband deployment scenarios.

Table 3: Wideband-Broadband Data Tradeoffs: Number of Channels

Number of Adjacent 1.25 MHz Broadband Channels	Spectrum Required (Including Guard Bands)	Number of 50 kHz Wideband Channels Consumed (120 channels total)	Number of 50 kHz Wideband Channels that Remain Available For Use
1	3.2 MHz	64	56
2	4.45 MHz	89	31
3	5.7 MHz	114	6

Motorola reaffirms its support for users to have the option to choose the best fit data solution to meet their needs, whether wideband or broadband, within the constraints of the spectrum available. Given that constraint, it is unlikely that public safety can meet all of its wideband and/or broadband requirements at 700 MHz. In crafting a solution, public safety therefore will need to consider other available bands, such as the 4.9 GHz band, which could provide additional capacity for public safety broadband data.

IV. <u>Protection Of Public Safety Narrowband Voice Spectrum Is Essential.</u>

NPSTC has clearly and consistently stated the importance of maintaining and protecting the current allocation of narrowband channels in the 700 MHz band as the Commission reviews options for accommodating broadband deployments.[12] Motorola strongly supports NPSTC in this position.

[12] *See, e.g.*, Letter from Vincent R. Stile, NPSTC, to Michael J. Wilhelm, FCC, Docket

Significant progress has been made in the development and deployment of narrowband technologies in the 700 MHz band. Multiple regions have submitted and the FCC has approved 700 MHz plans.[13] Indeed, all regions have initiated coordination efforts for the use of this band.[14] Several regions have even begun deploying networks utilizing P25 Phase I equipment in the 700 MHz band. To date, the majority of this development has been for voice communications. Although all public safety communications are critical, voice communications are fundamental when public safety agencies respond to an emergency situation. Accordingly, the narrowband operations that are currently under development and that have already begun to be deployed must be protected from interference.

Given the multi-year and multi-billion dollar process in which public safety and industry is currently engaged to help rid the 800 MHz band of interference, it would be particularly ill-advised not to take all reasonable steps to protect the 700 MHz voice band at the outset of broadband and wideband deployment. Motorola provides additional information in this section of the comments regarding the necessary guard bands and other steps needed to provide this protection.

(Continued . . .)
Nos. 05-157, 96-86 (filed Nov. 18, 2005).

[13] *See, e.g.*, Wireless Telecommunications Bureau Approves Region 19 (New England) 700 MHz Regional Plan, Public Notice, 20 FCC Rcd 14375 (2005); Wireless Telecommunications Bureau Approves Region 12 (Idaho) 700 MHz Regional Plan, Public Notice, 21 FCC Rcd 2382 (2006); *The Region 5 (Southern California) 700 MHz Regional Committee Proposed Public Safety Plan*, Order, Public Notice, 19 FCC Rcd 8110 (2004) (approving Region 5's proposed 700 MHz plan); Comments Invited on Region 39 (Tennessee) 700 MHz Regional Planning Committee Public Safety Plan, Public Notice, Public Notice, 21 FCC Rcd 533 (2006); Comments Invited on Region 22 (Minnesota) Regional Planning Committee Public Safety Plan and Request for Waiver, Public Notice, 21 FCC Rcd 312 (2006).

[14] *See* National Public Safety Telecommunications Council 700 MHz RPC Update (May 2006) *at* http://www.npstc.org/documents/Status%20Map%20700%20RPCs%20051606.pdf.

A. Out-of-Band Emissions

Motorola has examined the out-of-band emissions from both wideband and broadband transmitters and their impact on voice receivers and transceivers in the adjacent narrowband channels. Given the wider bandwidth, broadband emissions roll off more slowly than wideband emissions. One of the key reasons why the public safety community and TIA previously focused on wideband solutions for the 700 MHz public safety spectrum was its ability to be a good neighbor in a relatively small block of spectrum. Off-the-shelf broadband products developed for commercial operations typically are not as good a spectrum neighbor to the narrowband or wideband operations used by public safety because their emissions impact a larger number of adjacent channels.

In assessing the out-of-band interference, and the guard band needed to protect narrowband voice systems, Motorola incorporated an external filter design for base stations based on a commercially available filter. The filter for broadband transmitters provided greater than 25 dB of additional attenuation beyond that required in Section 27.53 of the FCC's rules for commercial operations at 700 MHz. Wideband base station signals were assessed with both a current filter and an improved one which could be readily available by the time the spectrum is cleared.

In conducting its out-of-band interference analysis and the guard band required to help protect narrowband voice operations, Motorola also examined different levels of protection, including a 3 dB, 6 dB, 10 dB and 17 dB rise in the noise floor. Motorola continues to believe that public safety narrowband voice systems should be designed for minimal interference, *i.e.*, less than 1 dB rise in the noise floor. Motorola strongly recommends that the rules for coordination and implementation of broadband systems be based on no more than a 3 dB rise in the noise floor. Based on the additional base transmit filtering for broadband, Motorola

determined that a guard band of approximately 1 MHz is needed on either side of the broadband channel(s) deployed in this band. Table 4 shows the specific results of our analysis.

Table 4: Necessary Guard band for Narrowband Protection

	Noise Floor Increase in Voice Band				
	1 dB noise	**3 dB noise**	**6 dB**	**10 dB**	**17 dB**
1.25 MHz Broadband (OFDM w/ filter)	0.975 MHz	0.950 MHz	0.825 MHz	0.680 MHz	0.500 MHz
TIA 902 (SAM) (150 kHz)	0.275 MHz	0.125 - 0.250 MHz	0.110 MHz	0.100 MHz	0.080 MHz
TIA 902 (SAM) (50 kHz)	0.275 MHz	0.150 MHz	0.140 MHz	0.135 MHz	0.080 MHz

Based on this analysis and an examination of other factors including ability to fit broadband channels within the bandwidth available, Motorola supports the NPSTC proposed plan, which incorporates a 0.975 MHz guard band on either side of a broadband spectrum deployment.

We note that guard bands might still be needed to protect a given voice receive site, even for cases in which a broadband or wideband transmitter is co-located with that receive site. As addressed in the section of these comments regarding coverage, broadband operation requires significantly more sites than voice, so such co-location throughout the service area is unlikely. In contrast, the wider coverage of wideband makes co-location with voice sites much more feasible. Therefore, the guard band is more essential with respect to the deployment of broadband technology.

B. Near-Far Interference

The larger number of sites required for broadband technology presents an additional interference challenge for public safety systems. One of the primary interference mechanisms that the Commission found in the 800 MHz band was interference due to a "near-far" effect. Near-far interference occurs when a receiver is in an area of relatively weak signal coverage from its intended site, but is experiencing a strong signal from an interfering site. In such a situation, the radio is overwhelmed by the interfering signal and is no longer able to differentiate its intended signal and the user cannot communicate.

One of the most effective solutions for resolving near-far interference is to collocate antennas so that the relative strength of both the desired and interfering signals remains the same as a user moves through an area. Co-location is more readily accomplished when deploying wideband technologies because the coverage between a narrowband voice system and a TIA 902(SAM) wideband system can be closely matched for mobile coverage. The larger number of sites required for broadband coverage makes it impossible to co-locate all sites and increases the potential for users to experience near-far interference. This again illustrates the need to maintain flexibility for licensees to deploy either wideband or broadband technology and for the Commission to incorporate interference protection mechanisms in the rules.

C. Intermodulation Interference

Both broadband and wideband technologies have the potential to cause intermodulation interference to narrowband voice operations. Therefore system planning must consider the potential for intermodulation regardless of which technology is used. However, the intermodulation effects are different between wideband and broadband technologies, and related system architectures also play a role. With broadband, the span of potential intermodulation is much greater than that of wideband. Wideband on the other hand may have different levels of

intermodulation, but the signal tends to be confined to several channels. Furthermore, it is far more likely that wideband systems will be co-located with narrowband voice systems at high-elevation antenna sites which will significantly mitigate any effects from intermodulation interference.

Another phenomenon experienced in the 800 MHz interference between commercial and public safety systems is the difference that antenna height can make in the resultant potential for intermodulation interference. Systems that use a low site architecture generally place a higher level of signal in the vicinity surrounding the transmit antenna than that normally experienced from high site systems. This is often the case even though a low site transmitter may have a lower overall power level than a high site transmitter. This occurs because of typical antenna patterns used in low site systems and because there is additional path loss between a high site antenna and the ground compared to that of a low site antenna system. With a stronger interfering signal at ground level, mobile and portable units are more likely to experience intermodulation and overload interference. Again, such real life deployment considerations reinforce the need for public safety to have flexibility in the technology and configuration of the systems deployed in the 700 MHz band.

V. **The Commission Should Adopt TIA 902(SAM) As The Wideband Interoperability Standard.**

Interoperability means the "ability of public safety agencies to talk across disciplines and jurisdictions via radio communications networks to exchange voice and/or data with one another on demand, in real time, when needed."[15] As history demonstrates, interoperability is essential in public safety communications. During the 9/11 terrorist attacks, many first responders were

[15] When They Can't Talk, Lives are Lost: What Public Safety Officials Need to Know About Interoperability, National Institute of Justice, Office of Science and Technology Program (Feb. 2003) *available at* http://www.dhs.alabama.gov/PDFs/cannot_talk.pdf.

unable to communicate with each other because of non-interoperable systems.[16] Even this past year, after the hurricanes in the Gulf, public safety agencies were unable to communicate with each other resulting in significant response delays.[17] This lack of interoperability has time and again resulted in significant, sometimes fatal, delays in emergency response. Indeed, as noted in a recent IACP Project Response, "[a]fter each major event in recent history, the most glaring indication of success or failure by responding agencies has been their ability to effectively communicate with each other."[18]

In response, Congress, the Executive Branch, and the FCC have recognized the importance of interoperability as part of their funding and policy objectives. For example, Congress has introduced multiple bills addressing the need for interoperable communications.[19]

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[16] *See, e.g.*, New FDNY Comm System May Take Years, Associated Press, *available at* http://www.firehouse.com/terrorist/911/18_APfdnycomm.html (noting that, during 9/11, the fire department radios were incompatible with the police radio system and as a result the fire and police squads were unable to communicate).

[17] *See, e.g.*, Mark Benjamin, Communications Breakdown: As the Katrina disaster unfolded, many emergency responders had no way to talk to each other. Why were they so unprepared? (Sept. 9, 2005) *available at* http://dir.salon.com/story/news/feature/2005/09/09/comm_meltdown/index.html (indicating that the lack of interoperable communications remained a significant problem after Hurricane Katrina and providing an illustrative story in which soldiers had to flag a police car down after apprehending two looters because they were unable to communicate with police).

[18] Law Enforcement's Role in Combating and Preparing for Domestic Terrorism, IACP Project Response – Leading from the Front (Oct. 2001) *available at* http://www.theiacp.org/documents/pdfs/Publications/Terrorism.pdf.

[19] *See, e.g.*, Assure Emergency and Interoperable Communications for First Responders Act of 2005, S. 1725, 109th Cong. (as reported by S. Comm. on Homeland Sec. & Gov't Affairs, Sept. 29, 2005) (establishing an Office for Emergency Communications, Interoperability, and Compatibility within the Department of Homeland Security and directing that organization to conduct certain studies and to oversee a grant program for interoperable communications); First Responders Interoperable Communications Act of 2005, S. 1762, 109th Cong. (as introduced Sept. 22, 2005) (authorizing the Secretary of Homeland Security to make grants, on a competitive basis, to states, local governments, local law enforcement agencies, and local fire departments to assist in purchasing interoperable communications); Public Safety Interoperability Implementation Act, H.R. 1323, 109th Cong. (as introduced Mar. 15, 2005)

Similarly, the Department of Homeland Security has initiated the process of selecting standards for equipment used by first responders and instituted a number of grant programs that provide funding for the development of interoperable public safety communications.[20] The FCC itself has noted the need for interoperability, finding that "[e]mergency response providers would benefit from the development of an integrated, interoperable nationwide network."[21]

The Commission has already taken significant steps toward improving interoperability among the public safety community by adopting TIA P25 as the interoperability standard required for use on the 700 MHz narrowband interoperability channels. The Commission must not miss this opportunity to also lay the foundation for data interoperability by adopting the standard for use on the wideband interoperability channels.[22]

(Continued . . .)
(mandating the creation of the Public Safety Communications Trust Fund, administered by the National Telecommunications and Information Administration, to make grants for interoperability communications to meet the needs of public safety, fire, emergency, law enforcement, and crisis management organizations); Connecting the Operations of National Network of Emergency Communications Technology for First Responders Act of 2005, H.R. 1251, 109th Cong. (as introduced Mar. 10, 2005) (requiring the Secretary of Homeland Security to develop a national interoperable communications strategy and creating an interoperable communications grant program to provide money to states and localities).

[20] *See, e.g.*, Review of DHS' Progress in Adopting and Enforcing Equipment Standards for First Responders, Department of Homeland Security, Office of Inspector General, OIG-06-30 (Mar. 2006) *available at* http://www.dhs.gov/interweb/assetlibrary/OIG_06-30_Mar06.pdf.

[21] Report to Congress on the Study to Assess Short-Term and Long-Term Needs for Allocations of Additional Portions of the Electromagnetic Spectrum for Federal, State, and Local Emergency Response Providers, ¶ 26 (2005).

[22] This need for wideband interoperability channels remains true even in if the Commission provides the option to deploy broadband technology. Under a flexible approach it is likely that public safety agencies will deploy wideband systems. Accordingly, wideband interoperability is necessary to ensure that these agencies will be able to communicate with one another. *See 8th NPRM* at ¶ 12

While some argue that an "IP backbone" solution is a better solution for public safety interoperability,[23] Motorola believes that such proposals fail to recognize the inherent shortcoming of this approach in providing the final wireless link to the radio. SAFECOM[24] accurately recognizes that interoperability is a continuum with numerous aspects and levels as depicted below in a diagram developed by SAFECOM. While an IP gateway or backbone can greatly advance communications among a wide variety of users and systems, it falls into the middle of the interoperability continuum as shown on the Technology line in the SAFECOM diagram. The highest level of interoperability is only achieved through use of standards-based systems. The Commission has the opportunity to greatly advance the prospects for interoperable data communications systems by adopting the TIA 902(SAM) standard for the interoperablity channels now – as systems are just beginning to be deployed. Failure to act now could lead to deployment of numerous incompatible systems based on proprietary technologies and make it costly, if not impossible for public safety to ever reach the highest, most effective level of interoperability.

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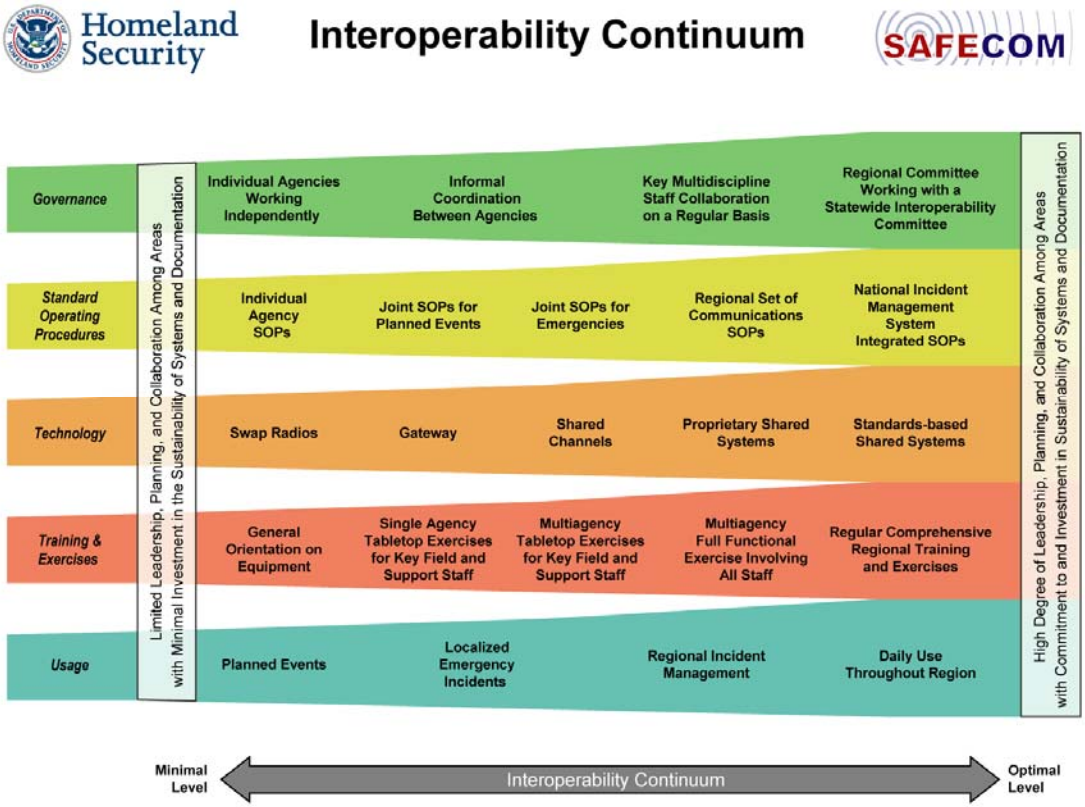
[23] *See, e.g.*, Comments of M/A-Com, Inc., Independent Panel Reviewing the Impact of Hurricane Katrina on Communications Networks, 9-12 (filed Jan. 30, 2006) *available at* http://www.fcc.gov/eb/hkip/PubCom/ma_com.pdf.

[24] SAFECOM is a communications program established by the Department of Homeland Security that provides research, development, testing and evaluation, guidance and assistance on communications interoperability issues for local, tribal, state, and federal public safety agencies. *See* http://www.safecomprogram.gov/SAFECOM/.



TIA 902(SAM) is the right standard. The TIA 902(SAM) standard is documented and published by both TIA and ANSI and provides the necessary and appropriate framework as an interoperability standard for public safety. TIA 902(SAM) was chosen by TIA participants as the interoperability standard for 700 MHz wideband operations. In adopting this standard, multiple public safety agencies and vendors provided input, allowing the standard to be modified to meet both public safety and vendor needs. As a result, it is suitable for a wide variety of applications, including direct unit-to-unit communications, which are essential in areas where infrastructure has not been constructed or has been destroyed. In addition, it allows for wide area coverage, an essential element of any wideband standard. Accordingly, TIA 902(SAM) equipment can be used by a variety of agencies in multiple ways. Finally, Motorola has

committed to royalty-free licensing of TIA 902(SAM)'s essential intellectual property rights for use on 700 MHz interoperability channels, thereby allowing multiple vendors to develop and market TIA 902(SAM) equipment in a more cost-efficient manner. For these reasons, the FCC should adopt TIA 902(SAM) as the interoperability standard for wideband operations in the 700 MHz band.

In contrast, the FCC should not adopt an interoperability standard for public safety broadband operations at this time. Broadband technologies are still in the development stage. Although great strides have been made in terms of broadband development, many questions on how these technologies will operate in the public safety sector remain unanswered. For example, Motorola is not aware of any standardized broadband technology that includes provisions for direct unit-to-unit communications that do not go through the network, an essential feature where no network coverage is available either due to lack of coverage or because the infrastructure has been destroyed. In addition, to our knowledge, no holder of essential broadband intellectual property has made any commitment to license that IPR on a royalty free basis as Motorola has done for TIA 902(SAM).

Existing broadband technologies have been developed with the commercial user in mind and do not currently support all of the features and functions unique to public safety. Accordingly, additional consideration and standards development work is necessary before a broadband interoperability standard is adopted. A more appropriate approach would be to continue to encourage the development of a variety of broadband technologies with industry groups working towards an ultimate interoperability standard that would meet all agencies needs, like TIA 902(SAM). This approach ensures that when a standard is established it will utilize the most appropriate features of the latest technologies, from a public safety perspective.

VI. Conclusion

For the reasons detailed above, the FCC should adopt NPSTC's proposed band plan for modifying the 700 MHz public safety band. This plan provides public safety agencies a high degree of flexibility to tailor their communications networks to their needs. While broadband will provide benefits of higher overall data rates, particularly at locations near the base station antenna, it comes at the cost of installing and maintaining a far greater number of sites and therefore may prove to be cost prohibitive for coverage in suburban or rural areas. Accordingly, in any revised band plan, the FCC must provide licensees flexibility to choose between wideband and/or broadband technologies, not just on a regional basis but also within regions pursuant to plans developed by the RPCs. Such flexibility will provide public safety entities the opportunity to choose technologies based on the most appropriate data solution, taking into account trade offs between data rate, coverage, cost requirements, and interference impact rather than a regulatory mandate as Lucent proposes.

NPSTC has also emphasized the need to protect narrowband voice operations and Motorola has provided some additional information herein that identifies steps to help provide that protection. Mission critical voice services that are being deployed in the 700 MHz narrowband channels provide the backbone of public safety communications and must be protected from interference.

The Commission should also adopt the TIA 902(SAM) standard for use on the wideband interoperability channels in order to lay the foundation for achieving the highest level of interoperability among users. Finally, while Motorola fully supports the accommodation of broadband technologies as an option in this band, we believe that the spectrum available is ultimately insufficient to meet the needs of public safety. Therefore, we urge the Commission to continue to identify and allocate additional spectrum for public safety broadband operations.

Respectfully submitted,

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APPENDIX A: ASSUMPTIONS USED FOR COVERAGE COMPARISON ESTIMATES ON TABLE 1

Usage:

- SAM 50 kHz: Minimum 20 kbps at the edge of the cell, average 50 kbps
- SAM 150 kHz and Broadband 1.25 MHz: Minimum 80 kbps UL and 80 kbps DL at the edge of the cell
- Tier 3 usage definition: 150 MB/user/month
- Average 150 kbps (enabling most Tier 3 applications - web browsing, file downloads, messaging, AVL, occasional live streaming video 15 fps, CIF, mpeg4)
- Number of Tier 3 users: Medium City: 300; Suburban County 1400. 75% Mobile modems

Spectrum:

- 700 MHz upper public safety
- Channel bandwidth: 50 and 150 KHz for SAM, 1.25 MHz for broadband
- Frequency Division Duplex (FDD)

Coverage:

- Area:
  - Medium City: 50 sq. miles
  - Suburban County: 500 sq. miles
- Environment:
  - Medium City: 30% urban, 45% suburban, 25% rural
  - Suburban County: 10% urban, 40% suburban, 50% rural
  - Antenna Height: Medium City = 75; Suburban County = 125’
  - Terrain adjustment: none
  - Coverage reliability: 95% area, 90% contour
- Coverage design:
  - Mobile on-street coverage (13 dB Log Normal fade margin)
  - Portable on-street coverage (13 dB Log Normal fade margin, 8 dB body loss)