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

In the Matter of Improving Public Safety Communications in the 800 MHz Band Consolidating the 900 MHz Industrial/Land Transportation and Business Pool Channels	WT Docket No. 02-55

COMMENTS OF MOTOROLA, INC.

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SUMMARY

Motorola congratulates the Consensus Parties on their collective efforts to develop an extensive and detailed 800 MHz rebanding plan. Public safety associations, private radio associations and Nextel have expended many hours to address this very complex issue. The FCC and affected licensees should now carefully analyze and fully understand the overall impact of the Plan. To assist in that effort, Motorola offers these comments centered on the following areas: (1) the implications of the mechanics of the realignment, including the impact of the Plan on users' ability to continue licensing and implementing system upgrades during the rebanding process; (2) implications of the proposed post-realignment interference mitigation measures; and (3) additional information regarding costs associated with the rebanding.

The Consensus Parties recommend that the Commission impose a freeze on new applications for business, industrial and land transportation systems, as well as high-site SMR systems, on channels 121-400, in order to prevent speculators from impeding the 800 MHz rebanding. This proposed freeze would also apply to applications for existing system modifications. Motorola believes that the limited amount of "white space" in the 800 MHz band leaves little opportunity for speculative activity. Given that the freeze would have significant negative impact on the ability of licensees to modify their systems, Motorola recommends that the proposed freeze not be implemented. At a minimum, any freeze should be limited to new applications and thereby allow existing licensees to continue upgrading their systems, including upgrades that expand coverage areas.

According to the Supplemental Comments, the Consensus Parties would direct a newly created Relocation Coordination Committee (RCC) to work with public safety licensees to implement new systems on the new NPSPAC channels rather than on existing NPSPAC

channels whenever possible. While Motorola appreciates the desire of the Consensus Parties to minimize the instances where newly deployed facilities are required to be retuned, the Commission must ensure that the timely deployment of public safety systems takes priority over the conservation of realignment funds. The RCC's activities should neither create undue delays in the implementation of public safety systems already under development nor have a "chilling effect" on the design of new 800 MHz public safety systems.

Motorola questions whether the proposal to relocate the current NPSPAC spectrum to 806-809/851-854 MHz requires the implementation of additional interference protection measures with regard to TV stations broadcasting on Channel 69 (800-806 MHz). Placing Public Safety directly adjacent to high-powered Channel 69 TV operations raises the likelihood that interference will be more problematic in areas where TV channel 69 stations exist.

The Supplemental Comments set forth recommendations regarding the rights and responsibilities of public safety users, private users and carriers, should interference occur after rebanding is completed. The Consensus Plan proposes that licensees operating base stations in the 851-861 MHz band would be entitled to operate free from measurable interference caused by CMRS operations above 861 MHz, in areas where (1) signal levels at the receiver exceed thresholds of –98 dBm and –95 dBm for existing and new systems respectively; and (2) the users' receivers meet the TIA's Class A performance specifications. Motorola points out that many existing public safety and private wireless users expect coverage at lower signal strengths than these thresholds represent. Therefore, these public safety and private wireless licensees may be required to take additional measures, such as constructing additional transmit sites, to continue receiving interference protection in their fringe coverage areas.

The Consensus Plan proposes the adoption of several receiver performance standards. While Motorola generally supports the adoption of appropriate receiver performance criteria, it is inappropriate to focus on receiver performance as the principal means of providing interference protection for 800 MHz users. Interference is a function of the overall system design and the environment in which the radio operates. The consensus parties have taken steps to better define the radio operating environment, but have unnecessarily restricted acceptable receivers to those that meet Class A specifications. While Class A receivers represent state-of-the-art receiver design, it is possible to design a radio that has performance equivalent to Class A without meeting the Class A specifications. Therefore, the Commission should adopt rules that provide full interference protection to radios that can produce acceptable performance while receiving specified desired signal levels and experiencing a certain level of undesired signal.

Finally, Motorola notes that manufacturers will incur costs directly related to the rebanding by having to develop software needed to support relocation of NPSPAC mobile and portable receivers from the current NPSPAC spectrum to the new NPSPAC block. It is unclear whether these costs were included in the cost analysis provided in Appendix A of the Supplemental Comments and Motorola invites the consensus parties to address this issue.

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Motorola, Inc. ("Motorola") submits these comments on the Supplemental Comments filed by the Consensus Parties on December 24, 2002 in the above captioned proceeding.[1]

The Consensus Parties have developed and submitted an extensive plan in an effort to deal with the complex issues involved in realigning the 800 MHz band. The Commission and affected licensees should now carefully analyze and fully understand the overall impact of the Plan. To assist in this effort, Motorola offers these comments centered on the following areas: (1) the implications of the mechanics of the realignment, including the impact of the Plan on users' ability to continue licensing and implementing system upgrades during the rebanding process; (2) implications of the proposed post-realignment interference mitigation measures; and (3) additional information regarding costs associated with the rebanding. We offer these

[1] Public Notice, Wireless Telecommunications Bureau Seeks Comment on "Supplemental Comments of the Consensus Parties" Filed in the 800 MHz Public Safety Interference Proceeding, WT Docket No. 02-55, DA 03-19 (rel. Jan. 3, 2003); *see also* Improving Public Safety Communications in the 800 MHz Band, Consolidating the 900 MHz Industrial/Land Transportation and Business Pool Channels, WT Docket No. 02-55, Order Extending Time for Filing of Comments, DA 03-163 (rel. Jan. 16, 2003) (extending the comment filing deadline); Supplemental Comments of the Consensus Parties, Dec. 24, 2002 ("Supplemental Comments").

comments to assist the Commission and the industry to determine whether adjustments to the proposed plan are necessary to minimize the impact on incumbent 800 MHz band licensees.

I. INTRODUCTION AND BACKGROUND

Motorola congratulates the Consensus Parties on their collective efforts to develop such an extensive 800 MHz rebanding plan. Public safety associations, private radio associations and Nextel have expended many hours working to develop a plan to address this very complex issue. The Consensus Parties, individual licensees, equipment manufacturers and others will need to dedicate many more hours and resources to implement the Plan.

Motorola is not a member of the Consensus Parties group. However, as a long term member of the industry and an advisor to many of our customers, we have reviewed both the Consensus Plan originally submitted to the Commission on August 7, 2002, and the modifications included in the recent Supplemental Comments.

The August 7, 2002, Consensus Plan proposed to segregate each segment of the 800 MHz band into two principal blocks: a lower block for non-cellular, high-site, high-power system architecture (806-816/851-861 MHz); and an upper block for cellular, low-site, low-power system architecture (816-824/861-869 MHz).[2] The lower block would support public safety, Business and Industrial/Land Transportation ("B/I/LT") and Specialized Mobile Radio ("SMR") licensees that operate with a non-cellular system architecture.[3] A 2 x 2 MHz guard band would be established at the upper end of this block for "campus-type" B/ILT or SMR systems that may

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[2] *See* Reply Comments of Aeronautical Radio, Inc. et al., Aug. 7, 2002, at 8-9 ("August 7 Consensus Plan").

[3] *See id*. at 9.

be able to operate in an environment that would cause interference to wide area systems.[4] The current 3 x 3 MHz National Public Safety Planning Advisory Committee ("NPSPAC") block at 821-824/866-869 MHz would be shifted down to a block of spectrum at 806-809/851-854 MHz, adjacent to the upper end of the 700 MHz band.[5] The Consensus Plan would provide an increase in public safety spectrum by making available some additional 800 MHz channels in a number of markets for public safety use. The number of new channels to be made available for public safety use would vary by market.[6] With regard to funding, the original Consensus Plan states that Nextel would reimburse public safety entities up to $500 million of their relocation costs and this commitment has now been increased as addressed below.[7]

The Consensus Plan also calls for re-designation of Nextel's 700 MHz guard band spectrum for public safety use, re-designation of approximately 4 MHz of Nextel's 900 MHz SMR channels for B/I/LT and SMR use, and the contribution of 2.5 MHz of spectrum in the 800 MHz band for realignment of non-cellular systems.[8] In return, the Plan calls on the Commission to grant Nextel a nationwide 10 MHz license in the 1.9 GHz band.[9]

The Consensus Parties' December 24, 2002 Supplemental Comments modify and provide additional detail on the August 7 Consensus Plan. The Supplemental Comments also revise the funding of the Consensus Plan by including Nextel's commitment to fund up to $850 million in relocation costs of 800 MHz band incumbents – up to $700 million of which is dedicated for public safety licensees – subject to the condition that the Commission grants Nextel a nationwide

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4 *See id*.

5 *See id*. at 11.

6 *See id*. at 15-16.

7 *See id*. at 20.

8 *See id*. at 18.

9 *See id*. at 18-19.

10 MHz license at 1.9 GHz.[10] The Supplemental Comments also provide details regarding: the timeline and mechanics for relocating 800 MHz incumbents under the Consensus Plan; a realignment plan for the Canadian and Mexican border regions; post-realignment interference mitigation measures that define protection of non-cellular incumbents operating in the 851-861 MHz band; and a funding mechanism for relocation costs. Motorola offers the following comments on the Consensus Parties' Supplemental filing.

II. PROCEDURES FOR REALIGNMENT OF THE 800 MHZ BAND

A. The Proposed Freeze on B/ILT and SMR Systems on Channels 121-400

The Consensus Parties propose an aggressive timeline that would complete the realignment of the 800 MHz band in 42 months.[11] During the realignment process the Consensus Parties propose a "freeze" on new applications for B/ILT or high-site SMR ("H-SMR") licenses on channels 121-400 (809-816/854-861 MHz) and on system upgrades by incumbent B/ILT or SMR licensees that would expand the licensees' service area contour.[12]

As noted in the original Consensus Parties' comments and in the Supplemental filing, Rebanding would be implemented by region. Those regions containing licensees with a history of interference would commence rebanding first, followed by high population regions without a history of interference and concluding with lesser populated regions without a history of interference. According to the Supplemental filing, the freeze on B/ILT/SMR modifications as described above would commence nationwide when the Commission issues a Report and Order adopting a plan, and it would continue in a given Region until the Commission has granted all

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10 *See* Supplemental Comments at 5-6.

11 *See id*. at App. D.

12 *See id*. at 26 & n.43.

incumbent relocation applications for the non-cellular block and has certified the specific relocation channel plan in that Region.[13] According to the timeline in Appendix D of the Supplemental filing, the frequency plans for each Region must be completed within 120 or 180 days. However, that is the timing that occurs *once the planning has started for a particular region.* Because all regions will not immediately begin the rebanding process, the freeze will be much longer than 120-180 days in most regions. Those regions that reband last would have the longest time to endure a freeze, *i.e.*, 3 years or more.

Motorola believes this is a very significant burden for licensees to face. Given a climate in which terrorism is of significant concern, a number of the nation's utilities, petroleum companies and others are busy planning and implementing improvements to their communications systems. Such improvements may very well include expansion of service contours to resolve coverage issues. Licensees often find it most efficient from a business standpoint to incorporate multiple improvements to their systems at the same time. These improvements include implementation of newer features, greater spectrum efficiency and coverage improvements all as an integrated package. Freezing the ability to include coverage expansion as a part of such improvements would create unnecessary burdens on licensees and hinder the development of effective communications networks.

In addition to significantly impacting existing licensees, Motorola believes that the proposed freeze is not necessary. The stated rationale for this freeze is that it would prevent speculators from grabbing up the remaining "white space" on B/ILT Pool channels in an effort to impede the relocation of incumbents currently operating on channels 1-120 (806-809/851-854

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[13] *See id* at 26.

MHz) to channels 121-400.[14] However, given congestion of the 800 MHz channels, it is unlikely that there is any significant white space present on these channels, especially in the top 50 markets.

Any remaining 800 MHz capacity will likely be insufficient to support new systems and, therefore, would be of little interest to speculators. Such white space, if it still exists, would be of use primarily to existing licensees seeking to expand their systems to improve their service coverage. Furthermore, given that the possibility of rebanding has been well known for more than a year, it would be surprising if any such speculators had not already acquired white space. Therefore, the proposed freeze would serve little or no purpose.[15]

The harmful effects of the proposed freeze on existing licensees would far outweigh any presumed benefit described in the Supplemental Comments. Motorola therefore recommends that the proposed freeze not be implemented. However, if the Commission should decide to freeze applications for new B/ILT and H-SMR licensees to prevent speculation, Motorola contends that there is no need to extend this freeze to include upgrades to existing licensee's systems. If any freeze is adopted, it should apply only to new applications and thereby allow existing licensees to continue upgrading their systems, including upgrades that include coverage expansion.[16]

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[14] *See id*. at 26.

[15] The preservation of any existing white space on B/ILT Pool channels would not benefit public safety users. Public safety licensees that need to be relocated from channels 1-120 would be relocated either to spectrum vacated by Nextel or to white space in the Public Safety Pool spectrum on channels 121-320. *See id*. at 17. Under the Consensus Plan, public safety applications would continue to be accepted and processed for new assignments on the Public Safety Pool channels. *See id*. at 26.

[16] Transfers of ownership should also not be included in any freeze as they have no material impact on the technical operations of the transferred system. Such changes are not uncommon. For example, utilities and petroleum companies have been undergoing ownership changes to provide more efficient operations in a challenging business climate.

B. **Potential Impact on Public Safety Systems Being Planned or Partially Implemented.**

According to the Supplemental Comments, the Consensus Parties would direct a newly created Relocation Coordination Committee (RCC) to work with public safety licensees to implement systems on the new NPSPAC channels whenever possible. Specifically, the Consensus Plan includes the following recommendation:

> The Consensus Parties recognize that some 800 MHz licensees, including a number of public safety communications licensees, plan to commence new 800 MHz system deployments during the proposed relocation period. Some wide-area, i.e., statewide public safety communications networks, have already commenced construction and have scheduled phased deployments over the next several years. The Consensus Parties recommend that the Commission direct such licensees, from the effective date of the Report and Order herein, to construct such stations and systems on the channels they will be licensed on post-realignment, to the extent possible, thereby avoiding the unnecessary cost and inconvenience of relocating such recently-constructed facilities. Accordingly, the RCC would be responsible for working with such incumbents, and the current licensees of the channels to which they will be relocated, to arrange their initial construction and deployment on the realigned channels whenever possible. Constructing new systems on the realignment channels will facilitate the overall realignment process, reduce realignment costs, and minimize the disruption of incumbent licensee services, consistent with the Commission's objectives as articulated in the [*NPRM*].[17]

Motorola appreciates the desire of the Consensus Parties to minimize the instances where newly deployed facilities are required to be retuned and, where possible, minimize the disruption to licensees. However, the Commission must ensure that the timely deployment of public safety systems takes priority over the conservation of realignment funds. To this end, the RCC's activities should neither create undue delays in the implementation of public safety systems

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[17] Supplemental Comments at 16-17.

already under development nor have a "chilling effect" on the design of new 800 MHz public safety systems.

It is very unlikely that public safety users will know their new NPSPAC frequency assignments when the Commission ultimately issues its Report and Order. Further, given the prioritization approach spelled out by the Consensus Parties, some regions may wait over three years before realignment would begin. For state-wide systems, a licensee's service area may encompass multiple regions, including populated regions that may be planned near the beginning of the transition and less populated regions where planning would fall near the end of the transition period. All of these factors will likely create varying levels of uncertainty among public safety users, as well as the RCC, which may result in deployment delays unless all parties are clear on their priorities.

Further, the Consensus Parties envision that the existing NPSPAC channel assignments would merely be "translated" down to the new spectrum block without the need to redo the regional planning previously performed when the original NPSPAC plans were developed. While this approach may provide public safety with some advanced knowledge of their ultimate frequency assignments, Motorola notes that this does not mean that the new channels will be immediately fungible with the original NPSPAC channels. As addressed in Section IV of these comments, new software must first be developed and installed before a current NPSPAC radio can operate in the new proposed NPSPAC band.

In view of the above, Motorola urges the Commission to ensure that the actions of the proposed RCC committee do not impede the deployment of new public safety facilities. Licensees should have the option to choose the deployment path that meets their requirements.

C. Security of Information

The Consensus Plan would require that licensees submit an extensive amount of information on their communications systems. Appendix C sets forth a list of information approximately four pages long that Public Safety or B/ILT licensees would need to submit.[18] Motorola is concerned that the accumulation of detailed data on so many public safety and critical infrastructure systems in the RCC database could create a potential security risk.

Therefore, Motorola recommends that a Federal Government agency should maintain control over this sensitive data, rather than the RCC. We note that the National Institute of Justice ("NIJ"), which is part of the U.S. Department of Justice, may be an appropriate custodian of this database. Appropriate steps would need to be taken to properly classify the data. While some elements of the data are currently public, an integrated database with the degree of information requested on Public Safety and B/ILT systems provides a much greater security risk than piecemeal data. The NIJ would work closely with the RCC to effectuate the rebanding, while ensuring the protection of sensitive data.

III. POST-REALIGNMENT INTERFERENCE MITIGATION

A. Interference Protection from CMRS Operations

1. Signal Strength Thresholds

Appendix F to the Supplemental Comments sets forth recommendations regarding the rights and responsibilities of public safety users, private users and carriers, should interference occur after rebanding is completed. The Consensus Plan proposes that licensees operating base stations in the 851-861 MHz band would be entitled to operate "free from measurable

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[18] *See* Supplemental Comments at App. C.

interference . . . caused by CMRS operations above 861 MHz."[19] However, this interference protection would apply only if (1) signal levels at the receiver exceed appropriate thresholds;[20] and (2) the users' receivers meet the Telecommunications Industry Association ("TIA") Class A performance specifications.[21] These requirement would require licensees to make various changes in order to qualify for interference protection.

The Consensus Plan proposes two signal strength thresholds for the 851-859 MHz band.[22] For "existing systems", *i.e.*, systems that are under construction or in operation as of the effective date of the Report and Order, a signal strength of –98 dBm or greater would be required in order for a licensee to obtain interference protection in the area of interference.[23] For new or replacement systems, or systems that have been modified or upgraded after the effective date of a Report and Order, a minimum signal strength of –95 dBm would be required.[24] This proposal more clearly defines the interference rights of users, and provides existing systems 3 dB of additional protection compared to new systems. However, Motorola would like to point out that proposed signal strength thresholds do not reflect the expected usable signal strengths of today's public safety systems.

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[19] *Id*. at App. F, § 2.1.1. For voice systems, Appendix F defines interference as a reduction in the ratio of the desired signal to undesired signals and noise below a minimum C/I+N of 20 dB. *See id*. § 1.2. This definition would allow a 3 dB degradation, which is consistent with the standard FCC definition of interference.

[20] *See id*. at 41, App. F § 2.1.1.

[21] *See id*. at 41, App. F § 4.1.1.a.

[22] In the 859-861 MHz guard band, signal strength thresholds progressively increase from 859 MHz to 860.5 MHz and then remain constant from 860.5 MHz to 861 MHz. *See id*. App. F § 2.1.2. In the 860.5-861 MHz sub-band, a licensee with an existing system would be required to attain a signal level of at least –65 dBm (33 dB higher than at frequencies below 859 MHz) to qualify for interference protection. *See id*. Therefore, systems located in the guard band would be required to achieve significant increases in signal strength to obtain protection.

[23] *See id*. at 41, App. F § 2.1.1.a.

[24] *See id*. at 41, App. F § 2.1.1.b

Motorola is concerned that these proposed criteria would require public safety and private licensees operating in the 851-859 MHz band to increase their signal level by approximately 8 to 11 dB from current levels to retain the right to interference protection. Licensees in this band operate noise-limited systems, which will have acceptable audio quality, as defined by TIA Technical Services Bulletin 88, with signal strengths as low as –106 dBm.

To reach the stronger –95 dBm and –98 dBm signal levels proposed in the Consensus Plan, therefore, public safety and private licensees might be required to construct a considerable number of additional transmit sites to their existing systems to obtain interference protection, particularly at the outer areas of their current coverage. Motorola has calculated, for example, that a public safety licensee operating a 10 site system may need to expand its system to 33 sites to achieve a –95 dBm signal level throughout its existing coverage area.[25]

The proposed –95 dBm and –98 dBm thresholds would therefore require public safety/private licensees to make significant investments merely to qualify for interference protection in substantial portions of their coverage areas after rebanding. While higher signal strengths would provide a benefit to licensees in the form of improved systems coverage, the necessary systems modifications would be very expensive to implement and would require the expenditure of licensees' own funds. Moreover, if licensees were unable to make these significant investments, they would receive no interference protection and would have to accept even harmful levels of interference, which could significantly shrink their usable coverage areas. To illustrate the impact on licensees' coverage areas, the following table shows reductions in the approximate coverage radius of public safety/private systems with various base antenna heights, assuming a power of 250 watt effective radiated power ("ERP").

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[25] *See* Letter from Steve B. Sharkey, Director, Spectrum Standards and Strategy, Motorola, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 02-55, Sept. 20, 2002, Attach. at 7.

	500 ft. HAAT	250 ft. HAAT	100 ft. HAAT
Coverage Radius @ -106dBm	29.3 miles	22.5 miles	15.3 miles
Coverage Radius @ -98 dBm	21.5 miles	15.9 miles	9.8 miles
Coverage Radius Reduction (-98 dBm)	27%	29%	36%
Coverage Radius @ -95 dBm	18.9 miles	13.8 miles	8.0 miles
Coverage Radius Reduction (-95 dBm)	36%	39%	48%

Motorola is also concerned that the Consensus Plan's more stringent –95 dBm signal level requirement for new/replacement systems would apply to licensees that have awarded contracts for new systems, if construction has not begun prior to the effective date of the Report and Order adopting the Plan. In Motorola's view, this aspect of the Plan would unfairly impose more onerous conditions on such licensees. In addition, Section 2.1.1(b) of Appendix F includes systems that are "modified or upgraded" as being required to meet the –95 dBm signal strength to receive interference protection. Depending on how the terms modified and upgraded are defined, this higher threshold could apply to virtually all systems, since licensees make minor system modifications on a regular basis. Motorola urges that these terms be clearly defined to allow reasonable system modifications without a licensee losing rights to interference protection.

While licensees are not required under the Consensus Plan to design and construct new systems in a way that provides –95 dBm throughout its expected area of operation, resolution of any interference post-realignment in areas that do not meet the higher desired signal levels would

be the responsibility of public safety, and B/ILT/H-SMR licensees. In Motorola's experience, customers often encounter practical difficulties implementing additional sites even where funding is available. Given esthetic concerns and local regulations, it is a challenge today to obtain zoning approvals for new sites. Furthermore, implementing additional sites in a system would require the use of additional frequencies to prevent inter-system interference. If those additional frequencies are not available, a licensee would need to redesign its system to use simulcast operation, which allows frequencies to be re-used at multiple sites within a system. However, simulcast operation also requires that a system be redesigned. With simulcast operation, the specific location of all base sites is critical for optimal operation, so some existing sites may need to be relocated in addition to adding new sites. In addition, simulcast sites must be tightly controlled so that all sites transmit the same signal, at the same time, at the same deviation, and at the same frequency. Each simulcast site requires high stability oscillators and unique equipment to properly condition the signals. Furthermore, links between the sites may need to be upgraded. While simulcast systems have a proven track record in public safety operations, changing from a standard multi-site system to simulcast operation is a significant modification.

In making a final determination regarding appropriate signal threshold levels, the Commission should consider the ability of licensees to implement systems meeting the criteria. In addition, Motorola recommends that any signal level thresholds that the Commission adopts should be clearly defined. For example, the reliability percentage for the measured result and the area over which the signal level is measured should be specified. Motorola also notes that the Consensus Plan recommends that procedures for measuring signal strength in order to determine whether a licensee meets the proposed signal level thresholds be developed later by an industry

working group.[26] Motorola agrees that a complete and repeatable measurement procedure to determine signal levels at spot locations must be addressed. In our view, the TIA is the appropriate industry group already established and operating to develop such a measurement procedure.

2. Out-of-Band Emission Limits for Cellular Base Station Transmitters

The Consensus Plan requires all cellular base station transmitters operating in the 861-895 MHz band to suppress out-of-band emission ("OOBE") noise by at least $43 + 10\log_{10}(P)$ dBc at the edges of the spectrum allocation for the transmitter, and to further reduce OOBE noise at frequencies below 861 MHz.[27] On all frequencies below 859 MHz, *i.e.*, below the 859-861 MHz guard band, an additional 45 dB of noise attenuation would be required.[28]

In Motorola's view, these OOBE limits should not be imposed on transmitters that clearly present no opportunity to produce out-of-band interference, such as high rural CMRS sites. Interference potential from such sites is essentially eliminated through attenuation inherent in the greater path loss resulting from the high site. Yet, it is not appropriate to define by rule a class of transmitters that would be exempt from the general OOBE limits because unique operational circumstances may dictate the experienced level of interference. For example, high levels of interference can be experienced in tall buildings near windows and other tall structures, such as elevated roadways, or in other circumstances where first responders are in elevated locations near taller antenna support structures.

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[26] *See* Supplemental Comments at 41 n.75.

[27] *See id*. at 43, App. F § 4.1.2. In addition, Motorola notes that the OOBE limits proposed in the Consensus Plan assume a 30 kHz measurement bandwidth. If the Commission specifies a different measurement bandwidth, these proposed limits would need to be adjusted accordingly.

[28] *See id*. at App. F § 4.1.2.

Motorola therefore recommends that the Commission allow CMRS operators to request exemptions for specific transmitter sites where it has been demonstrated that the site does not pose a threat for harmful out-of-band interference. The Commission should also implement procedures to quickly respond to such requests.

B. Interference Protection from Channel 69 TV Stations

The Commission should determine whether the proposal to relocate the current NPSPAC spectrum to 806-809/851-854 MHz requires the implementation of additional interference protection measures with regard to TV stations broadcasting on Channel 69 (800-806 MHz). Currently, six full power analog TV stations are operating on Channel 69 in the following cities/markets: Allentown, PA (serving the Philadelphia market); Atlanta, GA; Block Island, RI (serving the Providence market); Hollywood, Florida (serving the Miami market); San Diego, CA; and Indianapolis, IN.[29] This list includes two of the top 10 and five of the top 30 markets in the United States. These TV transmitters operate at extremely high power and would be located on the frequency block directly adjacent to public safety base station receivers in the new 806-809 MHz NPSPAC band. The Commission is aware that Channel 69 stations have caused interference to 800 MHz operations. Placing public safety users directly adjacent to high-powered Channel 69 TV operations raises the likelihood that interference will be more problematic.

[29] There are pending applications for analog TV stations in three other markets, and one pending application for a digital television station in Puerto Rico. In addition, seven low power TV stations are also currently operating on Channel 69, and more than one hundred associated low power translator and booster stations. Several dozen applications for low power TV, translator and booster stations are also pending.

Motorola suggests that one of two approaches would be appropriate to reduce the potential for interference to public safety users in the 806-809 MHz segment. The most appropriate measure, in our view, would be to clear these six remaining analog TV stations from Channel 69 prior to relocating public safety to the new proposed NPSPAC band. This option would have two significant advantages. First, it would open Channel 69 for 700 MHz public safety licensees to deploy in areas where Channel 69 TV stations currently operate, thereby increasing available public safety spectrum in these areas, provided that adjacent and paired channel operations are not an issue in these areas. Second, clearing Channel 69 TV operations would permanently eliminate the potential for out-of-band interference from full-power Channel 69 operations to public safety users in the new NPSPAC band.

The second alternative would be to require Channel 69 TV stations to employ additional filtering prior to rebanding where analysis shows that out-of-band interference to the new NPSPAC channels is expected to occur, based on the locations of the TV transmitters and public safety base station receivers that are scheduled for relocation to the 806-809 MHz band. Moreover, the Commission should specify an appropriate source of funding for this additional filtering protection.

C. Receiver Quality Standards

The Consensus Plan proposes the adoption of several receiver performance standards. While Motorola generally supports the adoption of appropriate receiver performance criteria, it is inappropriate to focus on receiver performance as the principal means of providing interference protection for 800 MHz users. Interference is a function of the overall system design and the environment in which the radio operates.

There are three elements that must be considered to ensure interference-free operation: (1) radio receiver design – this is a balance of competing user and engineering demands; (2) the desired signal strength – the level of the desired signal in areas of expected operation; and (3) the undesired signal strength – the level of signal experienced at the receiver from sources other than the desired source. The potential for interference is greatest in areas where the desired signal is low, and the undesired signal is high. Regardless of the receiver design, there will always be a point at which inference will occur if the ratio of desired-to-undesired signal strength is low enough. The only effective way to reasonably ensure interference-free operation is to define the overall environment and to allow manufacturers to design equipment accordingly.

Recognizing the need to more clearly define the radio environment, the Consensus Parties have attempted to create greater certainty as to the conditions that a receiver will experience. The Supplemental Comments: (1) state that interference protection would only occur in areas where the desired signal is equal to or greater than –98 dBm or –95 dBm, depending on whether a system is existing or new,[30] and (2) impose limits on out of band emissions from cellular base stations in the 861-895 MHz band, which are the most likely sources of undesired signals. These steps would more clearly define the operating environment. The Consensus Parties' proposed approach with regard to radio receiver design, however, incorrectly focuses on specifics of the actual receiver design, rather than focusing on the overall receiver *performance* in the newly-defined environment. With this caveat, Motorola offers the following comments and recommendations on the proposed receiver performance standards.

[30] Motorola previously noted that these signal levels are higher than signal strengths regularly used for noise-limited systems today, and the difficulties that some licensees may have in adding sites to reach the new proposed signal strengths.

The Consensus Plan would provide an incentive for licensees to utilize receivers that meet the TIA Class A specifications by tying the availability of "full" interference protection to use of such receivers.[31] As noted previously, the Consensus Plan would protect licensees from measurable interference if they exceed specified signal strength thresholds *and* utilize receivers meeting Class A specifications. If users' receivers do not meet Class A specifications, licensees would be required to meet higher signal strength thresholds to obtain interference protection.[32] The threshold would be set on a case-by-case basis at the signal strength necessary to restore the same C/I+N ratio as a Class A receiver in the same interference environment.[33] In other words, the signal strength threshold would be receiver dependent.

Motorola consistently has supported the adoption of Class A specifications for new public safety and private receivers.[34] Class A specifications represent state-of-the-art receiver design and high levels of intermodulation rejection, which are particularly beneficial in the 800 MHz operating environment. Motorola would like to note, however, that Class A requirements limit designs to a narrow specification framework and that it is possible to design a radio that has performance equivalent to Class A without meeting the Class A specifications. Accordingly, rather than require use of a specific receiver design, such as Class A, to receive interference protection, the Commission should adopt rules that provide full interference protection to radios that can produce acceptable performance while receiving specified desired signal levels and experiencing a certain level of undesired signal. The specific level of undesired signal that a receiver would be required to tolerate should be determined through industry discussion. If

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31 *See id*. at 41, App. F § 4.1.1.a.

32 *See id*. at App. F § 4.1.1.b.

33 *See id*.

34 *See* Comments of Motorola, Inc., WT Docket No. 02-55, May 6, 2002, at 21; Motorola Reply Comments at 20.

users' radios meet the performance criteria stated above, they should receive the same level of interference protection as users that operate Class A receivers.

This proposal to provide protection based on a well-defined environment rather than a specific receiver design coincides well with the recommendations of the Consensus Parties. The Consensus Plan recommends that the Commission adopt rules establishing mandatory criteria for rejection of signals in adjacent bands, with "numerical targets and schedules for implementation" that are set after consultation with manufacturers and industry experts.[35] Based on this recommendation that a radio should be required to operate in an environment where the desired and undesired signals are well defined, there is no reason to further limit the freedom of manufacturers to meet this requirement.[36]

Motorola also recommends that existing systems currently using radios that are not Class A compliant be grandfathered for interference protection rights. Under the rules proposed in the Consensus Plan, public safety and private wireless licensees that use radios that are not Class A compliant are required to achieve stronger desired signal levels to receive interference protection, the proposed rules would require the licensees to either construct more base station sites or replace their entire inventory of radios. Either of these options would impose significant costs on licensees and some consideration for existing systems is warranted.

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[35] Supplemental Comments at App. F § 4.1.1.c.

[36] Motorola does take exception to the statement by the Consensus Parties that these receiver performance targets should "set the expectation" that the rejection provided by existing 800 MHz-only receivers is "insufficient and will not be acceptable." *Id*. As Motorola has clearly stated, receiver performance is only one part of the interference equation and receivers today are built to a high standard that balances various competing requirements. It is inappropriate to prejudge the performance of receivers to operate in the newly defined environment.

D. Receiver Testing Standards

The Consensus Parties propose to expand the current TIA receiver testing standards "to account for th[e] change in the RF environment" in the 800 MHz band, because public safety and private wireless users may now face strong undesired signals from CMRS and other operators.[37] Appendix F of the Supplemental Comments includes recommendations for tests to characterize receiver performance for (a) overload characteristics, (b) adjacent channel interference rejection, (c) third order intermodulation, (d) fifth order intermodulation, and (e) front end filtering.[38]

Motorola supports testing receiver performance to ensure adequate performance in the required environment. Consistent with our discussion in the previous section, an industry standards body, such as TIA, should develop an appropriate testing regime. With regard to the recommendations for testing contained in the Supplemental Comments, Motorola offers the following:

(a) TIA specifications already include a specification for receiver overload. This should be reviewed in light of the expected conditions, but Motorola generally believes that the existing requirement will be adequate.

(b) If the Commission rebands 800 MHz as proposed by the Consensus Parties, the interferers proposed to be included in testing will no longer exist as adjacent channel sources. Accordingly, the requirement should be modified to address adjacent allocation rejection of appropriate signals, such as constant envelope modulations (FM), or modulations that employ combinations of amplitude and phase modulations with a peak to average of nominally 7 dB.

(c) Motorola agrees that testing for third order IM response at elevated signal levels should be considered.

(d) A radio's response to fifth order IM is predictable based on its response to third order IM, so a separate fifth order test is not necessary.

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[37] *See id*. at App. F § 4.1.

[38] *See id*.

(e) It is unnecessary to characterize the front-end filter response for a given radio. As discussed previously, there are a number of ways in which to provide acceptable receiver performance for a given environment, each with its own tradeoffs. Accordingly, a focus on front-end filters is inappropriate and unnecessary given a requirement to test to ensure that a receiver will perform adequately in a given environment.

E. Proposed Use of Bi-Directional Amplifiers

The Consensus Plan recommends modification of section 90.219 of the Commission's rules to allow licensees additional flexibility to use bi-directional amplifiers ("BDAs") to solve localized coverage problems in the 851-861 MHz band.[39] The Consensus Plan does not, however, suggest any specific amendment to section 90.219. Motorola notes that BDAs, especially Class B broadband signal boosters, can be a significant source of interference that is location and implementation dependent, as well as being dependent upon frequency band structure. Good system design principles therefore dictate that BDAs should be treated as simulcast transmitters for frequencies within the BDA's passband. When employed in this fashion, system designers and licensees should: consider the effects of frequency stability and propagation delays through the BDA, minimize the passband and consider unintended radiation of signals into other services within the passband, continue to control signal levels and radiation of signals into areas outside of the systems' normal coverage areas.

IV. FUNDING FOR INCUMBENTS' RELOCATION COSTS

In the Supplemental Comments, the Consensus Parties provide an analysis and estimate of the costs of rebanding the 800 MHz band. Based on this analysis, Nextel has committed to funding the relocation costs of public safety licensees up to $700 million and of B/ILT and SMR

[39] *See id*. at App. F § 4.1.3.a.

licensees up to $150 million.[40] These revised figures reflect extensive work done by the Consensus Parties to understand the rebanding procedure, the costs involved in retuning equipment, and Nextel's dedication to providing funding. Motorola notes, however, that there are costs that would be incurred by manufacturers.

Given the complexities of rebanding and the wide variety of radios in use, Motorola anticipates that manufacturers would have to incur substantial costs to develop software needed to support relocation of NPSPAC mobile and portable receivers from the current NPSPAC spectrum to the new NPSPAC block. As addressed in previous Motorola comments,[41] rebanding involves not only simple retuning, but in some cases actual development and reprogramming of a radio's firmware (*i.e.*, the operating system). Generally, rebanding totally within the 806-821/851-866 MHz band segment can be accomplished by retuning users' radios, without the need to reprogram any additional firmware. However, rebanding NPSPAC subscriber units currently operating in 821-824 MHz to operate with the same personality down at 806-809 MHz would be more complex. Rebanding radios in the current NPSPAC channels to the new NPSPAC channels would require the development of new firmware and the reprogramming of that firmware into the radio *before* the new channels can be programmed. Given the large number of radio models from numerous manufacturers that are currently used by public safety, each with its own unique design, Motorola estimates that manufacturers will have to dedicate hundreds of staff years in firmware development before radios operating in the NPSPAC channels can be programmed to operate in the new NPSPAC spectrum. Motorola believes that it is reasonable that these one-time development costs, incurred directly as a result of rebanding, be

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40 *See id*. at 5.

41 *See* Motorola Comments at 22; Letter for Steve B. Sharkey, Director, Spectrum Standards and Strategy, Motorola, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 02-55, May 21, 2002, Attach. at 25.

funded and that a mechanism be identified for payment as costs are incurred. These costs do not appear to be included in the analysis provided in Appendix A of the Supplemental Comments. Motorola therefore invites the Consensus Parties to address this issue.

While Motorola is dedicated to providing the resources necessary to develop the necessary firmware in as timely a fashion as possible, the Commission should also be aware that this is not an insignificant challenge. Diverting the engineering resources necessary to complete the development work, particularly given the aggressive schedule set forth in the Supplemental Comments will impact the schedule of other customer projects and it is possible that it will be difficult for some manufacturers to complete the development in the 24 months called for in the schedule.

V. CONCLUSION

Motorola welcomes the Commission's efforts to address the significant interference problem that exists for public safety and private wireless users in the 800 MHz band. While the Supplemental Comments fill in many of the gaps in the August 7 Consensus Plan, Motorola has reservations regarding several elements of the Plan, including the proposed freeze on system upgrades during the realignment process and the proposed signal strength thresholds. Motorola believes that the recommended modifications and refinements discussed in the text above would materially improve the Consensus Plan.

Respectfully submitted,

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