

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

In the Matter of

Amendment of Part 90 of the Commission's
Rules to Provide for Flexible Use of the
896-901 MHz and 935-940 MHz Bands
Allotted to the Business and Industrial Land
Transportation Pool

Oppositions and Petitions for Reconsideration
of 900 MHz Band Freeze Notice

WT Docket No. 05-62

DA 04-3013

COMMENTS OF M/A-COM, INC.

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18 May 2005

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SUMMARY

M/A-COM, Inc. (“M/A-COM”), urges the Commission to adopt an approach that would optimally reconfigure the 896-901 MHz and 935-940 MHz bands (“900 MHz frequencies”) so as to provide and promote efficient and innovative uses of the radio spectrum while providing for the future needs of commercial and critical infrastructure users, including utilities, many of which are M/A-COM customers. In particular, M/A-COM urges the Commission to protect incumbent spectrum users supporting critical infrastructure industries in the 900 MHz frequencies while ensuring that they, like other users of the radio spectrum, have the opportunity to develop and adopt new systems using the latest technologies. The Commission should also be mindful of its objectives and experience in re-banding the 800 MHz band.

First, M/A-COM urges the Commission to ensure the ability of incumbent users in the 900 MHz frequencies—particularly utilities—to develop and adopt new systems using the latest technologies. *Second*, M/A-COM argues that the Commission should consider segmenting the 900 MHz band to provide wholly separate frequencies for business and industrial land transportation (“B/ILT”) users and non-B/ILT users. *Third*, M/A-COM urges the Commission to modify its proposals and adopt technical and operational rules that would better protect incumbent B/ILT users—as explained in detail in the attached Technical Appendix. *Fourth*, M/A-COM argues that the Commission should proceed cautiously with any auction proposal in order to avoid jeopardizing continued B/ILT use of the 900 MHz frequencies.

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The decisions taken in the above-captioned proceeding will have a profound effect on the future use of 900 MHz bands by Business and Industrial Land Transportation (“B/ILT”) users.¹ M/A-COM, Inc. (“M/A-COM”), urges the Commission to adopt an approach that would optimally reconfigure the 896-901 MHz and 935-940 MHz bands (“900 MHz frequencies”) so as to provide and promote efficient and innovative uses of the radio spectrum while providing for the future needs of commercial and critical infrastructure users, including utilities, many of which are M/A-COM customers. In particular, M/A-COM urges the Commission to protect the systems of incumbent spectrum users supporting critical infrastructure industries in the 900 MHz frequencies while ensuring that they, like other users of the radio spectrum, have the opportunity

¹ See *Amendment of Part 90 of the Commission's Rules to Provide for Flexible Use of the 896-901 MHz and 935-940 MHz Bands Allotted to the Business and Industrial Land Transportation Pool, Notice of Proposed Rulemaking*, FCC 05-31, WT Docket No. 05-62 (rel. Feb. 16, 2005) (“NPRM”).

to develop and adopt new systems using the latest technologies. The Commission should also be mindful of its objectives and experience in re-banding the 800 MHz band.

M/A-COM is a leading technology developer and manufacturer of radiofrequency (“RF”), microwave, and millimeter wave semiconductors, components, and technologies serving the public safety and critical infrastructure, broadband, wireless data, aerospace, defense, and automotive market segments. M/A-COM has long been an industry leader in providing advanced two-way land mobile products and systems to the public safety, government, industrial, business, and utility markets, including significant business and industrial/land transportation (“B/ILT”) users in the 900 MHz frequencies. M/A-COM is also a pioneer in the development of Internet protocol (“IP”)-based networks for private radio applications, and supplies industry-leading brands such as EDACS®, OpenSky® and ProVoice™. Unique in the industry, M/A-COM is vertically integrated to produce and process semiconductor materials, to design and manufacture devices, combine these devices into single- and multi-function components, to manufacture integrated subassemblies using these components and devices and then to combine the integrated subassemblies into complete systems driven by in-house developed software. M/A-COM is part of Tyco Electronics, one of the world’s leading suppliers of electronic components.

M/A-COM’s comments in this proceeding consist of four parts. *First*, M/A-COM urges the Commission to ensure the ability of incumbent users in the 900 MHz frequencies—particularly utilities—to develop and adopt new systems using the latest technologies. *Second*, M/A-COM argues that the Commission should consider segmenting the 900 MHz band to provide wholly separate frequencies for systems of business and industrial land transportation (“B/ILT”) users and non-B/ILT users. *Third*, M/A-COM urges the Commission to modify its

proposals and adopt technical and operational rules that would better protect systems of incumbent B/ILT users. *Fourth*, M/A-COM argues that the Commission should proceed cautiously with any auction proposal in order to avoid jeopardizing continued B/ILT use of the 900 MHz frequencies.

I. THE COMMISSION SHOULD ADOPT RULES ENABLING INCUMBENT USERS IN THE 900 MHZ FREQUENCIES TO DEVELOP AND ADOPT NEW SYSTEMS USING THE LATEST TECHNOLOGIES

The Commission should adopt rules enabling incumbent users in the 900 MHz frequencies—particularly utilities—to develop and adopt new systems using the latest technologies, rather than provide only for the continuing use of legacy systems and technologies. The incumbent B/ILT users in the 900 MHz frequencies are not the highest-profile users of the radio spectrum, and their operations may strike some observers as unglamorous.² Nevertheless, these B/ILT licensees, including utilities, provide a range of indispensable services, including energy, water, transportation, and medical services. Moreover, the President has identified utilities as critical infrastructure necessary for the protection of U.S. national security, law enforcement, and public safety interests.

It is the policy of the United States to protect against disruption of the operation of information systems for critical infrastructure and thereby help to protect the people, economy, essential human and government services, and national security of the United States, and to ensure that any disruptions that occur are infrequent, of minimal duration, and manageable, and cause the least damage possible.³

² Under the Commission’s rules B/ILT licensees can provide communication services to support commercial (including critical infrastructure communications for utilities), educational, philanthropic, ecclesiastical, clergy, and medical activities. *See* 47 C.F.R. § 90.35(a).

³ *See* Critical Infrastructure Protection in the Information Age, E.O. 13,231 (Oct. 16, 2001), as amended by E.O. 13,286 (Feb. 28, 2003) (“Executive Order 13,231”).

In reconfiguring the 900 MHz frequencies in which utilities operate, the Commission must ensure that new entrants would not disrupt information systems for critical infrastructure. At the same time, the Commission should adopt rules that promote the adoption of new (and more advanced) technologies by critical infrastructure providers that will allow those providers to continue to carry out their national security, law enforcement and public safety duties.

A. The Commission Should Implement a Regulatory Framework and Flexible Use Policy that Regulates Incumbent and New Users in a Similar Manner, Without Constraining Incumbent Operations

In implementing a regulatory framework and flexible use policy for the 900 MHz frequencies, the Commission should implement a regulatory framework and flexible use policy that regulates incumbent and new licensees in a similar manner, without constraining incumbent operations. Unless the Commission pursues a more radical reconfiguration of the band, as discussed in part II below, M/A-COM believes that only the similar regulatory treatment of licensees by the Commission will promote compatible uses in the band without constraining operations or innovation.

As a provider of equipment to a wide range of operators, M/A-COM supports Commission initiatives to open new frequency bands or reconfigure existing ones to promote more intensive, efficient use, but only if it is not at the expense of viable incumbent services. We believe the 800 MHz PLMRS rules are instructive in this regard.

As the Commission knows, interleaving channels for use by dissimilar services, such as PLMRS and CMRS, makes coexistence for those services difficult. At 800 MHz, M/A-COM found that, in many instances, interference could be traced to commercial operators changing base station operating frequencies dynamically to suit their system needs. In a number of cases,

these operators switched to frequencies geographically and spectrally near PLMRS operations, which resulted in harmful interference to PLMRS networks.

To address this problem, the Commission should separate the systems of private and commercial users in terms of frequency and/or geography, much as the Commission attempted in its 800 MHz “rebanding” proceeding.⁴ Absent frequency and spatial separation, M/A-COM does not believe the Commission’s proposals will prevent harmful interference to incumbent operations. At the very least, however, M/A-COM believes that the Commission should seek similar regulatory treatment of private and commercial licensees in the 900 MHz frequencies in order to promote compatible uses of that band, so long as operations of incumbent licensees are not compromised. M/A-COM therefore supports the Commission’s proposal to regulate both new entrants and incumbent licensees pursuant to Part 90 of its rules.⁵

B. The Commission Should Base any Geographic Licensing Scheme on Smaller Geographic Areas

M/A-COM believes that if the Commission adopts a geographic area licensing scheme, it should adopt a scheme based on smaller geographic areas.⁶ Specifically, the Commission should base any geographic-based licensing scheme on Basic Economic Areas (“BEAs”), rather than the larger Major Economic Areas (“MEAs”).⁷

First, by licensing a smaller geographic area, the Commission would avoid situations in which a single new licensee would overlay a large number of incumbent licensees. *Second*, as

⁴ See *In the Matter of Improving Public Safety Communications in the 800 MHz Band, Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order, and Order*, 19 FCC Rcd. 19,469, 19,484-85 at ¶¶ 22-25 (2004) (“800 MHz Order”).

⁵ See NPRM at ¶ 15.

⁶ See *id.* at ¶ 19.

⁷ See *id.* at ¶¶ 17-18 and ¶¶ 21-22.

the Commission notes,⁸ incumbents could more readily obtain smaller geographic-area licenses to the extent they wish to expand their systems or create “buffer zones” in order to control interference factors that could effect their existing systems. *Third*, BEAs more closely approximate the site-based licenses previously granted to incumbent licensees. Adoption of a BEA scheme would therefore provide for better regulatory symmetry between new entrants and incumbent licensees in a reconfigured 900 MHz Band.⁹

II. THE COMMISSION SHOULD CONSIDER SEGMENTING THE 900 MHz BAND TO PROVIDE WHOLLY SEPARATE FREQUENCIES FOR B/ILT AND NON-B/ILT USERS

Having considered the need to protect systems of incumbent B/ILT licensees in the 900 MHz frequencies without limiting their operations to legacy systems and technologies, M/A-COM urges the Commission to consider segmenting the 900 MHz band to provide wholly separate frequencies for systems of B/ILT and non-B/ILT licensees users. M/A-COM believes that the Commission should consider bolder and more creative proposals than its current proposal to license 900 MHz “flexible-use” channels in nineteen blocks of ten contiguous channels each, and one block of nine contiguous channels.¹⁰ M/A-COM recognizes that the Commission’s actions are somewhat constrained by the presence of auctioned spectrum in the 900 MHz frequencies. But M/A-COM believes that the Commission must nevertheless strive to enhance the commercial attractiveness and efficient use of 900 MHz frequencies.

M/A-COM believes the optimum band plan for 900 MHz would entail transitioning B/ILT and non-B/ILT systems to separate segments of the band. As the Commission knows from its 800 MHz experience, interleaved channels for disparate services can lead to interference

⁸ See *id.* at ¶ 24.

⁹ Though certainly a BEA is larger.

¹⁰ See *id.* at ¶ 26.

problems and necessitate complicated technical rules necessary for any use of frequencies at all. M/A-COM believes that the Commission would resolve many of these technical issues by segmenting the 900 MHz Band. The Commission would also ensure the ability of incumbent B/ILT licensees to innovate and implement new systems and technologies while enhancing the attractiveness of the 900 MHz frequencies for potential auction bidders.

As noted above, given that the Commission has already auctioned parts of the 900 MHz band, M/A-COM acknowledges that the Commission is constrained from reconfiguring this band, absent more substantial action, as was the case in the at 800 MHz.¹¹ As a result, M/A-COM believes the Commission should, as a next-best alternative, dedicate the upper four channel blocks (QQ, RR, SS and TT) to “traditional” B/ILT services.¹² Under this alternative, although the Commission would still have spectrum interleaved with auctioned blocks Q, R, S and T, B/ILT licensees would enjoy 40 channels of dedicated B/ILT spectrum.

III. THE COMMISSION SHOULD ADOPT TECHNICAL AND OPERATIONAL RULES THAT PROTECT INCUMBENT B/ILT OPERATIONS

M/A-COM believes that the Commission should modify its proposed technical and operational rules in order to better protect incumbent licensees.

A. Without Further Interference Control Measures, the Commission’s Operational Flexibility Proposal Would Fail to Provide Adequate Protection to Incumbent Users

Without further interference control measures, the Commission’s operational flexibility proposal would fail to provide adequate protection to incumbent licensees and their systems. The Commission’s operational flexibility proposal would permit new 900 MHz licensees to use any location and any channel within their licensed areas without prior authorization from the

¹¹ Although the Commission auctioned some of this spectrum, a properly reconfigured band may prove more attractive to current auction licensees.

¹² See NPRM at ¶ 30.

Commission.¹³ The Commission would subject new entrants to separation distance, emission limit, and field strength rules the Commission proposes elsewhere in the NPRM.¹⁴ For example, the Commission proposes an adjacent channel emission limit of the lesser of $43 + \log_{10}(P)$ or 80 dB¹⁵—greater protection than Section 90.210(j) of the Commission’s rules currently provides—in order to protect systems of incumbent licensees from adjacent channel transmitters, but further away in frequency from the channel/block edge less protection than current rules provide.¹⁶

By themselves, however, these measures are insufficient. As with incumbent systems in the 800 MHz band, incumbent systems in the 900 MHz frequencies will likely experience interference from new entrants due to the overall increase in the noise floor and an increase in potential intermodulation interference caused by multiple CMRS transmitters.

M/A-COM therefore recommends that the Commission employ the following interference control tools, in addition to adjacent channel emission limits:

- Frequency coordination performed by certified frequency coordinators; and

¹³ See *id.* at ¶ 32,

¹⁴ These matters are addressed specifically later in these comments.

¹⁵ “P” is defined as transmitter power.

¹⁶ The Commission’s proposal provides about 22 – 42 dB additional protection near the channel/block edge, but it yields about 7 dB less protection further away in frequency from the channel/block edge. The “section J” emission mask yields a 21 dB attenuation at a channel edge versus the following attenuation versus (P) at a channel edge (using the Commission’s proposed formula):

43dB (1W)

53dB (10W)

63dB (100W)

Further away in frequency from the channel/block edge, the “section J” emission mask requires an attenuation of the lesser of $50 + 10 \log(P)$ or 70 dB. See 47 C.F.R. § 90.210(j).

- Interference protection equivalent to that now provided in the 800 MHz band.¹⁷

As a final resort, the Commission should also consider adopting “enhanced best practices,” as it has done in the 800 MHz band.¹⁸ These measures would better control interference that would result from the overall increase in the noise floor and the increase in potential intermodulation interference caused by multiple CMRS transmitters.

B. The Commission’s Proposed Separation and Co-Channel Short Spacing Proposals Will Protect Incumbent B/ILT Users, So Long as the Commission Modifies Its Operational Flexibility Proposal

So long as the Commission modifies its operational flexibility proposal, as noted above, M/A-COM believes that the Commission’s proposed separation proposal (113 km)¹⁹ and co-channel short spacing proposal will protect systems of incumbent B/ILT licensees. Specifically, M/A-COM supports the Commission’s proposal to afford to incumbent B/ILT licensees the same level of protection currently provided to 900 MHz SMR MTA licensees.²⁰

C. The Commission Should Modify Its Proposed Field Strength Contour In Order to Avoid Shrinking the Existing Coverage Areas of Incumbent B/ILT Users

The Commission should modify its proposed field strength contour in order to avoid shrinking the existing coverage areas of incumbent B/ILT licensees. The Commission proposes to “grandfather” incumbent B/ILT facilities by defining their protected area as the originally

¹⁷ In its *800 MHz Order*, the Commission concluded that it would need a basis other than distance separations or predicted signal strength contours to determine entitlement to interference protection. *See 800 MHz Order* at ¶ 95. The Commission instead adopted a signal strength threshold as well as signal measurement procedures and minimum receiver performance criteria. *See 800 MHz Order* at ¶¶ 105-114.

¹⁸ *See 800 MHz Order* at ¶¶ 88-132.

¹⁹ The Commission proposes that geographic licensees locate their facilities at least 113 km (70 miles) from any incumbent’s facilities. NPRM at ¶ 34.

²⁰ *See id.* at ¶ 34. The Commission awarded 900 MHz MTA licenses by auction.

licensed 40dB μ V/m field strength contour.²¹ Similar to its proposal to permit “operational flexibility” to geographically licensed 900 MHz users, the Commission would afford operational flexibility to grandfathered incumbent licensees within their 40dB μ V/m contours, allowing them to augment or modify their facilities so long as their original field strength contour is not exceeded.²² While M/A-COM generally supports these efforts, it believes the Commission’s specific proposals are insufficient, as they fail to account fully for the effect of new 900 MHz frequency users will have on incumbents’ existing coverage.

As the Commission knows, the 40dB μ V/m contour is defined by a “one-way” measurement: field strength.²³ But such a field-strength measurement fails to account for the effect of additional transmitters in the band on B/ILT receiver performance. M/A-COM believes that additional transmitters could well increase the overall noise level in the band, resulting in a lower signal-to-noise (“SNR”) ratio than now exists at the 40dB μ V/m contour. This would effectively shrink the existing coverage areas of B/ILT licensees, as receiver performance at the contour will decline. To compensate for this effect, and to protect incumbent B/ILT licensees’ coverage areas, M/A-COM believes that the Commission should consider affording additional protection (*i.e.*, extending the protected contour) for incumbent B/ILT licensees—particularly critical infrastructure licensees.

D. The Commission Should Modify Its Proposed Emission and Field-Strength Limits to Ensure Technological Flexibility for Users and Consistency Across Frequency Bands

The Commission should modify its proposed emission and field-strength limits to ensure technological flexibility for users and consistency across frequency bands. As noted above, the

²¹ See *id.* at ¶ 36; 47 C.F.R. § 90.667(a).

²² See NPRM at ¶ 36.

²³ Of course, this contour can also be predicted rather than measured.

Commission proposes that “on any frequency in a geographic area licensee’s spectrum block that is adjacent to a non-geographic area frequency, we propose that the power of any emission shall be attenuated below the transmitter power (P) by at least 43 plus $10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation.”²⁴

This proposed emission mask is more restrictive than currently required for transmitters of 900 MHz licensees.²⁵ The Commission’s proposed mask would require an additional 22 – 42 dB of attenuation (based on reasonable transmitter powers of one to 100 watts) at a channel block edge (the “outer” channel edge in the block) than is now required under the Commission’s rules.²⁶ Consequently, the proposed emission mask would impose severe restrictions on current or future technologies, particularly in the “outer” channel(s) of a channel block.

Granted, the Commission’s proposed emission mask is consistent with some Part 90 emission masks.²⁷ Nevertheless, it is inconsistent with the emission mask adopted for EA-based systems (“EA mask”) for auctioned spectrum blocks in the 800 MHz band.²⁸ The EA mask includes an extension of the “outer” channel mask, specified in Section 90.210(g), from outside of the edge of a given spectrum block to convergence to a limit that is the lesser of $43 + 10 \log(P)$ or 80 dB defined as a function of frequency offset. The EA mask allows any technology satisfying the Commission’s Section 90.210(g) mask to operate in an “outer” 800 MHz channel. M/A-COM proposes that the Commission apply the same mask derivation methodology used for the 800 MHz EA mask to the 900 MHz band.

²⁴ See *id.* at ¶ 42.

²⁵ See 47 C.F.R. § 90.210(j).

²⁶ *Id.*

²⁷ See 47 C.F.R. § 90.210.

²⁸ See 47 C.F.R. § 90.691.

For example, the Commission’s proposed emission mask could significantly restrict technology currently employed, or to be developed for use, in the “outer” channel(s) in a channel block could suffer significant restrictions. If the Commission adopted its proposed mask, some incumbent licensees currently operating in these “outer” channels and satisfying the Section 90.210(j) emission mask would likely be precluded from operating their current systems. The Commission’s proposed emission mask would preclude licensees employing M/A-COM’s EDACS product line (which satisfies Section 90.210(j) emission mask) in these “outer” channel(s) from operating in the band. Similarly, the Commission’s proposed emission mask would preclude licensees using a recent digital radio technology—such as a Project 25 Phase 1 radio, based on the ANSI/TIA-102 series of standards—from operating in the “outer” channel(s) of the spectrum block.²⁹ Although equipment based on ANSI/TIA-102 satisfies an even more restrictive 12.5 kHz channel emission mask (*i.e.*, the mask in Section 90.210(d)), than the current 12.5 kHz channel emission mask found in Section 90.210(j)), the Commission’s proposed emission mask would preclude licensees from deploying such equipment in the “outer” channel(s) of a channel block.

By adopting the same methodology used for the 800 MHz EA mask³⁰ for new 900 MHz systems, the Commission would provide for consistency between 800 MHz and 900 MHz rules for geographically-licensed systems. It would also avoid unnecessary restrictions on technology solutions that could be employed near the edge of channel blocks or in the “outer” channel(s) of the block. Following the same methodology used for the 800 MHz EA emission mask, M/A-COM recommends that the Commission modify the proposed emission mask to include the

²⁹ ANSI/TIA-102 technology is required for use in the 700 MHz band voice interoperability channels.

³⁰ See 47 C.F.R. § 90.691.

“outer tail” (as appropriately defined based on Sections 90.210(j) (2) & (3)) of the Section 90.210(j) emission mask into the adjacent channel block with convergence to the NPRM proposed mask level as a function of offset frequency.

In the Technical Appendix to these comments, M/A-COM provides an illustration of the effect of the Commission’s proposed emission mask on the ANSI/TIA-102 Common Air Interface.³¹ In addition, the Technical Appendix provides an illustration and description of M/A-COM’s proposed emission mask, which should accommodate all existing and near term digital technologies, compared with the Commission’s proposed emission mask.³²

IV. THE COMMISSION SHOULD PROCEED CAUTIOUSLY WITH ANY AUCTION PROPOSAL

The Commission should proceed cautiously with any auction proposal in order to avoid constraining the operations of incumbent B/ILT licensees and their critical infrastructure operations. The Commission has sought comment on whether to allow incumbent 900 MHz licensees to return their licenses to the Commission for inclusion in an auction that would include the licensee’s site-based license as well as the new geographic area overlay license. This arrangement would allow the auction bidder to obtain an entire geographic area free of site-licensees and the site-based licensee would be suitably compensated.³³

In considering this proposal, M/A-COM cautions the Commission to consider whether this option could harm incumbent B/ILT licensees who choose not to exercise it. For example, if existing B/ILT licensees finds themselves surrounded by a high concentration of commercial users, the Commission could inadvertently replicate at 900 MHz the same problems it has spent

³¹ See Technical Appendix at 3.

³² See Technical Appendix at 5-9.

³³ See NPRM at ¶¶ 37-38.

considerable time and resources remediating at 800 MHz, where expanding commercial use led to increasingly untenable interference to public safety users.

Moreover, the Commission should avoid creating incentives that would reduce the breadth and range of 900 MHz critical infrastructure communications, much less subject remaining users to increased interference. The lure of potential auction revenues is a strong one, and the Commission must consider whether a majority of critical B/ILT licensees (and not just M/A-COM customers) would sell their licenses in response to such an incentive. If utility users are “squeezed” at 900 MHz, they lack alternative spectrum for relocation.

Ideally, the Commission would adopt a homogeneous 900 MHz licensing regime with an improved channeling plan. Rather than pursue a hybrid auction system that could lead to increased conflict over 900 MHz frequencies, the Commission should instead consider a transition to the alternative band plan promoting segmentation.

CONCLUSION

For the reasons stated above, M/A-COM urges the Commission to promote efficient and innovative use of the 900 MHz frequencies while providing for the future needs of commercial and critical infrastructure users, including utilities.

Respectfully submitted,

M/A-COM, INC.

A handwritten signature in black ink, appearing to read "Kent D. Bressie", is written over a horizontal line.

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Appendix

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APPENDIX:

COMPARISON OF THE COMMISSION'S PROPOSED 900 MHz EMISSION MASK WITH RELEVANT EXISTING EMISSION MASKS AND WITH M/A-COM'S PROPOSED 900 MHz EMISSION MASK

As M/A-COM states in the attached comments in WT Docket No. 05-62, the Commission's proposed 900 MHz emission mask could significantly restrict the use of current or near-term future technology in the "outer" channel in a given channel block.³⁴ If the Commission adopts its proposed mask, some incumbent licensees now operating in these "outer" channels and satisfying the current emission mask in Section 90.210(j)³⁵ of the Commission's rules would likely be precluded from operating their systems.

For example, the Commission's proposed emission mask would preclude licensees employing M/A-COM's EDACS product line (which complies with the current Section 90.210(j) emission mask) from operating in the "outer" channels. Similarly, the Commission's proposed emission mask would preclude licensees using fairly modern digital radio technology—such as a Project 25 Phase 1 radio, based on the ANSI/TIA-102 series of standards—from operating in the

³⁴ M/A-COM uses the term "outer" to refer to the channels abutting the lower and upper channel block edges. Depending on the emission mask the Commission ultimately adopts, the usability of these channels could be impacted severely.

³⁵ Section 90.210 of the Commission's rules contains a number of land mobile radio emission masks that apply according to the frequency band a transmitter operates in as well as the transmitters filtering capabilities. *See* 47 C.F.R. § 90.210. The Section 90.210(j) emission mask applies to transmitters (without audio low-pass filters) that operate in the 896-901/935-940 MHz bands. The Section 90.210(d) emission mask applies to 12.5 kHz channel bandwidth equipment that operates in the 421-512 MHz and 150-174 MHz bands and is used as an illustrative example of a more restrictive mask to which new digital technology must comply.

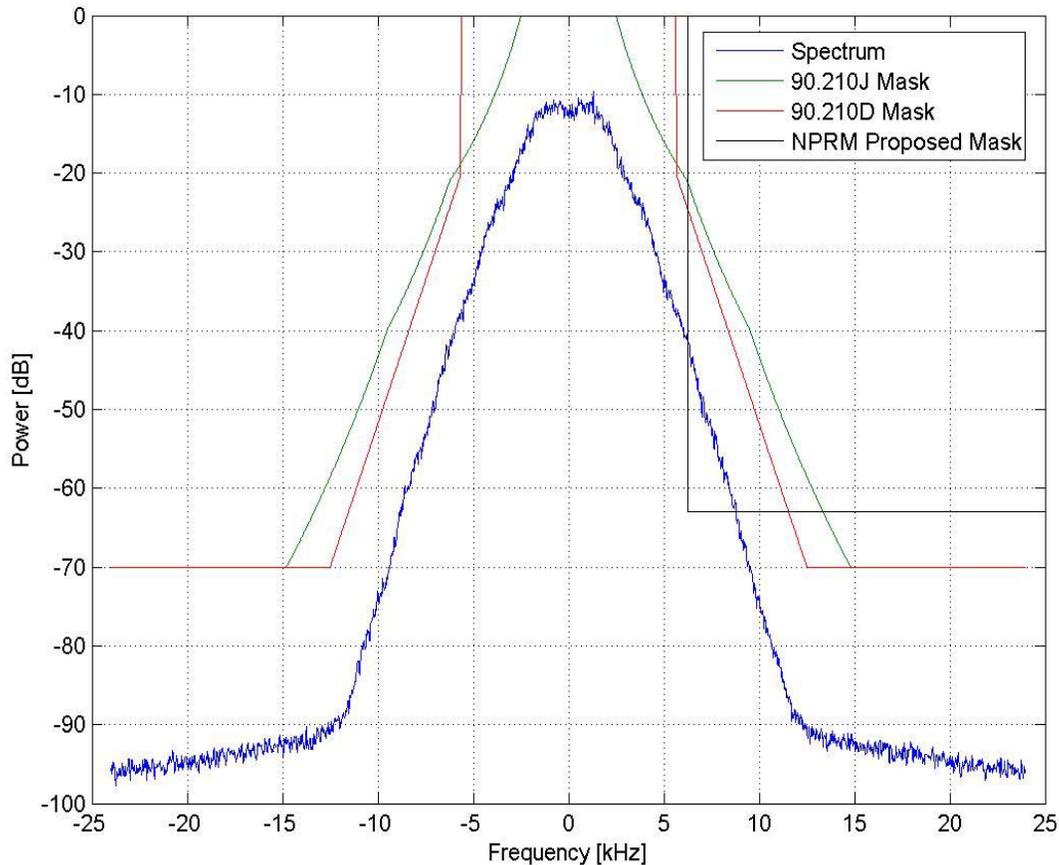
“outer” channel(s) of a given spectrum block.³⁶ To avoid this surely unintended consequence, M/A-COM proposes an alternative emission mask for 900 MHz services. M/A-COM believes that adopting its proposed mask will avoid inadvertently diminishing the usability of the outer channel/block edges. Consequently, the Commission should consider adopting M/A-COM’s proposed emission mask.

1. Comparison of the Current Section 90.210(j) Emission Mask for 900 MHz Equipment, the 12.5 kHz Mask of Section 90.210(d), the Commission’s Proposed 900 MHz Emission Mask, and a Spectrum Plot for an ANSI/TIA-102 Project 25 Phase 1 Device

In Figure 1 below, M/A-COM provides a graphical comparison of the current Section 90.210(j) emission mask for 900 MHz equipment, the 12.5 kHz mask of Section 90.210(d), the Commission’s proposed 900 MHz emission mask and a spectrum plot for an ANSI/TIA-102 Project 25 Phase 1 device, all referenced to a 100 Watt transmitter which would be typical of a land mobile radio base station transmitter. Specifically, Figure 1 shows what would happen if an operator attempted to use the ANSI/TIA-102 Common Air Interface in an “outer” channel of a 900 MHz spectrum block under the Commission’s proposed emission mask. Also shown for reference are current Part 90 emission masks that a device using the ANSI/TIA-102 Common Air Interface meets handily.

³⁶ Although equipment based on the ANSI/TIA-102 series of standards complies with the more restrictive (compared to the current Section 90.210(j) 900 MHz emission mask) 12.5 kHz channel emission mask found in Section 90.210(d)), the Commission’s proposed emission mask would preclude licensees from deploying even ANSI/TIA-102 equipment in the “outer” channel(s) of a channel block.

Figure 1



ANSI/TIA-102 (Project 25 Phase 1), Narrowband 12.5 kHz, Common Air Interface (“CAI”) Spectrum and 90.210(j) (900 MHz), 90.210(d) (12.5 kHz narrowband), and NPRM Proposed Emission Masks for a Typical 100 W Transmitter

Figure 1 demonstrates the following:

- Compliance with the 900 MHz 90.210(j) emission mask requires 21.2 dB of attenuation at the channel/block edge.
- Compliance with the more stringent 12.5 kHz 90.210(d) emission mask requires 24.5 dB of attenuation at the channel/block edge.
- The power level of an ANSI/TIA-102 CAI emission spectrum is about 42 dB below the transmitter power at the channel/block edge (in other words it complies with the “j” and “d” emission limits).

- Compliance with the Commission’s proposed emission mask requires 63 dB of attenuation (for a 100 W transmitter typical of an LMR base station) at the channel/block edge. This translates to:
 - About 21 dB more attenuation than the ANSI/TIA-102 CAI emission spectrum exhibits;
 - About 38.5 dB more attenuation than the 900 MHz 90.210(j) emission mask; and
 - About 41.8 dB more attenuation than the 90.210(d) emission mask.

In real-world terms, this means that equipment adhering to the ANSI/TIA-102 CAI standard could not be deployed in the “outer” channel(s) as illustrated here. In addition, M/A-COM’s EDACS products now operating in the 900 MHz band are closer to the 90.210(j) emission limits than would be an ANSI/TIA-102 CAI compliant product. Therefore, equipment such as M/A-COM’s EDACS products could not be deployed in the “outer” channel(s).

Moreover, even if it were technically feasible for an operator to meet the Commission’s proposed emission mask, the center of the “outer” channel would have to be shifted nearly one-half (about 5 kHz) of the 12.5 kHz channel width to bring a device meeting the 90.210(j) emission mask to the - 63 dB level at the channel edge (which would allow ANSI/TIA-102 CAI and/or the EDACS products to operate in the resultant “downshifted outer” channel). This “downshift” in frequency, however, would cause increased adjacent channel interference to adjacent channel 900 MHz operations. Alternatively, to avoid interference (at least to some channels)—in a domino effect—operators would need to affect an incremental shift of center operating frequencies of several channels.

Ultimately, the Commission’s proposed emissions mask would harm an incumbent or a new user relegated to the “outer” channels. The Commission’s proposal would likely render unusable two channels (upper and lower “outer” channels) for each channel block, resulting in a

loss of 20 percent of available spectrum for many technologies. M/A-COM believes that the Commission should therefore re-think its proposed emissions mask.

2. M/A-COM's 900 MHz Emission Mask Proposal

To avoid inadvertently diminishing the usability of the outer channel/block edges, M/A-COM proposes an alternative emission mask for 900 MHz services, based on the Commission's actions at 800 MHz.

In its comments, M/A-COM noted that for 800 MHz auctioned spectrum blocks, the Commission adopted an emission mask for Economic Area ("EA") licensed systems that includes a modification of the Section 90.210(g) emission mask for (as applied to 800 MHz equipment) whereby the mask beginning at the outer edge of a spectrum block converges to a limit of the lesser of $43 + 10 \log (P)$ or 80 dB defined as a function of frequency offset – the "EA mask." The EA mask allows any 800 MHz technology that complies with Section 90.210(g) mask to operate in an "outer" 800 MHz channel.

Using this concept and methodology, M/A-COM derives an equivalent mask that it proposes the Commission adopt for 900 MHz services. Below, M/A-COM provides a graphical representation comparing the Commission's proposed emission mask to the M/A-COM proposed emission mask, as well as an "expanded view" comparison of the two masks at the upper and lower channel block edges. Finally, to ensure easier codification for rulemaking purposes, M/A-COM provides a mathematical description of its proposed emission mask.

Figure 2 illustrates M/A-COM's proposed emission mask for a 10-channel contiguous, 125 kHz block. For comparison, the Commission's proposed emission mask is plotted in the same figure.

Figure 2

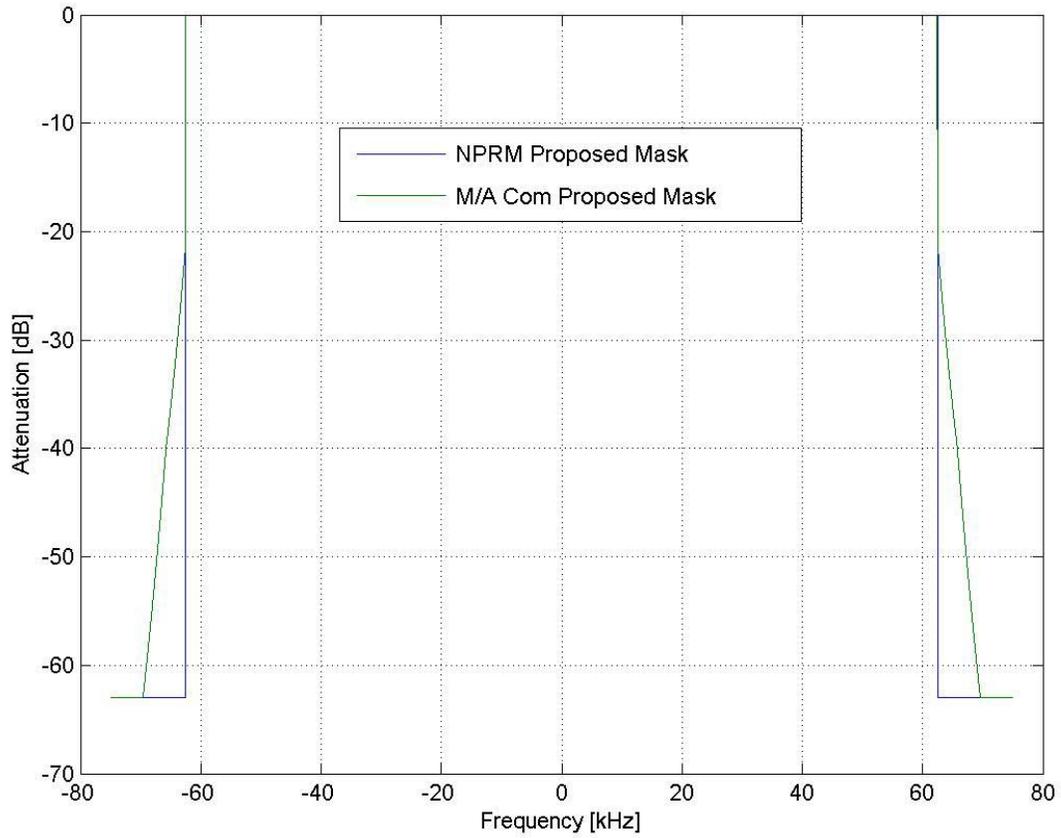
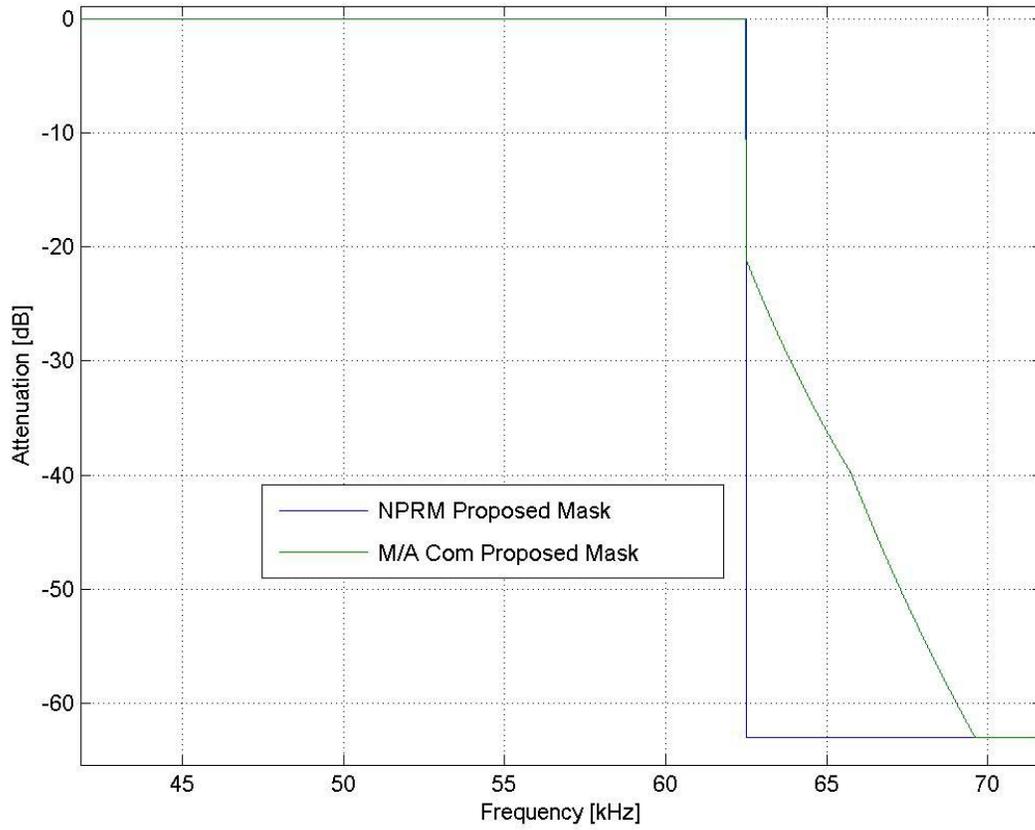


ILLUSTRATION OF THE M/A-COM PROPOSED EMISSION MASK
FOR A 10-CHANNEL CONTIGUOUS, 125 KHz BLOCK,
ALONG WITH THE NPRM PROPOSED EMISSION MASK

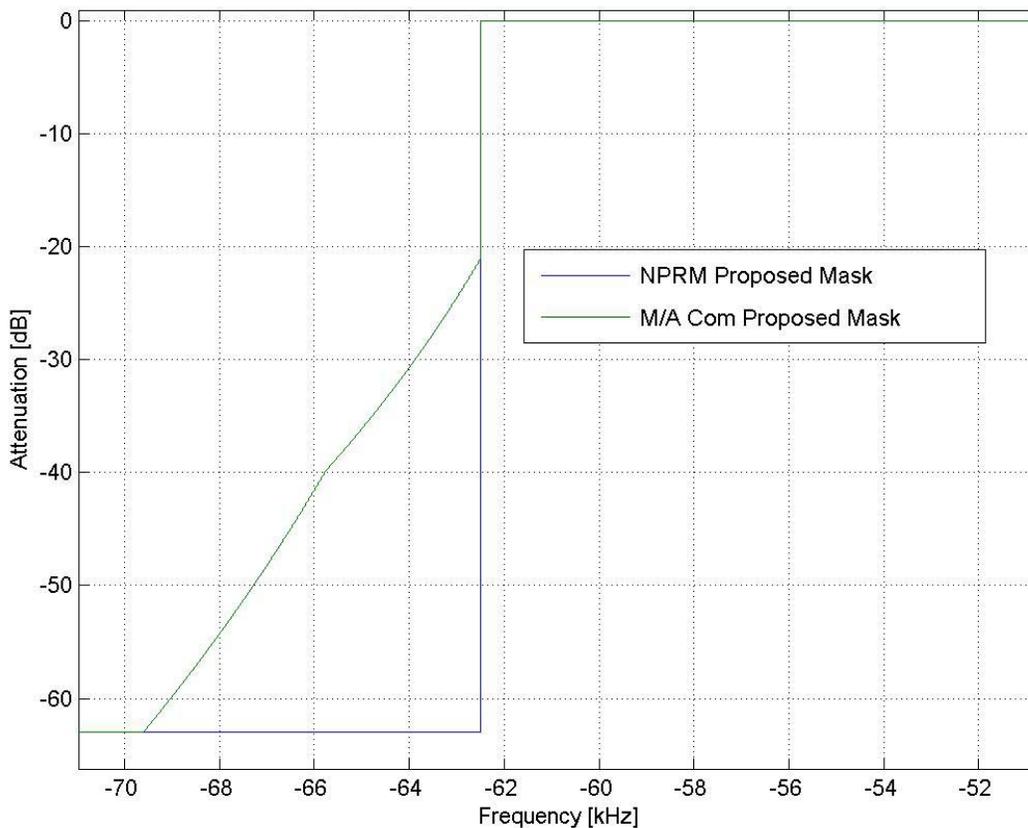
Figures 3 and 4 illustrate an expanded view of the M/A-COM proposed emission mask for the upper and lower block edges respectively along with the NPRM proposed emission mask.

Figure 3



**Expanded View Illustration of M/A-COM's
Proposed Emission Mask for the Upper Channel Block Edge,
Along with the NPRM Proposed Emission Mask**

Figure 4



**Expanded View Illustration of M/A-COM's
Proposed Emission Mask for the Lower Channel Block Edge,
Along with the NPRM Proposed Emission Mask**

Mathematically, M/A-COM's proposed emission mask—referenced to the center of the licensee's frequency block³⁷ and corresponding to Figure 2 above—can be described as follows:

- (1) On any frequency removed from the center of a frequency block by a displacement frequency (f_d in kHz) of less than 62.5 kHz:

Zero dB

³⁷ The mathematical description provided is referenced to the center of a frequency block. Nevertheless, the mathematical description could be referenced to the upper and lower edges of a frequency block through a simple frequency shifting of the definition given here.

- (2) On any frequency removed from the center of a frequency block by a displacement frequency (f_d in kHz) of more than 62.5 kHz, but no more than 65.75 kHz, the power of any emission shall be attenuated below the transmitter power (P) by:

$$\text{At least } 103 \log_{10}[(f_d - 56.25)/3.9]$$

- (3) On any frequency removed from the center of the licensee's frequency block by a displacement frequency (f_d in kHz) of more than 65.75 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by:

$$\text{At least } 157 \log_{10}[(f_d - 56.25)/5.3] \text{ or } 43 + 10 \log_{10}(P) \\ \text{or } 80 \text{ dB, whichever is the lesser}$$

M/A-COM believes by adopting this proposed emission mask, the Commission would accommodate existing and near term technologies while simultaneously protecting adjacent band operations and maximizing spectrum use.