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

In the Matter of	)	
	)	
Amendment of Part 90 of the Commission's	)	
Rules to Provide for Flexible Use of the	)	WT Docket No. 05-62
896-901 MHz and 935-940 MHz Bands	)	
Allotted to the Business and Industrial Land	)	
Transportation Pool	)	

Comments of the Association of American Railroads

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May 18, 2005

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To: The Commission

Comments of the Association of American Railroads

The Association of American Railroads ("AAR"), by its undersigned counsel, in accordance with Section 1.415 of the Commission's rules, hereby submits its Comments in response to the Notice of Proposed Rulemaking ("NPRM")[1] in the above-referenced matter.[2]

I. Summary of Position

AAR holds a nationwide geographic license for six frequency pairs in the band that is the subject of this proceeding. Those six channels are used by railroads throughout the United States (and in Canada, too, pursuant to a parallel frequency allocation) for safety-related communications that support train control and train operations. The

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[1] *Notice of Proposed Rulemaking and Memorandum Opinion and Order*, released February 16, 2005; 70 Fed Reg. 13143 (March 18, 2005). By *Order* (DA 05-1084) released April 14, 2005, the deadlines for comments and reply comments were extended to May 18 and June 2, 2005.

[2] AAR is also a party to the "Joint Comments" filed on this date in concert with the American Petroleum Institute, MRFAC, Inc., the National Association of Manufacturers and United Telecommunications Council.

Commission's proposal to license by auction the channel blocks that include those six channels is in direct conflict with the terms of AAR's license. It is also inconsistent with an applicable international agreement to which the United States is a party. Accordingly, those six channels must be removed from the Commission's auction proposal.

In addition, even if the railroad industry's six train control channels are removed from auction consideration, the Commission's proposal is still unacceptable because it will create harmful interference among users, including the railroads, resulting from incompatible adjacent channel usage. The Commission's proposal promises to replicate at 900 MHz the same interference problems that have beset incumbents in the 800 MHz band in recent years, *i.e.*, operation of incompatible system architectures on adjacent channels – which is precisely the condition that forced the recent wholesale reconfiguration of the 800 MHz band in WT Docket No. 02-55. For that reason, the Commission must adopt technical and procedural safeguards that will protect 900 MHz incumbents from objectionable interference, especially those with critical, safety-related communications systems such as the railroad industry's train control networks. Absent such safeguards, the Commission's proposal will result in harmful interference among users of the 900 MHz band in violation of Section 303(y) of the Communications Act.

II. Statement of AAR's Interest

AAR is a voluntary non-profit organization composed of member railroad companies operating in the U.S, Canada and Mexico. One of AAR's roles is to represent its members in connection with federal regulatory matters of concern to the railroad industry, including matters relating to communications and access to radio frequency

spectrum. AAR has been certified by the Commission as the designated frequency advisory committee that coordinates licensing in the Private Land Mobile Radio ("PLMR") bands for railroad use. In this regard, AAR serves as the frequency coordinator not only for its own members, but also for other entities that meet the definition of "railroad licensee" in Section 90.7 of the Commission's rules (such as metropolitan transit authorities and regional and short-line railroads).

AAR and its member railroads have a direct and vital interest in this proceeding because AAR is the licensee of six channels in the bands 896-901 and 935-940 MHz (hereafter the "900 MHz Band") that are used by the railroad industry throughout the U.S. for mission-critical train operations and train control communications, pursuant to the Commission's 1988 decision to set aside six channels in the 900 MHz Band for the railroad industry's "ATCS" ("Advanced Train Control System") operations.[3] In 2001, the Commission converted over 300 site-specific ATCS licenses held by AAR, covering over 1,000 base stations, into a single nationwide geographic-area license (Call Sign WPSF894).[4] At present, the U.S. railroad industry operates a nationwide network of over 1,600 base stations, together with thousands of trackside and mobile units, using the six ATCS channel pairs. The Commission's proposal in the NPRM to license by auction the "channel blocks" that contain the six ATCS channels is in direct conflict with the terms of AAR's geographic-area license.

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[3] Waiver of Sections 90.621(d), 90.623(a), 90.629, 90.633, and 90.651(c) of the Commission's Rules to License Use of Six Conventional 900 MHz Frequency Pairs for an Advanced Train Control System, *Order*, 3 FCC Rcd 427 (1988).

[4] In Re Petition of the Association of American Railroads for Modification of Licenses for Use in Advanced Train Control Systems and Positive Train Control Systems, *Order*, DA 01-359, 16 FCC Rcd. 3078 (2001).

III. AAR's Geographic License Supports Vital, Safety-Related Operations

As shown in the following summary of the background and history of the railroad industry's use of the ATCS channels, the Commission's 1988 allocation decision and its 2001 licensing decision were both grounded upon important public safety considerations.

In 1986 and 1987, AAR filed hundreds of applications on behalf of its members for authority to operate on six frequency pairs in the Business, Industrial and Land Transportation ("B/ILT") Pool of the 900 MHz Band.[5] AAR sought those licenses to facilitate the construction and development of a nationwide ATCS network, and requested waivers of certain FCC rules with respect to the use of the frequencies. In 1988, the Commission granted the waivers and issued hundreds of site-specific licenses to AAR for use of the six frequency pairs for ATCS train control operations,[6] noting that its action was in furtherance of the statutory mandate in the Communications Act to regulate communications in a manner that will "promote the safety of life and property."[7]

At approximately the same time (in the late 1980s), the government of Canada allocated the same six channel pairs for ATCS operations by the railroads in Canada and,

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[5] The six frequency pairs are 896.8875/935.8875 MHz, 896.9375/935.9375 MHz, 896.9875/935.9875 MHz, 897.8875/9375 MHz, 897.9375/936.9375 MHz, and 897.9875/936.9875 MHz. These six channel pairs are identified at Section 90.613 of the Commission's rules as Channel Nos. 71, 75, 79, 151, 155 and 159.

[6] Although AAR was the applicant for each station, AAR was acting on behalf of its member railroads on whose property the stations would be built. Thus, AAR was named as the licensee on each license, but the equipment comprising the stations (towers, transmitters, wayside stations, mobile radios, antennas, etc.) was paid for and is owned by the railroads on whose property the stations are situated.

[7] Waiver of Sections 90.621(d), 90.623(a), 90.629, 90.633, and 90.651(c) of the Commission's Rules to License Use of Six Conventional 900 MHz Frequency Pairs for an Advanced Train Control System, *Order*, 3 FCC Rcd 427 (1988), at ¶ 8, citing Sections 1 and 332(a)(1) of the Communications Act of 1934, 47 U.S.C. §§ 151 and 332(a)(1).

in 1990, the FCC and the Canadian Department of Communications (now called "Industry Canada") entered into an agreement concerning use of the 900 MHz Band along the Canada-U.S. border. In that agreement, the governments of the United States and Canada agreed that the same six channel pairs would be available for ATCS implementation in both countries, and delegated to AAR and its Canadian counterpart, the Railway Association of Canada ("RAC"), the responsibility for working out the details concerning use of the six ATCS channels in border areas.[8]

Approximately five years ago, on March 24, 2000, AAR filed a "Petition for Modification of Licenses" asking the Commission convert all of AAR's site-specific ATCS licenses into a single geographic-area license, the boundaries of which would be defined as 70 miles on either side of all railroad rights-of-way anywhere in the United States. In 2001, the FCC granted AAR's petition[9] and issued a single license to AAR (Call Sign WPSF894), which states that the geographic area of the license "is defined by a 140-mile wide swath or ribbon that tracks all of the railroad rights-of-way in the United States," and that the licensee "may locate, move, or modify its stations anywhere within its 140-mile wide geographic area without obtaining Commission consent…"[10]

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[8] *See* Arrangement Between the Department of Communications of Canada and the Federal Communications Commission of the United States of America Concerning the Use and the Bands 896 to 901 MHz and 935 to 940 MHz, September 17, 1990; in particular, *see* Section 2.1(c) concerning use of the same six channels in the U.S. and Canada for implementation of an Advanced Train Control System.

[9] In Re Petition of the Association of American Railroads for Modification of Licenses for Use in Advanced Train Control Systems and Positive Train Control Systems, *Order*, DA 01-359, 16 FCC Rcd. 3078 (2001).

[10] License for Call Sign WPSF894, ULS Reference Copy, FCC 601-LM.

The Commission gave four reasons – all safety-related – in support of its decision to modify AAR's numerous site-specific ATCS licenses by merging them into a single geographic-area license. First, the Commission agreed with the supporting comments of the Federal Railroad Administration ("FRA"), the federal agency responsible for rail safety standards, that geographic licensing would not only streamline the Commission's licensing process, but also, and more importantly, give the railroads much greater flexibility in choosing where to deploy their ATCS base stations.[11] Second, noting that Congress had recognized in the Balanced Budget Act of 1997 that "railroad radio communications are used to protect the safety of life and property,"[12] the Commission concluded that the geographic licensing approach "will result in improvements to the safety of train operations in general" by facilitating the deployment of current and future ATCS facilities.[13] Third, the Commission concluded that adopting a geographic-area licensing approach would "ensure that the railroads' safety-critical communications data links continue to be protected from interference."[14] And fourth, noting that the Canadian government had recently converted RAC's multiple 900 MHz ATCS licenses into a single nationwide geographic license covering rail lines throughout Canada, the Commission agreed that "international harmonization would further the public interest by

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[11] *Id*. at ¶ 7.

[12] *Id.* at n. 26, citing Implementation of Sections 309(j) and 337 of the Communications Act of 1934 as Amended, *Report and Order and Further Notice of Proposed Rule Making*, FCC 00-403, ¶¶ 75-76 (released November 20, 2000), and H.R. Conf. Rep. No. 105-217, 105th Cong., 1st Sess. at 572 (1997).

[13] *Id*. at ¶ 7.

[14] *Id.*

contributing to smooth transborder [train control] operations."[15] In summary, the Commission concluded that "significant *public safety* benefits will be realized" by converting all of AAR's site-specific ATCS licenses into a single nationwide geographic-area license.[16]

IV. The Commission's Proposal is Irreconcilable with AAR's Geographic License and Inconsistent with an Applicable International Agreement

The Commission is proposing in this proceeding to issue new geographic-area licensees by auctioning the twenty B/ILT "blocks" of channels in the 900 MHz Band, including the two blocks that include the six ATCS Channels (*i.e.,* the two channel blocks identified as "DD" and "HH" in the NPRM).[17] The new licensees (*i.e.,* the auction winners) will be permitted to provide Commercial Mobile Radio Service ("CMRS"), either in the form of cellular telephone service or Enhanced Specialized Mobile Radio service ("ESMR").

AAR's geographic-area license for the six ATCS channels is mutually exclusive (*i.e.,* geographically and spectrally incompatible) with the Commission's proposal to issue new geographic licenses for channel blocks "DD" and "HH." From a geographic perspective, AAR's "ribbon" license is, for all practical purposes, a nationwide license. Owing to the ubiquity of rail lines throughout the United States, there is very little land area that is not situated within 70 miles of a railroad right-of-way. As shown on the

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[15] *Id.*

[16] *Id*. at ¶ 10, emphasis added.

[17] NPRM at ¶ 27 and Appendix A (Table 7 of proposed Section 90.617 and Table 2B of proposed Section 90.619).

attached map, the area encompassed by AAR's license covers almost all of the continental United States (the exceptions being small portions of central Nevada and southeastern Oregon, and very small areas in Idaho, Utah and New Mexico).[18] There are no areas where a new geographic area license issued pursuant to an auction (whether based on MTAs, EAs or MEAs) would not overlap the area encompassed by AAR's "ribbon" license for the six ATCS channels.

Although it may be legally permissible for the Commission to "overlay" a new co-channel geographic license "on top of" a *site-based* license (on the condition that the geographic licensee protect the site-based station from radiofrequency interference), it is *not* permissible for the Commission to superimpose a new co-channel geographic-area license upon another, pre-existing *geographic area* license, because the two are incompatible by definition.[19] The essential feature (and principal benefit) of a geographic license resides in the licensee's flexibility to deploy stations anywhere within the geographic boundaries without Commission consent (subject, of course, to terms and conditions that are not relevant for present purposes). In this regard, proposed Section 90.679 (set forth in Appendix A of the NPRM) would allow new EA or MEA-based

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[18] The shaded portions on the attached map represent areas in the 48 contiguous states that are 70 miles or less from a railroad right-of-way. The map was generated using a map from the National Transportation Atlas Database that shows all rail lines in the U.S. A software program (ArcGIS) was used to position the center of a 140-mile circle at numerous points on said rail lines (approximately 229,000 separate points). The multiple circles were then merged and dissolved to show the total area covered by the ribbon license. The map was created by AAR's frequency coordination staff located at AAR's subsidiary, Transportation and Technology Center, Inc., in Pueblo, CO.

[19] Such action would result in the *de facto* modification (at best) or revocation (at worst) of the prior geographic license, which could not be accomplished properly by the Commission without compliance with the due process safeguards and procedures spelled out in Sections 312(c) and 316 of the Communications Act of 1934, 47 U.S.C. §§ 312(c), 316.

licensees in the 900 MHz Band to "construct and operate base stations using any frequency identified in their spectrum block anywhere within their authorized license area…"[20] If spectrum blocks "DD" and "HH" are auctioned so as to include in block "DD" Channel Nos. 71, 75 and 79 and in block "HH" Channel Nos. 151, 155 and 159, the Commission's proposal will be in direct conflict with the terms of AAR's "ribbon" ATCS license, which covers those same six channels and states that the licensee "may locate, move, or modify its stations anywhere within its 140-mile wide geographic area without obtaining Commission consent…"[21] Obviously, the Commission cannot grant "exclusive" licenses to two entities authorizing each of them simultaneously to construct and operate co-channel stations anywhere within the same geographic area.

The proposed licensing by auction of channel blocks "DD" and "HH" inclusive of the six ATCS channels would also be inconsistent with the agreement governing use of those channels between the governments of the United States and Canada,[22] and therefore in violation of Section 303(y) of the Communications Act which authorizes the Commission to allocate spectrum for "flexible use" only if such allocation is, *inter alia*, "consistent with international agreements to which the United States is a party."[23]

Under the circumstances, the Commission must modify its proposal by removing from the channel blocks to be auctioned for "flexible use" the three ATCS frequency

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[20] NPRM at Appendix A, proposed Section 90.679(a).

[21] License for Call Sign WPSF894, ULS Reference Copy, FCC 601-LM.

[22] See n. 8, *supra*, and associated text.

[23] 47 U.S.C. § 303(y).

pairs in channel block "DD" (Channel Nos. 71, 75 and 79) and the three in channel block "HH" (Channel Nos. 151, 155 and 159).

V. The Commission's Proposal, Without More, Will Result in Harmful Interference Among Users

Even if the Commission omits the six ATCS channels from the channel blocks to be auctioned, significant interference problems will materialize in the 900 MHz Band as a result of out-of-band emissions and intermodulation effects from adjacent channel CMRS operations, unless the Commission adopts remedial measures at the outset. The interference problems will be identical to those that have plagued incumbent licensees in the 800 MHz band, arising from the interleaving of dissimilar and incompatible system architectures on adjacent channels (*i.e.*, "high site, high power" land mobile systems operating on channels adjacent to those occupied by "low site, low power" cellular or ESMR systems). If the Commission fails to adopt adequate safeguards and allows CMRS systems to proliferate unconstrained on channels adjacent to the railroad industry's six ATCS channels (which employ typical "high-site, high-power" technology), the same type of interference that has been suffered by incumbents in the 800 MHz band will be experienced by the railroads on their mission-critical train control communication systems that operate on the six ATCS channels. In other words, the Commission will have created a spectrum environment that will result in "harmful interference among users" – a result that would contravene the "flexible use" authority conferred by Section 303(y) of the Communications Act.[24] AAR therefore recommends

[24] The Commission may make a "flexible use" allocation on the condition that, *inter alia*, "such use would not result in harmful interference among users." 47 U.S.C. § 303(y).

that the Commission adopt appropriate interference safeguards, and takes this opportunity to respond specifically to the questions posed at paragraphs 35 and 42 of the NPRM.

At paragraph 35 of the NPRM, the Commission took proper note that incumbent licensees in the 900 MHz Band "may be faced with the same interference problems that necessitated the remedies adopted in the *800 MHz R&O* unless equivalent interference abatement requirements are established at 900 MHz." As mentioned above, unless proper safeguards are adopted at the outset, the Commission will create precisely the same intolerable interference environment at 900 MHz as has existed at 800 MHz in recent years. Indeed, the Commission itself has already admitted as much, having stated last August that: "From an interference perspective, our decision to permit operational flexibility (*i.e.* cellular architecture) in the 900 MHz band effectively precludes use of 900 MHz by public safety at this time."[25]

If allowing cellular architectures to proliferate at 900 MHz will create sufficient interference problems so as to preclude *public safety* systems from operating in the 900 MHz Band, certainly those same interference problems will have an identical impact on *other* (*i.e.*, non-public safety) incumbents, for there is no inherent difference between the technology and equipment used by public safety agencies and B/ILT incumbents at both

[25] Improving Public Safety Communications in the 800 MHz Band, WT Docket No. 02-55, *Report and Order*, 19 FCC Rcd 14,969 (2004) ("*800 MHz R&O*") at ¶ 207.

the 800 MHz and the 900 MHz bands.[26] Therefore, the interference abatement procedures adopted for the benefit of public safety entities in the 800 MHz proceeding must be adopted for incumbents in the 900 MHz Band.[27] AAR is already on record with the Commission on this point, having stated in its Petition for Reconsideration in WT Docket No. 02-55 that the only way adequately to protect 900 MHz incumbents is for the Commission to adopt interference abatement procedures for the 900 MHz Band that are equivalent to those adopted in the 800 MHz proceeding. A copy of AAR's Petition for Reconsideration is attached hereto, and AAR hereby incorporates by reference the arguments and statements set forth in said Petition as if they were set out here in full.[28]

In response to AAR's Petition for Reconsideration (and similar petitions filed by other parties), Nextel Communications, Inc. ("Nextel") recently claimed that there are

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[26] Indeed, the evidence available to AAR indicates that, if anything, the 900 MHz equipment is *more* susceptible to interference than equipment used at 800 MHz. AAR performed a comparative analysis of the adjacent channel rejection and intermodulation rejection performance of generic mobile radios manufactured for use in both the 800 MHz and 900 MHz bands, in the context of the relevant parameters adopted in the 800 MHz proceeding. That analysis revealed that the radios do not achieve the same rejection performance at 900 MHz of which they are capable at 800 MHz. *See* Petition for Reconsideration filed by the Association of American Railroads in WT Docket No. 02-55, on December 17, 2004, at n. 18 (hereafter "AAR Petition for Reconsideration in WT Docket No. 02-55").

[27] In the 800 MHz proceeding, the Commission adopted rules governing interference protection entitlement and the assignment of responsibility for the abatement of unacceptable interference. *800 MHz R&O* at ¶¶ 105-141; *see also Supplemental Order and Order on Reconsideration*, FCC 04-294, 19 FCC Rcd 25120 (2004) at ¶¶ 37-50.

[28] AAR Petition for Reconsideration in Docket No. 02-55 (*supra*, n.23). In particular, AAR emphasizes here the statement at footnote 18 of its Petition for Reconsideration that, in order to achieve a threshold for entitlement to protection against unacceptable interference at 900 MHz that is *equivalent* to what was adopted for the 800 MHz band, the Commission should specify 65 dB of adjacent channel rejection and 65 dB of intermodulation rejection for systems at 900 MHz.

four reasons why the 800 MHz interference protection measures are not "necessary" in the 900 MHz Band.[29] Not one of Nextel's four reasons is valid. First, Nextel claimed that it "has been operating its 900 MHz ESMR systems since 2002, and it has not received a single interference complaint from a B/ILT licensee during that period."[30] But Nextel's assertion regarding its operating history at 900 MHz is belied by the Commission's own prior finding last August (which Nextel did not challenge) that "there currently is no extensive ESMR use of the 900 MHz band…"[31] In this regard, the interference problems associated with dissimilar system architectures operating on adjacent channels at 800 MHz did not reach crisis proportions for several years, *i.e.*, until the cellular-type architecture had proliferated and achieved a very high density. The same scenario exists at 900 MHz, and Nextel's claim that it has not yet received "a single interference complaint" from a 900 MHz licensee is utterly meaningless given the nascent state of deployment of cellular/ESMR architecture in the 900 MHz Band.

Nextel's second argument why interference abatement rules are "unnecessary" at 900 MHz is equally flawed. Nextel claims that it will "continue to rely on sound engineering principles, and it will follow voluntary Best Practices…" to resolve

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[29] Opposition and Comments of Nextel Regarding Petitions for Reconsideration in WT Docket No. 02-55, filed April 21, 2005, at 19-20 (hereafter "Nextel Opposition and Comments"). At page 20, Nextel suggested that interference abatement issues for the 900 MHz Band should be addressed in the context of the 900 MHz proceeding, rather than in the 800 MHz proceeding. AAR agrees. Hence, AAR is responding here to Nextel's four arguments in its "Opposition and Comments" that interference protection measures are not necessary at 900 MHz.

[30] Id. at 19.

[31] *800 MHz R&O* at ¶ 336.

interference problems that may arise at 900 MHz.[32] But those measures are exactly what Nextel claimed to have tried for years at 800 MHz,[33] and the Commission concluded that they were clearly ineffective as a long term solution for the interference problems in that band.[34] Instead, the Commission decided that the *only effective ultimate solution* at 800 MHz was a total reconfiguration of the band to achieve adequate spectral separation between fundamentally incompatible system architectures.[35] Given the track record at 800 MHz, Nextel should not be permitted to rely on the same ineffective interference mitigation techniques at 900 MHz that failed so notoriously to solve the interference problems at 800 MHz.

Nextel's third argument is that adopting the same interference measures at 900 MHz as were used at 800 MHz "would impose substantial operational burdens on 900 MHz commercial licensees, and would be contrary to the 'flexible use' policies" proposed for the 900 MHz Band.[36] The argument is not valid. As the ultimate financial beneficiary of the Commission's overall resolution of the interference problems at 800 MHz *that were caused by Nextel's presence in that band*, Nextel cannot legitimately object to paying the costs of protecting incumbent 900 MHz licensees from interference as a result of Nextel's expanded presence in the 900 MHz Band. Stated another way, the

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[32] Nextel Opposition and Comments, *supra*, at 19-20.

[33] Nextel White Paper, November 2001, at 16-18.

[34] *800 MHz R&O* at ¶ 17 (case-by-case treatment using "Enhanced Best Practices" techniques "does not provide the best long-term answer to the problem of interference to public safety and other non-cellular operations in the 800 MHz band"), and ¶ 101 (addressing interference reactively on an *ad hoc* basis "is no longer workable in the 800 MHz band").

[35] *Id.* at ¶ 22.

[36] Nextel Opposition and Comments at 20.

900 MHz incumbents should not be forced to subsidize Nextel by means of higher equipment costs or impaired service, especially for mission-critical safety-related communications links such as ATCS.

Nextel's fourth argument is that "unlike public safety licensees [in the 800 MHz band], B/ILT licensees at 900 MHz generally have the resources to deploy robust, interference-resistant systems."[37] This argument is totally without merit for several reasons. First, there is an enormous difference in deployment status as between incumbents and new CMRS entrants (such as Nextel) at 900 MHz. In this regard, it bears repeating that the Commission has already found that there currently is minimal CMRS deployment in the 900 MHz Band.[38] For that reason, the Commission concluded that "ESMR licensees designing systems 'from the ground up' in the 900 MHz band will be better able to take interference abatement into account when designing their systems."[39] In stark contrast, the railroads and other B/ILT licensees do not have the opportunity to design their systems "from the ground up" because they already have vast networks of existing installations (base stations, mobiles and related equipment) that would have to be redesigned, retrofitted or replaced, all at great cost, to make them more "robust" and "interference-resistant" (to use Nextel's terminology) or, in other words, to make them capable of coexisting with Nextel's expanded presence in the band.

Furthermore, not only would it be inequitable to require the incumbents to bear the financial burden of upgrading their equipment to protect themselves against

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37 *Id.*

38 *800 MHz R&O* at ¶ 336.

39 *Id.*

interference from Nextel, it also would be unreservedly contrary to long-established Commission precedent requiring that an interference-causing "newcomer" pay the costs of remedying interference suffered by PLMR users: "[T]here is no doubt that the financial responsibility for eliminating the objectionable interference falls upon the 'newcomer.'"[40] Financial resources of the interference victim are not a factor in applying this longstanding "newcomer pays" policy, and there is no reason why the policy should not be fully applicable to Nextel or any other CMRS carrier seeking expanded presence in the 900 MHz Band.

And finally, the statutory mandate in Section 303(f) of the Communications Act requiring the Commission to adopt rules to "prevent interference between stations"[41] does not give the Commission latitude to afford some licensees (*e.g.*, public safety entities) greater interference protection than others (*e.g.*, B/ILT licensees). And even if Section 303(f) could be read to permit such discriminatory treatment, the history of the Commission's allocation and licensing decisions regarding the six ATCS channels,[42] not to mention the statutory public safety directive in the Balanced Budget Act of 1997 and the Commission's implementation thereof,[43] make it abundantly clear that the railroads' status in this context is equivalent to that of a "public safety" entity.

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[40] Broadcast Corporation of Georgia (WVEU-TV), 92 FCC 2d 910 (1982) at ¶ 7.

[41] Section 303(f) of the Communications Act of 1934, as amended, 47 U.S.C. § 303(f).

[42] See Section III, *supra*, entitled "AAR's Geographic License Supports Vital, Safety-Related Operations."

[43] Implementation of Sections 309(j) and 337 of the Communications Act of 1934 as Amended, *Report and Order and Further Notice of Proposed Rule Making*, FCC 00-403, ¶¶ 75-76 (2000) (The railroad industry and certain other "critical infrastructure" industries are imbued with public safety characteristics because "the nature of their day-

In summary, if the proposals set forth in the NPRM are adopted, the FCC will have fashioned precisely the same interference environment at 900 MHz as existed previously at 800 MHz. By auctioning all of the B/ILT portions of the 900 MHz Band to CMRS providers and allowing them to operate on channels immediately adjacent to those occupied by incumbents, with no geographic or spectral separation, the Commission will have created in the B/ILT channel blocks a *de facto* interleaving of channels occupied by incompatible system architectures (*i.e.*, high site *vs*. low site). Under the circumstances, the Commission must do no less than adopt interference protection measures for the 900 MHz incumbents that are *at least* equivalent to those adopted for public safety licensees in the 800 MHz proceeding.[44]

At paragraph 42 of the NPRM, the Commission proposed that the power of any CMRS 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." The Commission specifically sought comment on its "tentative" conclusion "that this emission mask would adequately protect licensees in neighboring spectrum,"[45] and asked commenting parties to include a "technical analysis" in support of any alternative proposals.[46] AAR believes the

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to-day operations provides little or no margin for error and in emergencies they can take on an almost quasi-public safety function. Any failure in their ability to communicate by radio could have severe consequences on the public welfare. For example, the failure or inability of trains to communicate with each other or a central dispatcher could result in unsafe conditions and an increased risk of derailment.").

[44] As described at n. 27, *supra*, those measures consist of (1) rules for interference protection entitlement, and (2) assignment of responsibility for abatement of unacceptable interference.

[45] NPRM at ¶ 42. The same emission mask formula is included at proposed Section 90.669(a) in Appendix A of the NPRM.

[46] *Id*.

proposed protection would *not* be adequate, and recommends that the Commission adopt additional restrictions on CMRS operations to protect against interference to adjacent-channel incumbents from out-of-band emissions and intermodulation effects.

The attached report entitled "Technical Analysis in Support of AAR Comments in WT Docket No. 05-62" (hereafter called "Technical Analysis"), states the reasons why the emission mask proposed at paragraph 42 of the NPRM is inadequate for protecting adjacent-channel incumbents, and sets forth recommendations for remedying this shortcoming. Perhaps the most obvious means of addressing the inadequacy of the proposed mask is for the Commission to adopt a more stringent one,[47] as was recommended in the 800 MHz proceeding by Nextel and others in the *ex parte* filing of the "Consensus Parties" on August 7, 2003, in WT Docket No. 02-55.[48]

Should the Commission decline (for whatever reason) to adopt a more stringent emission limit than the one proposed at paragraph 42,[49] there are alternative means of protecting 900 MHz incumbents from interference, as explained in the attached Technical Analysis. One of them involves geographic separation between a CMRS base station and a "high site" operator's mobiles, a solution that is feasible only where the location of the mobiles can be predetermined as in the case of the railroad industry, where the mobiles

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[47] Technical Analysis at 3.

[48] "Ex Parte Submission of the Consensus Parties," August 7, 2003, WT Docket No. 02-55, at Attachment 1 (Appendix F) at ¶ 4.1.2. See also *800 MHz R&O* at ¶ 104.

[49] In the 800 MHz context, the Commission chose not to adopt the recommended increased emission restrictions out of a concern for the additional filtering costs expressed by rural cellular carriers and others. *800 MHz R&O* at ¶ 104. That may or may not be a valid concern here, and AAR urges the Commission to consider more stringent emission limits as a means of protecting incumbents at 900 MHz from interference from adjacent CMRS operations.

(*i.e.*, ATCS radios aboard locomotives) are confined to a fixed right-of-way. In that context, the Technical Analysis recommends that adjacent-channel CMRS base stations be located no closer than four miles from the predetermined right-of-way.[50] For vehicular fleets whose travel area is not confined to a fixed right-of-way, the Technical Analysis suggests a spectral separation solution for first-adjacent channel usage or filtering for second-and-higher adjacent channel usage, in order to protect a "high site" operator's mobiles from interference.[51] The Technical Analysis also contains a recommendation for minimum distance separation between "high site" mobiles and CMRS base stations with respect to intermodulation.[52]

VI. Conclusion

In conclusion, because AAR's nationwide geographic license for the six ATCS channels is mutually exclusive with a portion of the Commission's proposed new licensing scheme for the 900 MHz Band, those six channels must be omitted from the Commission's auction proposal. In addition, even if the six ATCS channels are excluded from the auction channel plan, safety-critical train control communications will be vulnerable to adjacent-channel interference from new CMRS providers unless the Commission adopts adequate protective measures at the outset. Accordingly, the

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[50] Technical Analysis at 3, Recommendations for "Geographic Separation" under (1) "First Adjacent Channel Usage" and (2) "Second-and-Higher Adjacent Channel Usage."

[51] *Id*. at 3, Recommendations for "Spectral Separation" under (1) "First Adjacent Channel Usage," and "Filtering" under (2) "Second-and-Higher Adjacent Channel Usage."

[52] *Id*. at 4, "Intermodulation."

Commission must adopt procedural safeguards and operational limitations on CMRS providers in the 900 MHz Band that will protect the railroad industry's vital train control networks from objectionable interference.

Respectfully submitted,

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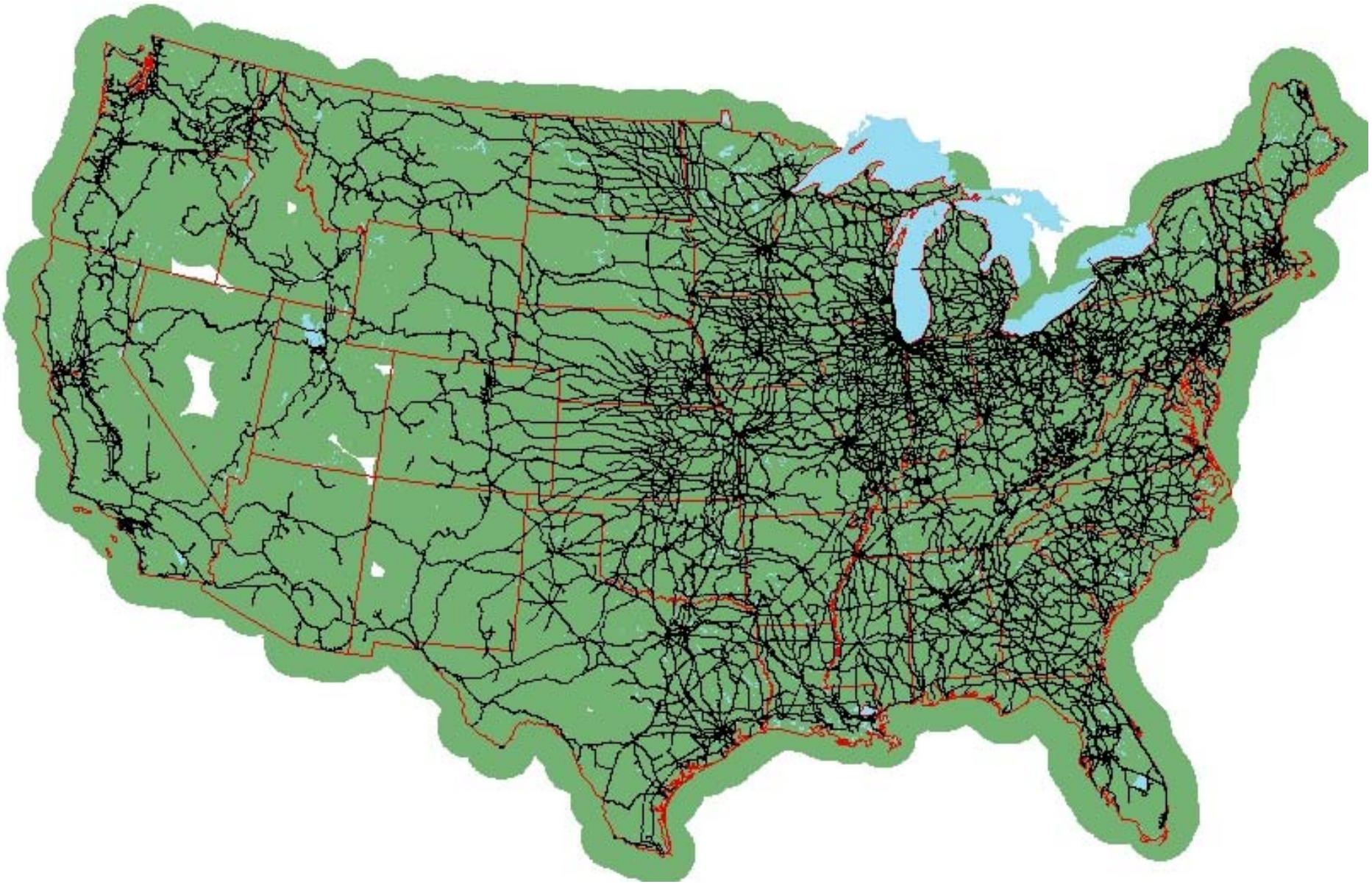
May 18, 2005

Attachments: 1. Map: Geographic Scope of ATCS "Ribbon" License (WPSF894)

2. Technical Analysis in Support of AAR Comments

3. AAR Petition for Reconsideration in WT Docket No. 02-55

Geographic Scope of ATCS “Ribbon” License (WPSF894)



Technical Analysis in Support of AAR Comments in WT Docket No. 05-62

This report was prepared in support of the Comments of the Association of American Railroads (AAR) in response to the FCC's Notice of Proposed Rulemaking in WT Docket No. 05-62. The report was prepared by R. Vandeberg, AAR Frequency Coordinator, and D. Corley, Communications Engineer, Union Pacific Railroad. The purpose of the report is to demonstrate why the proposals at paragraph 42 of the Notice, and proposed rule 90.669(a) at Attachment A of the Notice, do not adequately protect incumbent systems in the 900 MHz Band.

Out of Band Energy

The emission mask limits that are being proposed in the Notice appear inadequate to protect other users in the band. The wording of paragraph 42 of the Notice (and of proposed rule Section 90.669(a)) appears to make reference to out of band energy only, and not frequency displacement as in Section 90.210 (i)(3) of the FCC's rules, which describes that energy as being removed from the channel center by 15 kHz or greater. Note that the limitation in paragraph 42 (and proposed Section 90.669(a)) would allow the interfering transmitter's energy to pass through the adjacent channel's near side modulation acceptance bandwidth, through the adjacent channel's center, and into the far side of the adjacent channel's modulation acceptance bandwidth.

The proposed rule 90.669(a) will limit out of band energy power levels at the transmitter output port to a -13 dBm limit until the power levels increase above 5000 watts. A "high site" mobile radio approaching a "low site" base station would begin to see noise floor levels rise when the mobile is approximately four (4) miles from a single "low site" transmitter. As an example, with a -13 dBm absolute out of band energy level from the "low site" transmitter, a typical antenna gain of 12 dB, and assumed system losses of 5 dB, the expected ERP of the out of band energy would be approximately -6 dBm. **Table 1** indicates expected noise floor levels attributed to the "low site" out of band energy mitigated by free space path loss calculated as;

Path Loss in dB = 36.6 + 20 log (Distance in miles) + 20 log (Frequency in MHz)
Path Loss in dB = 36.6 + 20 log (Distance in miles) + 20 log (940)
Path Loss in dB = 36.6 + 20 log (Distance in miles) + 59.46

TABLE 1

Mobile distance from "low site" transmitter	Path loss in dB	Expected Noise Floor Level in dBm Attributed to the "low site" Transmitter
4 miles	108.1	-114
2 miles	102.1	-108
1 mile	96.1	-102
.5 mile	90.0	-96
.25 mile	84.55	-90.55
.125 mile	77.99	-83.99
300 feet	71.15	-77.15
200 feet	67.63	-73.63
100 feet	61.61	-67.61

Emission Mask

The greater risk is the interfering transmitter's main modulation mask.

Referring to test data submitted to the FCC for type acceptance for the Motorola iDEN system transmitter at 900 MHz (equipment type ABZ89FC5798), a single iDEN carrier produces spectrum energy that is calculated by Motorola to be 17.7 kHz in bandwidth (Test Data: Exhibit 11B-1, "Necessary Bandwidth Calculation").

The submitted test data indicates modulated power levels approximately 17 dB down from the unmodulated 52 watt (+47.16 dBm) transmitter. Assuming a typical antenna gain of 12 dB and system losses of 5 dB, this would indicate a possible ERP of (+47.16 dBm –17 dB) + 12 dB – 5 dB = +37.16 dBm. A “high site” mobile that approaches this example of the iDEN transmitter would see energy levels rise as if the iDEN transmitter were co-channel, i.e., as if there were a transmitter operating at the equivalent of several watts ERP in the “high site” operator’s channel bandwidth.

The submitted test data implies that the iDEN system is being moved from 800 MHz 25 kHz channel bandwidths to 900 MHz 12.5 kHz (or 13.6 kHz) channel bandwidths with no change in the amount of bandwidth that the iDEN system transmitter occupies. A "low site" operator using such an iDEN transmitter centered on a channel adjacent to that of a "high site" operator would be generating energy well inside the "high site" operator’s channel center. See **Figure 1: “Proposed Section 90.669(a) Emission Mask”**.

It is assumed that "low site" operators would be able to aggregate their channel usage with respect to channel centers and position those channel centers anywhere within their block of channels. In light of the interference potential portrayed in **Figure 1: “Proposed Section 90.669 (a) Emission Mask,”** coupled with the added interference potential of a 17.7 kHz bandwidth, it would seem apparent that the iDEN system’s

transmitter channel center should *not* be placed on a normal channel center only 12.5 kHz away from an adjacent channel assignment in the Business/Industrial/Land Transportation Pool table of frequencies.

Recommendations:

1) First Adjacent Channel Usage

Other than a more stringent emission mask, there are two additional ways to avoid the situation where a “low site” operator places so much excess radio energy in a “high site” operator’s adjacent channel that the “high site” operator is denied use of the channel -- distance separation and spectral separation. Because the problem occurs with the “high site” operator’s mobiles, the geographic separation solution is available only where the location of the mobiles can be predetermined (as is the case with the railroad mobiles). For vehicular fleets whose range is ubiquitous (i.e., not predetermined by a railroad track or similar right-of-way), the spectral separation solution is available.

Geographic Separation. “Low site” operators using channels immediately adjacent to "high site" user's channels should install sites no closer than four (4) miles from the predicted location of the "high site" mobiles. In the rail industry that would include all railroad track and rail facilities in order to reduce the possibility of adjacent channel interference to mobile equipment and trackside train control equipment.

Spectral Separation. The "low site" operator's channel center should be no closer than 20 kHz from the "high site" operator’s first adjacent channel center. This would move the emission mask for the "low site" operator 7.5 kHz farther away from the "high site" operator's channel center.

2) **Second-and-Higher Adjacent Channel Usage**

Geographic Separation. Proposed Section 90.669 limits emissions in immediately adjacent channels, although to an insufficient degree, as described above. For channels further removed from a “low site” transmitter channel, Section 90.669 apparently provides no limits to emitted energy. Although this may not be an issue with typical transmitters, emission limits for these more distant channels should be specified. If the intent were to maintain the “43 plus $\log_{10}(P)$” minimum attenuation beyond the immediately adjacent channels, then the geographic spacing restrictions (in recommendation 1) would apply to all of these channels. Other regimes for second-, third-, and higher adjacent channel attenuation requirements would imply their own geographic spacing restrictions.

Filtering. Another solution might be for the "low site" operators to install additional filtering so as to ensure that their out of band emissions would be reduced to a level that would not cause interference to the "high site" operator’s mobiles as they approach a "low site" installation. The degree of additional out of band filtering may be site specific.

3) **Intermodulation**

In order to prevent intermodulation interference to a "high site" operator's mobiles as they approach a "low site" installation, a mobile must maintain some minimum distance from the "low site" installation. This distance will vary depending on the "low site" transmitter power output and the "high site" mobiles intermodulation rejection figure of the receiver.

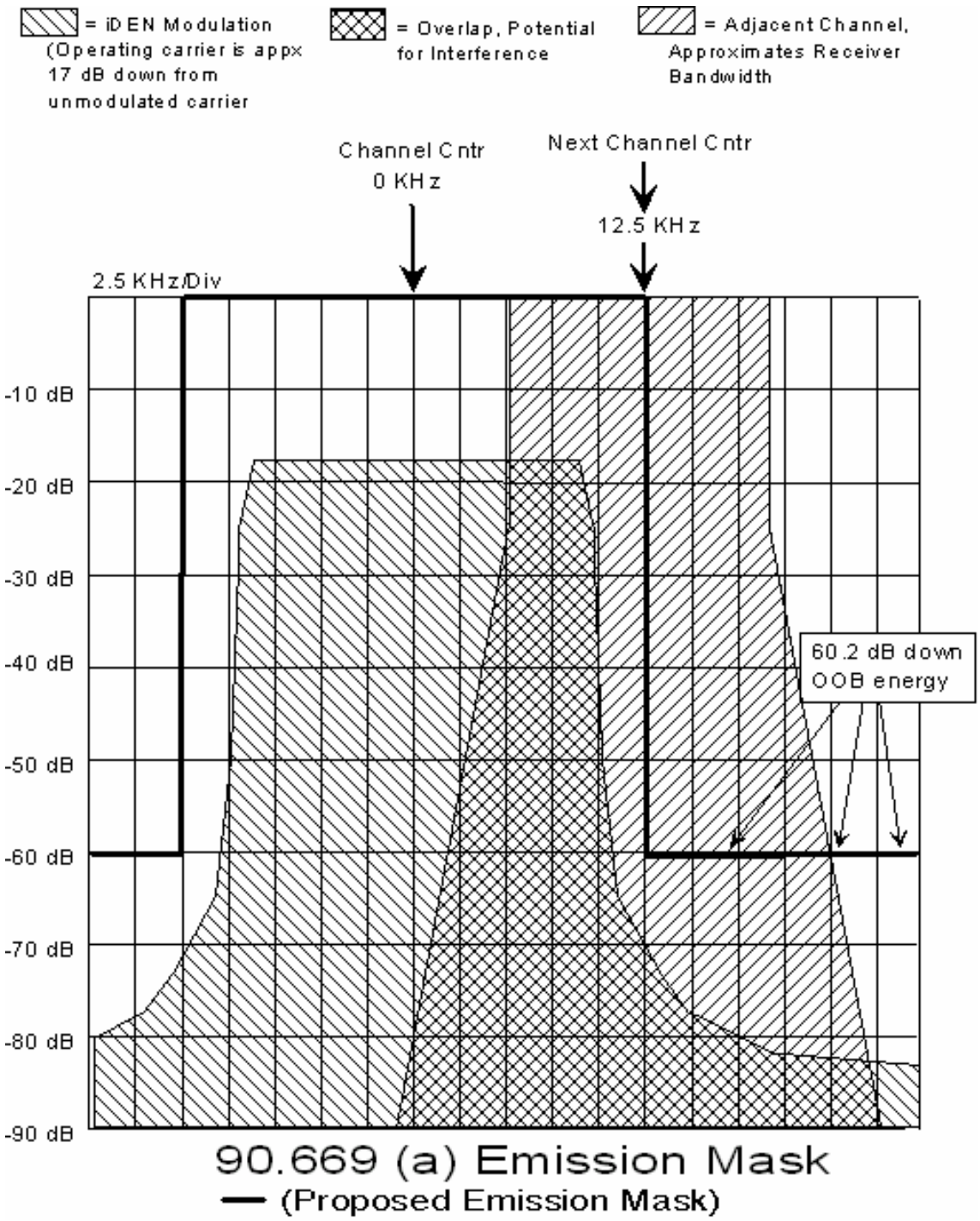
Worst case is estimated to be an intermodulation rejection figure of 65 dB for the mobile receiver and a "low site" modulated transmitter power output in a single channel around 20 dB down from the unmodulated carrier. In the case of a Motorola iDEN quad carrier 42 watt transmitter, actual modulated carriers are approximately 25 dB down from the +46.2 dBm unmodulated carrier, so each carrier level is approximately +21.2 dBm. With a typical antenna gain of 12 dB, assumed system losses of 5 dB, the expected ERP would be +28.2 dBm.

With a worst case intermodulation rejection of 65 dB and a receiver sensitivity of -116 dBm, the signal levels heard by the receiver should not exceed -116 dBm + 65 dB = -51 dBm. Path loss would have to be maintained at;

+28.2 dBm – 79.2 dB of path loss = -51 dBm

Based on the path loss calculation, a minimum distance of .14 miles would have to be maintained between any “high site” mobile and any "low site" base station in order to prevent intermodulation interference.

Figure 1: Proposed Section 90.669(a) Emission Mask



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

In the Matter of	)	
	)	
Improving Public Safety Communications in the 800 MHz Band	)	WT Docket 02-55
	)	
Consolidating the 800 and 900 MHz Industrial/Land Transportation and Business Pool Channels	)	ET Docket No. 00-258
Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems	)	RM-9498
	)	RM-10024
Petition for Rule Making of the Wireless Information Networks Forum Concerning the Unlicensed Personal Communications Service	)	ET Docket No. 95-18
Petition for Rule Making of UT Starcom, Inc., Concerning the Unlicensed Personal Communications Service	)	
	)	
Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for use by the Mobile Satellite Service	)	

To: The Commission

<u>Petition for Reconsideration</u>

The Association of American Railroads ("AAR"), by its undersigned counsel, pursuant to Section 1.429 of the Commission's rules, hereby requests the Commission to reconsider one aspect of the decision adopted in the *Report and Order* ("*R&O*") in the

above-captioned proceeding, FCC 04-168, released August 6, 2004,[1] notice of which was published in the Federal Register on November 22, 2004.[2] Specifically, AAR is requesting the Commission to adopt interference abatement procedures for incumbents in the 900 MHz band that are equivalent to those adopted in the *R&O* for the 800 MHz band. In support of this petition, the following is shown:

I. Statement of Interest

1. AAR is a voluntary non-profit organization composed of railroad companies operating in the U.S, Canada and Mexico. One of AAR's roles is to represent its members in connection with federal regulatory matters of concern to the railroad industry, including matters relating to communications and access to radio frequency spectrum. Also, AAR has been certified by the Commission as the designated frequency advisory committee that coordinates licensing in the Private Land Mobile Radio (PLMR) bands for railroad use.[3] In this capacity, AAR serves as the frequency coordinator not only for its own members, but also for other entities that meet the definition of a "railroad licensee" in Section 90.7 of the Commission's rules (such as metropolitan transit authorities and regional and short-line railroads).

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[1] *Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order*, WT Docket No. 02-55 *et al*., FCC 04-168, released August 6, 2004.

[2] 69 Fed. Reg. 67823, November 22, 2004.

[3] *See* Frequency Coordination in the Private Land Mobile Radio Services, *Report & Order*, 103 FCC 2d 1093, ¶ 94 (1986); Replacement of Part 90 by Part 88 to Revise the Private Land Mobile Services and Modify the Policies Governing Them and Examination of Exclusivity and Frequency Assignment Policies of the Private Land Mobile Services, *Second Report and Order*, 12 FCC Rcd 14307, 14324, 14330 (1997) ("*Second Report & Order*"), and *Second Memorandum Opinion and Order*, 14 FCC Rcd 8642, 8650-52 (1999).

2. Radio communications systems are a vital component of the railroad industry's operations, and AAR's members have a very strong interest in this proceeding. Although the railroad industry does not use frequencies in the 800 MHz band and therefore is unaffected directly by most of the policies and procedures adopted by the Commission in the *R&O*, the railroads make extensive use of frequencies in the 900 MHz band, as described in greater detail below. In this regard, AAR filed Comments in this proceeding urging the Commission not to allow the history of interference in the 800 MHz band to be repeated in the 900 MHz band.[4] In particular, AAR encouraged the Commission to consider favorably Nextel's proposal to vacate the "interleaved" spectrum it currently holds at 896/901 MHz and 934/940 MHz so that the Commission could then re-designate those channels for traditional "high-site" use by Business, Industrial and Land Transportation licensees.[5] AAR stated in its Comments that, by accepting Nextel's proposal, the Commission could avoid a repetition at 900 MHz of the interference problems that have occurred at 800 MHz as a result of allowing different system architectures to co-exist on interleaved channels.[6]

3. Unfortunately, instead of accepting Nextel's proposal to relinquish its rights to 900 MHz spectrum, the Commission surmised that Nextel may have a need for spectrum capacity in that band to accommodate subscriber demand during the 800 MHz reconfiguration (and possibly thereafter) and rejected Nextel's proposal to vacate the 900

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[4] AAR Comments in WT Docket No. 02-55, filed May 6, 2002 ("AAR Comments").

[5] Nextel "White Paper" filed November 21, 2001, at 4.

[6] AAR Comments at 3-4.

MHz band.[7] As a result of that decision (and unless protective measures are adopted as urged by AAR in this Petition for Reconsideration), the Commission will have created an environment in the 900 MHz band that will virtually ensure a repetition of the same kinds of interference problems that have plagued the 800 MHz band and which gave rise to this proceeding in the first place.

II. The Commission Should Protect 900 MHz Incumbents from Interference.

4. The railroad industry makes extensive use of six frequency pairs in the 900 MHz band[8] that were set aside by the Commission in 1988 for development of a nationwide "Advanced Train Control System" ("ATCS").[9] These six channel pairs constitute an extremely important component of the U.S. railroad industry's communications infrastructure.[10] Because these channel pairs are interleaved with

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[7] *R&O* at ¶ 207. Nextel's proposal to vacate the 900 MHz band was an integral part of this proceeding from the outset, having been included in Nextel's original November 2001 "White Paper" (see n. 5, *supra*). AAR submits that, in the context of this proceeding, the Commission's rejection of Nextel's proposal to vacate the 900 MHz band is a "changed circumstance" within the meaning of Section 1.429(b) of the Commission's rules governing petitions for reconsideration.

[8] The six frequency pairs are 896.8875/935.8875 MHz, 896.9375/935.9375 MHz, 896.9875/935.9875 MHz, 897.8875/936.8875 MHz, 897.9375/936.9375 MHz, and 897.9875/936.9875 MHz. In Section 90.613 of the Commission's rules, they are identified as Channel Nos. 71, 75, 79, 151, 155 and 159.

[9] *Use of Six 900 MHz Frequency Pairs for an Advanced Train Control System*, 3 FCC Rcd 427 (1988).

[10] In 2001, the Commission adopted a new licensing approach for these six channels by converting all of AAR's individual site-specific ATCS licenses operating in the 900 MHz band into a single nationwide geographic "ribbon" license (Call Sign WPSF894) covering all railroad rights-of-way in the United States. *See* In Re Petition of the Association of American Railroads for Modification of Licenses for Use in Advanced Train Control Systems and Positive Train Control Systems, *Order*, DA 01-359, released February 15, 2001.

channels licensed to others (including CMRS carriers), there is a very high probability that the railroads' ATCS operations will experience the same kind of harmful interference that public safety licensees and others have experienced at 800 MHz, once Nextel commences operations in the 900 MHz band.[11]

5. Particularly in light of the mission-critical nature of the railroads' ATCS operations,[12] AAR submits that it is appropriate for the Commission to reconsider its decision in the *R&O* by adopting interference abatement measures for the 900 MHz band that are equivalent to the measures adopted for the 800 MHz band.[13] Indeed, it is more important now than ever that such protection be afforded to 900 MHz incumbents in view of the Commission's express decision in the *R&O* to reject Nextel's offer to relinquish its 900 MHz spectrum rights, thereby not only inviting, but actually encouraging, a future proliferation of cellular-type architecture in the 900 MHz band.[14]

6. The *R&O* created a three-part framework for interference protection for 800 MHz licenses. First, the Commission adopted an objective definition of "unacceptable interference" to determine under what circumstances public safety and other non-cellular licensees would be entitled to interference protection.[15] Second, strict responsibility for

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[11] The problem will occur when a locomotive equipped with an ATCS radio travels in close proximity to a cellular-type base station.

[12] The railroad industry is one of the "Critical Infrastructure Industries" ("CII") upon which the Commission conferred special status with respect to interference mitigation. *See, e.g.*, *R&O* at n. 11 and ¶¶ 124, 128.

[13] *R&O* at ¶¶ 88-141.

[14] *Id.* at ¶¶ 207.

[15] *Id.* at ¶¶ 96-114.

eliminating "unacceptable interference" was assigned to the ESMR and cellular licensees.[16] And third, the Commission required that ESMR and cellular operators notify public safety and CII licensees in advance prior to activating new cells.[17] AAR urges the Commission to adopt all three of these interference abatement measures to protect incumbent licensees in the 900 MHz band in a manner that is equivalent[18] to the interference protection afforded incumbents in the 800 MHz band. Absent the adoption of such measures, the Commission will have created in the 900 MHz band an exact replica of the interference problems that have beset incumbents in the 800 MHz band over the past decade.

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[16] *Id.* at ¶¶ 128-131.

[17] *Id.* at ¶¶ 124-127.

[18] AAR recommends "equivalent" (as distinct from "identical") protection values to account for the frequency differential between the 800 MHz and 900 MHz bands and the resultant differences in receiver performance in each of the two bands. Several generations of commercial "off-the-shelf" mobile radios are installed as the platform for railroad ATCS radio systems. These are generic mobile radios that are made for use in both the 800 MHz and 900 MHz bands. AAR performed a comparative analysis of the adjacent channel rejection and intermodulation rejection performance of these radios, as between 800 MHz and 900 MHz, in the context of the relevant parameters adopted in the *R&O* (¶ 109). That analysis revealed that the radios do not achieve the same rejection performance at 900 MHz of which they are capable at 800 MHz. Specifically, the first generation of radios has 10 dB less performance for both adjacent channel and intermodulation rejection at 900 MHz than specified for the 800 MHz band in the *R&O*. The second and third generations have 5 dB less adjacent channel rejection and 10 dB less intermodulation rejection at 900 MHz than specified for the 800 MHz band in the *R&O*. In other words, it appears that the receiver performance standards for intermodulation and adjacent channel rejection specified at paragraph 109 of the *R&O* cannot be achieved by existing railroad 900MHz ATCS products. Thus, in order to achieve a threshold for entitlement to protection against unacceptable interference at 900 MHz that is equivalent to that which was adopted in the *R&O* for the 800 MHz band, AAR recommends that the Commission specify 65 dB of adjacent channel rejection and 65 dB of intermodulation rejection for systems at 900 MHz.

III. Conclusion

There is an obvious public interest benefit in preventing interference to mission-critical CII communications such as the railroad industry's ATCS links at 900 MHz. In light of the Commission's decision in the *R&O* to encourage the deployment of incompatible cellular-type systems in the 900 MHz band, the Commission should adopt interference abatement measures to protect 900 MHz incumbents that are equivalent to those adopted in the *R&O* to protect 800 MHz incumbents.

Respectfully submitted,

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December 17, 2004