Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington DC 20554

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In the Matter of	)	
	)	
The Development of Operational,	)	
Technical, and Spectrum Requirements	)	
For Meeting Federal, State and Local	)	WT Docket No. 96-86
Public Safety Agency Communication	)	
Requirements Through the Year 2010	)	
	)	
Establishment of Rules and Requirements	)	
For Priority Access Service	)	

PETITION FOR RECONSIDERATION AND CLARIFICATION

MOTOROLA, INC.

Richard C. Barth, Ph.D.
Vice President and Director
Telecommunications Strategy
and Regulation
Motorola, Inc.
1350 I Street, N.W.
Washington, DC
(202) 371-6900

Leigh M. Chinitz
Manager
Telecommunications Strategy
and Spectrum
Motorola, Inc.
1350 I Street, N.W.
Washington, DC
(202) 371-6900

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SUMMARY

The *First Report and Order* in the above captioned proceeding responds to the Congressional mandate that the FCC allocate 24 MHz of spectrum in the 746-806 MHz band for public safety use and develop service rules that allows for the commencement of licensing by September 30, 1998. In large measure, the FCC accomplishes these tasks through the adoption of a spectrum band plan that identifies channels for general use, wideband data operations, and interoperability. Also key is the decision to create a new Federal Advisory Committee, the National Coordinating Committee or NCC, that would have a wide range of coordination and operational responsibilities.

Motorola appreciates the FCC's efforts to address the overall communications requirements of public safety. Motorola is well aware that the development of a comprehensive regulatory structure for public safety is complicated by the diversity of the user community and their varying communications needs. Therefore, Motorola supports much of the operational and technical flexibility adopted by the FCC.

Motorola is very concerned, however, that some of the FCC's decisions will thwart Congressional intent to make this spectrum available expeditiously. Indeed, if the Commission's decisions stand, Motorola sees no opportunity for any public safety agency to use this spectrum for ***at least*** the next four years. This stands in contrast to the mandate of Congress to begin the licensing process by September 30, 1998.

Specifically, Motorola objects to the decision that requires the NCC to obtain certification from the American National Standards Institute (ANSI) for purposes of developing a digital interoperability standard. In addition to creating unwarranted delay, requiring that any interoperability standard be based on 6.25 kHz channel bandwidth will ensure incompatibilities with existing 800 MHz systems. Motorola strongly urges the FCC to reconsider these decisions and instead rely on the ANSI certified, Project 25 Common Air Interface standard for digital interoperability with analog capabilities available to provide backward compatibility with 800 MHz systems. These actions would be consistent with the recommendations of the Public Safety Wireless Advisory Committee (PSWAC).

Motorola also urges the FCC to revise the technical criteria for protecting television broadcast stations so that public safety land mobile systems may more fully share this spectrum across the country. The FCC failed to consider all relevant technical factors that would permit land mobile stations to deploy facilities in closer proximity to broadcast stations. Finally, Motorola seeks clarification and/or modification of several technical standards adopted by the Commission. As fully explained below, these modifications are intended to be non-controversial and, in fact, seek clarification of information previously submitted by Motorola. The suggested modifications will remove ambiguities in the equipment authorization process and thus facilitate the more timely delivery of products for public safety use.

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PETITION FOR RECONSIDERATION AND CLARIFICATION

Motorola hereby submits this petition for reconsideration and clarification of the FCC's *First Report and Order* in the above-captioned proceeding.[1] The modifications to the FCC's actions proposed herein are necessary to expand and expedite the availability of the new spectrum allocation at 746-806 MHz for public safety users.

I. Introduction and Background.

The Commission's *First Report and Order* responds to the FCC's Congressional mandate that it allocate 24 MHz of spectrum from the 746-806 MHz band for public safety use and, also, to adopt new rules that allow for the commencement of licensing in this new band by September 30, 1998.[2] In order to achieve the goals established by

[1] First Report and Order and Third Notice of Proposed Rule Making, WT Docket No. 96-86, FCC 98-191, released September 29, 1998 [*hereinafter First Report and Order*].

[2] *See* Balanced Budget Act of 1997, Pub. L. No. 105-33, § 3004, 111 Stat. 251 (1997) (BBA-97).

Congress, the *First Report and Order* endeavors to provide "a structure to: (1) enable the development of a national interoperability plan; (2) allow Regional Planning Committees (RPCs) maximum flexibility to meet state and local needs, encourage innovative use of the spectrum, and accommodate new and as yet unanticipated developments in technology and equipment; (3) provide the spectrum management and planning mechanisms necessary to develop multiple user public safety communications systems and local and regional interoperability systems that effectively incorporate all public safety service providers; (4) adopt licensing rules for eligibility, permissible use, and coordinated spectrum planning for the 700 MHz band; and (5) adopt such competitively neutral technical standards as required to efficiently achieve interoperability in designated spectrum."[3]

In large measure, many facets of these articulated goals were addressed through the adoption of a spectrum band plan that identifies spectrum for general use, wideband data operations, and interoperability. Also key to the FCC's decisions was the creation of a new Federal Advisory Committee, the National Coordinating Committee or NCC, that would have a very wide range of coordination and operational responsibilities defined by its charter. Finally, in further response to Congressional direction, the *First Report and Order* adopts technical standards for land mobile operations in the 746-806 MHz band including protection criteria that recognizes the continued existence of broadcast television stations within the band.

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[3] *First Report and Order* at ¶5.

Motorola appreciates the effort evidenced in the *First Report and Order* to address the overall communications requirements of public safety. Motorola is well aware that the development of a comprehensive regulatory structure for public safety is complicated by the diversity of the user community and their varying communications needs. As stated by Motorola in comments filed earlier in this proceeding, a single solution is unlikely to satisfy all users. For this reason, Motorola supports much of the operational and technical flexibility adopted in the *First Report and Order* as well as the concomitant obligation that public safety committees oversee and coordinate that flexibility.

Motorola is very concerned, however, that some of the decisions contained in the *First Report and Order* will thwart Congressional intent to make this spectrum available in an expeditious fashion in order to address "the critical need for public safety in some markets."[4] The Commission must balance the need of many public safety agencies to utilize this spectrum immediately to solve today's communications problems with its own goal of establishing a highly coordinated band intending to address public safety's needs through the year 2010 and beyond. If the Commission's decisions stand, Motorola sees no opportunity for any public safety agency to use this spectrum for ***at least*** the next four years. This stands in contrast to the goal of Congress for the FCC to begin the licensing process by September 30, 1998.

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[4] *Id.* at ¶3 [citing H.R. Report No. 149, 105th Congress, 1st Sess. At 1210 (1997)].

Motorola therefore objects to the decisions of the *First Report and Order* that require the NCC to obtain certification from the American National Standards Institute (ANSI) for purposes of developing a digital interoperability standard. Coupled with the decision to require that ***all*** radios sold in this band must be capable of operating in the interoperability spectrum, these actions will frustrate ***any*** public safety deployment in this band for at least four years. In addition, the condition imposed on the NCC to develop a digital interoperability standard based on 6.25 kHz channel efficiency is not in the best interest of public safety users as it will ensure incompatibilities with existing 800 MHz systems and will further serve to delay the use of this band to serve the needs of public safety.

Therefore, Motorola strongly urges the FCC to negate these actions and instead rely on the currently available, ANSI certified Project 25 Common Air Interface (CAI) standard for digital interoperability, with the analog mode available in the same radio unit (i.e., multi-mode operation as a baseline), to enable backward compatibility with incumbent 800 MHz systems. Such a decision would be consistent with the recommendations of the Public Safety Wireless Advisory Committee (PSWAC) as well as the vast majority of commenters in this proceeding.

Motorola also urges the FCC to reconsider its decisions with respect to the development of technical sharing criteria between public safety land mobile systems and broadcast television stations. While the FCC correctly adopted a standard that provides a desired to undesired signal ratio of 40 dB at the broadcast station's Grade B contour, it

failed to consider other relevant factors that would allow closer placement of land mobile stations while ensuring adequate protection to incumbent broadcast facilities. If the Commission reconsiders these other technical characteristics as recommended by Motorola, additional major markets would be able to take immediate advantage of this allocation and use some, or all, of a six megahertz channel pair for public safety use. If the Commission rejects these proposals, such markets will need to await the end of the DTV transition plan - which will not end before 2006 - before having access to the 700 MHz allocation.

Finally, Motorola seeks clarification and/or modification of several technical standards adopted by the Commission. As fully explained below, these discussions are intended to be non-controversial and, in fact, generally reflect clarification of data and information previously submitted by Motorola in this proceeding.

II. The FCC's Decision To Direct A Federal Advisory Committee To Develop A Digital Technology Standard For The Public Safety Interoperability Channels Will Delay The Introduction Of 700 MHz Public Safety Radios And Will Not Fully Promote Interoperability Among Public Safety Users.

Arguing that "the inability of public safety agencies to efficiently communicate with one another is a glaring deficiency in present day public safety communications", the *First Report and Order* designates approximately 10 percent of the 24 MHz allocation for nationwide interoperability use.[5] Characterizing this action as the "crowning achievement" of this proceeding, the FCC decided to charter a federal advisory committee,

[5] *Id.* at ¶7.

the National Coordinating Committee (NCC), to develop operational and technical recommendations that promote the effective utilization of the interoperability band.

As described in the *First Report and Order*, the major responsibilities of the committee will be to: (1) formulate and submit for FCC review and approval an operational plan to achieve national interoperability that includes a shared or priority system among users of the interoperability spectrum for both day-to-day and emergency operations including recommendations for Federal users' access to the interoperability spectrum; (2) recommend interoperability digital modulation, trunking, and receiver standards for Commission review and approval; (3) offer voluntary assistance in the development of coordinated regional plans; and (4) provide recommendations on other technical matters.[6] The FCC states that the NCC is intended to operate over a period of four years.[7]

The *First Report and Order* justifies the decision to empower the NCC to develop digital modulation standards on the basis that it is "premature" for the FCC to adopt such standards.[8] The Commission argues that the Project 25 Phase I standards are inappropriate for use on the narrowband channels because they are based on 12.5 kHz technology while the FCC intends that the 700 MHz public safety band "ultimately" be used with 6.25 kHz technology.[9] Lacking a suitable alternative in its view, the

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[6] *Id.* at ¶92.

[7] *Id.*

[8] *Id.* at ¶113.

[9] *Id.*

Commission has instead required the NCC, or a working group established thereunder, to seek and obtain recognition as an ANSI-accredited entity and to "recommend a set of voluntary technical standards for digital modulation to be used on the nationwide interoperability channels."[10]

In a related decision, the *First Report and Order* requires that all mobile and portable radios be "capable" of operating on the narrowband interoperability channels.[11] Of course, the capability of any radio to operate on the narrowband interoperability channels will be unknown until the NCC recommends the digital standard to the FCC and the FCC takes the affirmative action to codify that standard into its rules.

Motorola believes that, taken together, these decisions do not maximize the spectrum opportunities for public safety providers and, instead, have condemned public safety officials to rehashing the same technical issues that they have been debating for the past 10 years.[12] For the reasons expressed below, Motorola strongly urges the FCC to reconsider these decisions and instead ensure that the immediate critical needs of public safety users are addressed and satisfied.

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[10] *Id.* at ¶113. Use of the term "voluntary" in this context is unclear. By all other indications, the FCC would mandate the use of the interoperability standards on the interoperability channels.

[11] *Id. at* ¶135.

[12] In 1988, the FCC initiated a rule making proceeding designed to review the needs for standards for public safety trunking systems in order to enhance interoperability among public safety licensees. *See* Gen. Docket No. 88-441, Notice of Inquiry, 3 FCC Rcd 5399 (1988).

Timing Issues: As mentioned earlier, the FCC's decisions will unduly delay public safety access to the 746-806 MHz band even in those areas where the spectrum is immediately available. Considering that five years have already elapsed since Congress first compelled the FCC to evaluate the future spectrum requirements of public safety, additional regulatory delays could prove devastating.[13] And Motorola believes that the FCC's decisions embody substantial unnecessary and non-productive additional delay.

Motorola foresees the following timeline under the FCC's new rules. First, the Commission will need to resolve the likely petitions for reconsideration that will be filed with respect to the NCC before its charter can be finalized.[14] Assuming that the FCC can resolve these issues in an exceptionally expeditious fashion, the NCC could receive its charter toward the end of 1999. At that point, the NCC, or most likely a subcommittee of the NCC, would seek to establish an organizational structure and voting policies that would enable it to apply for accreditation by ANSI as a standard setting body. Based on Motorola's extensive experience in the standard setting process and a review of ANSI's operating procedures, we believe that this process will take at least 6 months and perhaps as long as two years to complete.[15] Assuming a conservative time frame of one year, the NCC could begin working on the digital interoperability standard by late 2000.

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[13] Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, Title VI, §6001(a)(3), 107 Stat. 312 (enacted August 10, 1993).

[14] Motorola understands that public safety officials will raise concerns and questions about other facets of the NCC's role including the availability of Federal funding.

[15] There is no guarantee, however, that the NCC will ever complete even this portion of its assigned tasks.

While the open participation processes demanded by ANSI ensure fairness in the exchange of ideas, they do not normally promote prompt resolutions. Based on Motorola's experience, it would take this committee an absolute minimum of two years to complete the design of an all new suite of digital interoperability standards. Assuming that the committee can complete this task in such an incredibly short period of time, an output document could be forwarded to the FCC by late 2002.[16] Assuming that the FCC would move exceptionally quickly to adopt this standard into the rules (*i.e.*, 6 months), the new standards could become effective by mid 2003.

At that point, manufacturers could begin to complete product development. Assuming that manufacturers such as Motorola began earnest work on the products during the latter stages of the NCC's efforts, and assuming that the standards employed technologies readily accessible to all manufacturers, the first radios for the 746-806 MHz band would become available in mid 2004. Note that this optimistic target, which relies on tasks being completed in near record time-frames, is still six years beyond the Congressionally mandated date of September 30, 1998, to commence the public safety licensing process for the 746-806 MHz band. Unfortunately, there is great probability that Motorola's timeline underestimates the likely duration of these proceedings by as much as three years

[16] Note that this target is exactly four years from today. Thus, this summary is consistent with the FCC's optimistic view that the NCC would be operational for four years.

Interoperability Issues: The FCC stated that it rejected the Project 25 suite of digital standards because "we intend that this bandwidth ultimately be used with a spectrum efficient 6.25 kHz technology (Project 25 Phase I is a 12.5 kHz standard.)"[17] In so doing, the FCC has led the industry down the long path detailed above.

Aside from the delays that this decision would impose, the decision to mandate the use of 6.25 kHz technology over the entire 746-806 MHz band, including the narrowband interoperability channels, does not take into account the need to promote interoperability with existing 800 MHz public land mobile systems. Indeed, those users most anxious to gain access to this new spectrum are those in major cities that have existing 800 MHz systems operating at high capacity without any additional spectrum available. These users cannot afford to replace their existing analog systems but will need interoperability solutions to bridge 700 MHz and 800 MHz systems. Indeed, compatibility with existing systems was cited by the FCC as a prime consideration in allocating the band to public safety services.[18]

The public safety community has reviewed these technology transition issues for the past 10 years and has widely concluded that the most efficient and cost-effective solutions for interoperability are the Project 25 suite of digital standards with some residual analog capability to provide backward compatibility.[19] As noted by the *First*

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[17] *Id. at* ¶113.

[18] *In the Matter of Reallocation of Television Channels 60-69, the 746-806 MHz Band,* Report and Order, ET Docket No. 97-157 (released January 6, 1998) at ¶8.

[19] Indeed, the Project 25 "Statement of Requirements" standard requires backward

Report and Order, the majority of public safety commenters supported this approach as the interoperability solution for upper UHF systems and is a recommendation consistent with the Final Report of the PSWAC committee.[20] Expecting the NCC to review the same issues addressed by both Project 25 and PSWAC ***and*** to arrive at different conclusions attacks the credibility of those efforts and reflects a misunderstanding of the public safety community and the standard-setting process.

Motorola Recommendation: The FCC should reconsider and reject its decision to empower a Federal Advisory Committee to develop a digital interoperability standard for the 700 MHz public safety band and instead adopt the recommendations contained in the PSWAC Final Report and decisions already taken by a significant majority of the public safety community that reflect the long debate on these issues. It is imperative that the FCC support the public safety community's effort to promote interoperability and a competitive equipment marketplace by adopting the Project 25 suite of standards as the digital baseline for interoperability in the 746-806 MHz band. While an analog functionality would facilitate immediate interoperability with public safety users in the 821-824/866-869 MHz band, Motorola expects that systems deployed in the new band will contain digital capabilities. The Project 25 standard is the most appropriate digital interoperability standard to recommend for public safety users.

If, for whatever reason, the FCC should decline to adopt the Project 25 suite of standards, then it should also decline to impose any solution that presumes the

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compatibility to analog systems, the ability to co-exist with analog systems and operation on mutual aid channels.

[20] As recognized in the *Third Notice of Proposed Rule Making*, there still exists the need

government is better at selecting standards than the users who must live with them as reflected in the *First Report and Order*. Instead, the FCC could choose to allow immediately digital systems operating at 12.5 kHz with, perhaps, a mandatory phased replacement to 6.25 kHz systems not later than 10 years from now, and let the market decide which standard to adopt. Such a decision, while regrettable in light of all the previous work on Project 25, would at least remove the serious impediment to using this spectrum imposed by the FCC.

Neglecting to select Project 25 as the digital interoperability standard because it is a 12.5 kHz technology rather than a 6.25 kHz technology severely undermines the immediate availability of this spectrum. Motorola believes that it will take at least four years to develop a public safety radio that is digitally modulated and confined to a 6.25 kHz channel and that contains the required features and durability in a cost-effective manner. Building radio products to a yet-to-be-developed standard will certainly take longer. Motorola believes that it is unwise for the FCC to establish efficiencies for public safety communications that have not yet been firmly established for commercial systems and thus force the public safety community to fund the technology development costs.

Except for the fact that the phase one standard is based on 12.5 kHz systems rather than 6.25 kHz, the Project 25 standards are everything that the FCC is seeking from the NCC. As noted by APCO, nearly three quarters of a million man-hours have been devoted to creating these specifications for US based public safety systems.

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to address interoperability for public safety systems operating in the VHF range.

Supervised by the Telecommunications Industry Association, the overall standards setting process has been fair and open to the entirety of public safety users and equipment manufacturers. In addition, both the Common Air Interface and the Vocoder, perhaps the two most critical factors for interoperability, have been approved and finalized through the ANSI process lending further testimony to the fair and open nature of the standard setting process.[21] To ignore these highly technical and complex accomplishments, which have been led and driven by the public safety user community, in favor of a new standards development effort imposes extreme additional burdens and costs on an industry that can ill-afford it.

If the FCC adopts the Project 25 Common Air Interface standard as the digital interoperability standard for the narrowband 700 MHz channels, public safety users will be able to purchase within two years software defined, multi-mode radios that offer digital interoperability and backward compatibility with legacy systems from multiple vendors at competitive prices. If the FCC maintains its present course, that future will be indefinitely delayed. The FCC should therefore reject its decision to reinvent the standards debate and instead proceed to expeditiously address the existing crisis in public safety spectrum allocations.

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[21] These standards are identified as Project 25 FDMA Common Air Interface New Technology Standards Project Digital Radio Technical Standards, TIA/EIA-102.BAAA, May 1998, and, Project 25 Vocoder Description, TIA/EIA-102.BABA, May 1998. ANSI participated in the final balloting of these standards to ensure correct voting procedures.

III. The FCC Should Modify Its TV Protection Criteria To Promote Greater Access To The Spectrum By Public Safety.

The entire 746-806 MHz band will be shared with both analog and digital television stations through the end of the DTV transition. While the number of broadcast stations in the public safety allocation is relatively small, the interference protection afforded these facilities is large and substantially impacts the availability of the spectrum for public safety use. Indeed, since the television stations are generally located in the same major markets where the need for public safety spectrum is most critical, the success of Congress's reallocation efforts depends mightily on the level of protection these stations are afforded in real world deployment situations.

A. The FCC did not adequately consider all relevant technical information in establishing its rules for Public Safety sharing with Broadcast Television.

In comments submitted in prior phases of this proceeding, Motorola made specific recommendations concerning co-channel and adjacent channel sharing between land mobile radio and television broadcast stations.[22] Those comments recommend that, in addition to using a 40 dB desired to undesired signal protection ratio at the television station's Grade B contour, other technical factors should be considered in the rules to enhance the ability of public safety users to deploy systems in the proximity of television stations. For example, Motorola cited the propagation difference between frequencies in the 470-512 MHz band and the 746-806 MHz band (about 5.3 dB) and a

[22] *See Comments Of Motorola To The Second NPRM,* WT Docket No. 96-86, submitted December 22, 1997. *See Also, Letter to Magalie Roman Salas from Leigh Chinitz,* WT Docket No. 96-86, submitted May 20, 1998.

conservative value for television antenna front-to-back directivity (about 15 dB) as factors that mitigate against interference to broadcast reception. Motorola also noted that other effects (the differing polarization of land mobile and broadcast transmissions, the conservative nature of R-6602[23], improvements in television receivers, and realistic mobile antenna heights) would all serve to further protect reception of the television broadcast signal.

Although the *First Report and Order* acknowledged Motorola's comments, the FCC ultimately concluded that:

> We have carefully reviewed all the technical information submitted. The suggestion made by the broadcasters to retain 50 dB D/U signal ratio is too conservative and seems to be based on a desire to keep the status quo without taking into consideration new technology or differences in propagation of the frequency bands. We believe that this would unnecessarily inhibit the use of the 700 MHz band by public safety entities during the DTV transition period and cannot justify keeping the old value of 50 dB unless it is based upon a technical showing, which we find lacking in the record. On the other hand, while the recommendations put forth by some commenters would allow more public safety entities to use the 700 MHz band prior to the end of the DTV transition (December 31, 2006), the record before us does not support reducing the D/U signal

[23] This conservative nature appears as a significant standard deviation in the time variation of the UHF signal strengths. Take, for example, a configuration in which there is a 1kW transmitter on a 150 meter tower, and the signal strengths are examined at 100 km. According to the FCC's propagation charts, the F(50,50) field strength for NTSC channels 14-83 is 14.621 dBμ, and the F(50,10) field strength is 27.686 dBμ, a difference of 13 dB. The ITU recommendation ITU-R P.370-7 "VHF And UHF Propagation Curves For The Frequency Range From 30 MHz To 1000 MHz" shows that, for the same parameters, the F(50,50) field strength is about 16 dBμ, while the F(50,10) field strength is about 22 dBμ, , which is a difference of only 6 dB (Attached as Appendix A are the relevant ITU propagation curves). This variance of 6 dB is more consistent with independent measurements taken by Motorola. Since the tables in §90.309 require the use of the F(50,10) field strength for the interfering station, it is Motorola's opinion that the interfering field strength is being overestimated by approximately 7 dB.

> ratio to the degree suggested based upon ideal or optimistic situations. The plan developed for TV/land mobile sharing in 1970 was deliberately very conservative in order to safeguard against adverse impact on TV reception.

Thus, as the FCC chides the broadcast industry for not taking into consideration the differences in propagation of the frequency bands, the Commission itself adopts rules that do not take into account any additional technical planning factors that would further mitigate against interference to television receivers beyond conservative field strength levels. The Commission clearly recognizes these factors in FCC OET Bulletin No. 69 which provides guidance to the Broadcasters in using terrain based propagation tools to evaluate TV service coverage and interference.[24] The difference in propagation across the UHF frequency band is clearly included in the planning factors as the dipole factor adjustment while the OET bulletin also proposes TV receiver antenna front-to-back ratio as a planning factor. Just as these factors are relevant when planning Broadcaster service coverage and co-channel and adjacent channel TV/DTV interference, so too are they relevant when performing TV/land mobile sharing calculations.[25]

B. Public Safety Systems should be required to protect only the actual TV station Grade B contour and not a hypothetical contour.

The tables in Section 90.309 protect a standard 55 mile Grade B contour for the protected broadcast TV stations. For example, Table B in Section 90.309, which is

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[24] *Longley-Rice Methodology for Evaluating TV Coverage and Interference*, OET Bulletin No. 69, (July 2, 1997).

[25] It should be noted that the ITU also recognizes these factors in their TV/land mobile sharing planning. See, ITU-R IS.851-1.

referenced in the new rule Section 90.545(c)(2)(I), provides a required separation distance of a land mobile transmitter operating at 725W and 152.5 meters as 201 km (125 miles) from the broadcast transmitter. This separation can be reproduced by the following calculation: a transmitter of 725 W at 152.5 meters produces a field strength of 24 dBμ at 112.3 km using the FCC's FM and NTSC TV propagation curves for F(50,10) availability. Adding this number to a 55 mile (88.5 km) TV station Grade B contour yields approximately 201 km (125 miles) while providing 40 dB D/U protection at the Grade B contour.

In the interest of maximum availability of public safety entities to the new public safety spectrum, the FCC should not require public safety systems to protect a hypothetical 55 mile contour. Rather, in those cases where the actual *predicted* service area of the incumbent broadcast facility is less than 55 miles, only the actual Grade B (64 dBμ) contour should be protected. This is entirely appropriate given the fact that incumbent broadcast stations are frozen at today's operating parameters and, thus, there is no need to protect for future service enhancements. Also, this policy is consistent with the provisions of section 90.545(c)(2)(iii) which states that: "In order to protect certain TV/DTV stations and to ensure protection from these stations which may have extremely large contours due to unusual height situations, an additional distance factor must be used by all public safety base, control and mobile stations." Because land mobile entities will be required to protect TV stations with unusually large coverage areas, it is only appropriate that protection be afforded to the actual coverage area when that area is less

than a 55 mile circle. This is particularly true given that the ultimate use of this spectrum will be for public safety land mobile with broadcast facilities eventually relocated to other portions of the UHF-TV band.

C. Adjacent Channel Interference Considerations

The same frequency propagation difference and antenna planning factors discussed above for co-channel interference calculations should also be applied to adjacent channel TV/land mobile sharing, as originally proposed in Motorola's earlier-filed comments in this proceeding. In addition, Motorola believes that other factors referenced in the *First Report and Order,* as well as existing sharing scenarios, should be considered and implemented as further discussed below.

Motorola believes that the new rules in Section 90.545 are too restrictive and do not allow for engineering solutions. As adopted, new Section 90.545 provides that:

> (c)(2)(i). Base stations having an antenna height (HAAT) less than 152 m (500 ft.) shall afford protection to co-channel and adjacent channel TV/DTV stations in accordance with the values specified in Table B (co-channel frequencies based on 40 dB protection) and Table E (adjacent channel frequencies based on 0dB protection) in §90.309 of this part...
>
> (c)(2)(ii). Control and mobile stations (including portables) are limited in height and power and therefore shall afford protection to co-channel and adjacent channel TV/DTV stations in accordance with the values specified in Table D (co-channel frequencies based on 40 dB protection) in §90.309 of this part and a minimum distance of 8 kilometers (5 miles) from all adjacent channel TV/DTV station hypothetical or equivalent Grade B contours...

Table E of Section 90.309 references Section 90.307(d), which states that the "minimum distance between a base station which has associated mobile units and a protected adjacent channel television station is 145 km (90 miles)." On the other hand, Section 90.545(c)(2)(ii) states that control and mobile stations need only maintain a minimum distance of 5 miles from adjacent channel TV station grade B contours. Motorola believes that the 90-mile limitation is too restrictive, and for several reasons should be eliminated.

This restriction appears to assume that the coverage area of the land mobile system will be a hypothetical circle of 30 mile radius. Thus, a 55 mile radius Grade B added to a 30 mile land mobile service area radius and a 5 mile separation between the two yields the 90 mile separation. Motorola believes that the above discussion concerning the protection of actual instead of a standard Grade B contour distance is relevant here. The rules should contain flexibility such that land mobile stations are not asked to protect areas that are not served by the broadcast stations. As written, the rule does not give any latitude to land mobile system operators to use engineering solutions to make maximum use of the new public safety spectrum. For example, a public safety system with a highly directional antenna could accomplish the same result of having mobile units operate within 5 miles of the grade B contour, yet the land mobile transmitter and the TV transmitter could be much closer than 90 miles.

In addition, the duplex spacing in the 700 MHz band makes the rules from the 470-512 MHz band less relevant in this case. Sections 90.307 and 90.309 were written in

reference to the 470-512 MHz band which has a duplex (transmit to receive) spacing of only 3 MHz. In the 470-512 MHz band, both land mobile base stations and mobile stations transmit within the same 6 MHz TV channel. In this situation, it is appropriate to consider the mobile station's service area when establishing the proper separation between land mobile systems and television broadcast facilities. However, in the 700 MHz band, standard deployment scenarios would separate base and mobile transmissions by 30 MHz. For example, a base station transmitting on what is now UHF-TV channel 63 would find its associated mobile units transmitting on UHF-TV channel 68. These mobile units will have no interfering effect on incumbent broadcast stations that are operating co-channel with the corresponding land mobile base stations and should not be considered in the interference analysis.

We believe that the Commission should avoid overly restrictive rules that restrict the public safety community from gaining access to this new spectrum. In this specific case we recommend that the Commission clarify that §90.307(d), and therefore footnote 3 of Table E in §90.309 should not apply to the 700 MHz band.

Application of these rules as adopted could also negatively impact opportunities for land mobile use of only portions of the 6 MHz wide broadcast channels. In the *First Report and Order,* the Commission states: " The determination of the appropriate D/U ratio in this case is based upon a number of factors, including the definition of acceptable picture quality, TV receiver susceptibility, antenna characteristics, and the aggregate

interference caused by multiple land mobile signals."[26] With regard to adjacent channel operations, the Commission further states that: "A typical TV receiver's adjacent channel rejection is at least 10-20 dB which will further safeguard TV from land mobile interference".[27]

Motorola has examined the document referenced on analog TV receiver susceptibility and it clearly shows that analog TV receiver susceptibility (also referred to as interference rejection) varies considerably across the adjacent channel.[28] As reflected in the table below, television receivers exhibit greater interference rejection on frequencies further removed from the adjacent TV channel edge. This phenomena should be exploited to allow TV/land mobile sharing at closer separations when land mobile systems use the frequencies that are not immediately adjacent to the TV station.

The table below shows the data from FCC's report[29] in increments of 1.5 MHz. Motorola believes that this demonstrates that Public Safety land mobile radio could operate at closer spacings in the outer 1.5 MHz of the adjacent channel, and possibly operate inside the Grade B contour of analog TV stations in the outer 1.5 MHz of the upper adjacent channel.

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[26] *First Report and Order* at ¶147.

[27] *Id.* at ¶152.

[28] *Receiver Susceptibility Measurements Relating to Interference Between UHF Television and Land Mobile Radio Services,* FCC/OET TM87-1 (April 1986).

[29] *Id.*

Distance from Television Channel Edge	D/U Ratio Desired F(50,50) Television Field Strength Level to Undesired F(50,10) Land Mobile Field Strength Level
Lower Adjacent Channel	
-6.0 to –4.5 MHz	-25 dB D/U
-4.5 to –3.0 MHz	-20 dB D/U
-3.0 to –1.5 MHz	0 dB D/U
-1.5 to –0.0 MHz	0 dB D/U
Upper Adjacent Channel	
+0.0 to +1.5 MHz	0 dB D/U
+1.5 to +3.0 MHz	-15 dB D/U
+3.0 to +4.5 MHz	-25 dB D/U
+4.5 to +6.0 MHz	-40 dB D/U

Thus, using a spectrum buffer between land mobile and television transmissions could provide between 15-40 dB additional protection to television service allowing for reduced separation. Indeed, land mobile use of the upper adjacent channel to the television station would benefit by at least 15 dB if a 1.5 MHz buffer were created and land mobile operations were confined to the upper 4.5 MHz of its channel. Land mobile

use of the lower adjacent channel to the television station would benefit by at least 20 dB if a 3.0 MHz buffer were created and land mobile operations were confined to the lower 3.0 MHz of its channel.

Potential interference from analog television transmitter[30] spurious emissions to land mobile radio receivers must also be considered. According to Section 73.687(d), broadcasters must attenuate all emissions removed in frequency in excess of 3 MHz above or below the respective channel edge by no less than 60 dB. This level, which is less than 4 dBμ[31] at the Grade B contour, in the outer 3 MHz of the adjacent channel should provide acceptable protection to land mobile operations. Furthermore, most analog broadcast transmitters transmit at much lower levels than –60 dBc for linearity reasons, thereby further minimizing interference potential.

As Motorola previously stated, should the FCC maintain the existing protection criteria, only about 17 of the top 50 markets would have available at least one of the two 6 MHz pairs for public safety. This number improves to about 30 markets if the methodology proposed by Motorola is adopted (40 dB D/U plus 5.3 dB for frequency difference and 15 dB for TV antenna front-to-back ratio coupled with lenient adjacent channel protection criteria). More aggressive co-channel sharing requirements will have only limited impact if the adjacent channel sharing rules are not reconsidered. However,

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[30] DTV must also be considered, but there are over 80 analog television stations on channels 62, 63, 64, 65, 67, 68, and 69 as compared to 11 DTV stations.

[31] 4 dBμ F(50,50) field strength converts to about –129 dBm across the 50 ohm output of a half-wave dipole land mobile radio antenna at 770 MHz.

more spectrum could be used in more markets if portions of the adjacent channels could be used at closer spacing to the TV station.

D. Land Mobile operation inside the Grade B contour

In earlier comments submitted in this proceeding, Motorola previously stated that the Commission should take into consideration that successful sharing between land mobile and TV broadcasting has occurred using a 40 dB D/U protection ratio. Motorola now urges the Commission to take into account other successful sharing examples in its reconsideration of these rules. There are numerous examples of Channel 14 and Channel 69[32] sharing scenarios in which land mobile operation has occurred within the Grade B contour of an adjacent channel TV station. Along with the recommendations above, Motorola here recommends that the Commission permit by rule such sharing when an engineering analysis shows it to be feasible.

* * * * *

The Commission has taken a great step in allocating 24 MHz of spectrum to the public safety community. It needs now to ensure that access to that spectrum is not hindered by rules which are either inflexible or inappropriate, or which seek to provide an excessive amount of protection to TV broadcast stations. The Commission should strive

[32] There are at least six channel 69 television stations licensed for greater than 1000 kW ERP operating adjacent to 806 to 812 MHz land mobile band where mobiles operate inside the Grade B contour. There are over 20 (of 30) channel 14 television stations licensed for greater than 1000 kW ERP operating adjacent to the 460-470 MHz land mobile band where mobiles operate inside the Grade B contour, including on the 8 emergency medical channels between 468.000 and 468.175 MHz.

for its rules to permit the maximum amount of engineering solutions to allow prompt access to this spectrum. All relevant technical parameters, such as propagation, antenna characteristics, and polarization should be taken into account. Non-standard deployments using only parts of the 6 MHz channel in order to avoid adjacent channel concerns should be encouraged.

IV. The FCC Needs to Clarify and Amend Certain Technical Matters

This section identifies a few technical issues that the FCC should either clarify or modify as appropriate. Most, if not all, of the suggested changes are relatively minor in scope and simply involve definitional and procedural matters. If left uncorrected, however, they do pose the possibility of complicating the equipment authorization process and thus result in significant delays in product deployments.

Adjacent Channel Protection: In Motorola's view, one of the major successes in the *First Report and Order* is the decision to regulate out-of-band and spurious emissions through the use of the method of adjacent channel power ratio instead of the traditional method of emission masks.[33] As discussed by the FCC, direct measurement techniques of interfering energy offers a technology-neutral solution to adjacent channel protection that is more compatible with the digital technologies currently envisioned for this band. Motorola strongly supports the FCC's decisions in this matter.

As indicated, the procedures adopted in the *First Report and Order* were first proposed by Motorola and, in Motorola's view, are mostly correct as incorporated into

[33] *First Report and Order* at ¶¶136-138.

the rules. Upon further review, however, Motorola believes that there is need for some clarification and modification. Therefore, Motorola is suggesting modifications, principally to Section 90.543, that would: 1) modify terminology to enhance consistency with TIA and ITU documents, 2) clarify measurement procedures, 3) add data for 50 kHz and 100 kHz wideband emissions, 4) slightly modify the measurement bandwidth to be used beyond 600 kHz offset to better comport with ITU specifications, 5) relax the adjacent channel specification at a few points due to revised technology assessments, 6) improve spurious emission specifications, and 7) correct typographical problems.[34]

The recommended changes are summarized below with a fully edited version of the revised rules attached as Appendix B:

Section 90.543(a):

- Telecommunications Industries Association Telecommunications System Bulletin 88 (TIA TSB-88) uses the term "adjacent channel coupled power" (ACCP) whenever the power is determined in the bandwidth of a companion receiver. The concept adopted in the *First Report and Order,* however, identifies the measurement bandwidth as the channel bandwidth, which is more appropriate given the expected variety of modulation types. In this context, however, the phrase adjacent channel power (ACP) is more appropriate and should be used rather than the phrase adjacent channel coupled power (ACCP).

- To conform the table data and headings with the definitions proposed herein for Adjacent Channel Power Ratio (ACPR) and Adjacent Channel Power (ACP), the third and

[34] In addition, Motorola recommends that the FCC add definitions for Adjacent Channel Power and Adjacent Channel Power Ratio to Section 90.7 of the Rules.

fourth columns of the tables in Section 90.543(a) should be modified as shown in the appendix to incorporate revised terminology as appropriate.

- In the tables, offset frequency specifications are improved along with corresponding adjustments in measurement bandwidth specifications.

- Tables are added for the 50 kHz and 100 kHz channel conditions and slight adjustments are made to the very close-in ACPR values to better match expected technology performances. (Slight adjustments are proposed to the narrowband tables for the same reason.)

- Improvements are recommended to emission specifications in the transmit and receive bands, with tables added appropriately.

Section 90.543(b):

- Section 90.543(b) is expanded into two subparagraphs (b) and (c) incorporating several terminology changes.

New Section 90.543(d):

- It is recommended that the title of this subsection be changed to *Spurious Emission Limit* instead of *Out-of band emission limit* to better conform with the definitions contained in Section 2.1 of the FCC's Rules.

- Measurement bandwidths are specified.

While these proposed changes will significantly clarify and aid the equipment authorization process, Motorola looks forward to working closely with the FCC's laboratory to ensure that the transition to adjacent channel power measurement techniques proceeds smoothly to the benefit of all manufacturers and users.

Data Definitions: On another matter, Motorola recommends that the text of Sections 90.535(b) and (c) be modified to better comport with the text of existing rule Section 90.203(j)(3). Currently, Sections 90.535 (b) and (c) read as follows:

> (b) Transmitters designed to operate in the narrowband segment using digital modulation must be capable of maintaining an data throughput of not less than 4.8 kbps in a 6.25 kHz bandwidth.
>
> (c) Transmitters designed to operate in the wideband segment using digital modulation must be capable of maintaining an data throughput of not less than 384 kbps in a 150 kHz bandwidth.

New Section 90.549 requires that equipment certification for 700 MHz radios must be in accordance with the provisions of Section 90.203. Since the data efficiency rate was adopted in Section 90.203 of the rules in the FCC's Refarming proceeding, Motorola has needed to work through several interpretive issues with the FCC equipment authorization staff to arrive at common understandings for terms such as "data rate" and "throughput" or "supporting/maintaining". To ensure that new uncertainties are not created in this proceeding, it is strongly recommended that the FCC revise new Sections 90.535 to correlate with Section 90.203. The revised text would read as follows:

> (b) Equipment designed to transmit data in the narrowband segment must be capable of supporting a minimum data rate of 4800 bits per second per 6.25 kHz of bandwidth.
>
> (c) Equipment designed to operate in the wideband segment must be capable of supporting a minimum data rate of 128,000 bits per second per 50 kHz of bandwidth.

V. Conclusion

For more than six years, the public safety community has urged the Federal Government to address the impending crisis in public safety communications caused by the lack of adequate spectrum allocations. The FCC's *First Report and Order* represents a great step forward and promises to help address this need. To fully resolve the immediate problems, however, the FCC must revise portions of its final actions, consistent with the recommendation made herein, that enable more ready access to this spectrum by more public safety users.

Respectfully Submitted,

Richard C. Barth, Ph.D.
Vice President and Director
Telecommunications Strategy
and Regulation
Motorola, Inc.
1350 I Street, NW
Washington, DC 20005
(202) 371-6900

Leigh M. Chinitz
Manager
Telecommunications Strategy
and Spectrum
Motorola, Inc.
1350 I Street, NW
Washington, DC 20005
(202) 371-6900

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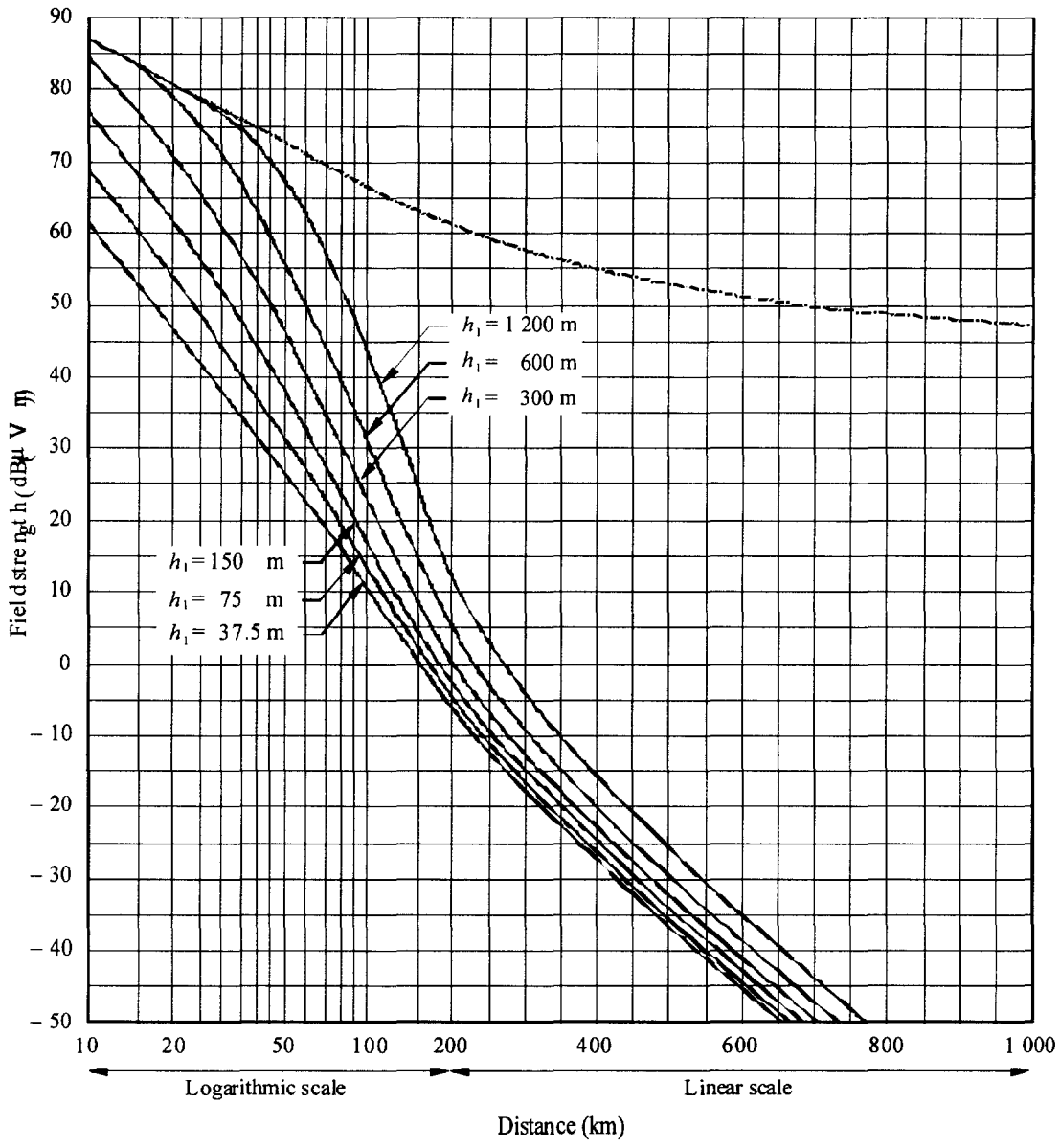
Appendix A

Field strength curves for UHF propagation from ITU-R P.370-7 (VHF and UHF Propagation Curves for the Frequency Range From 30 MHz to 1000 MHz)

FIGURE 9

Field strength (dB(μV/m)) for 1 kW e.r.p.



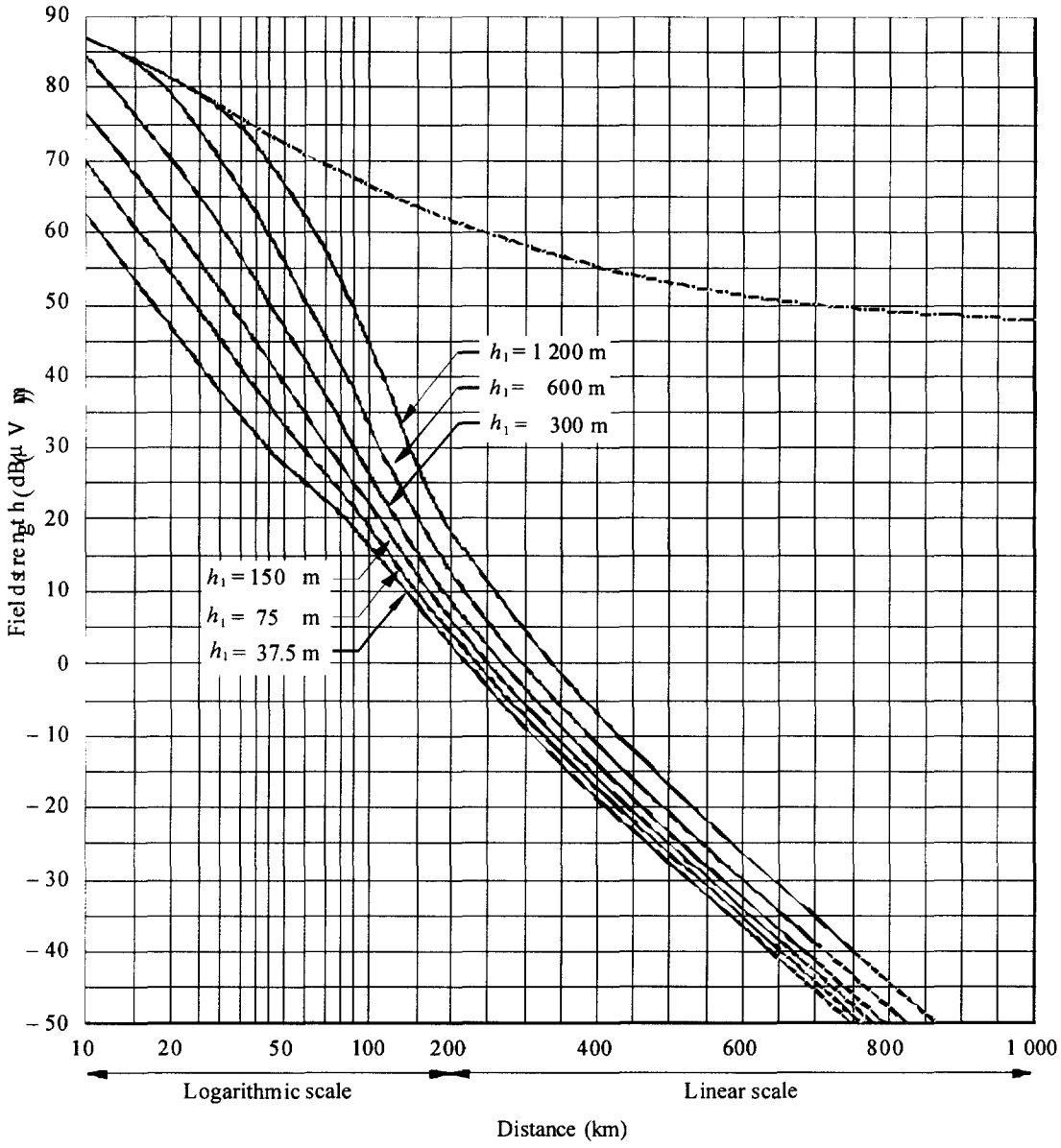
Frequency: 450-1 000 MHz (Bands IV and V); land; 50% of the time; 50% of the locations; h_2 = 10 m; Δh = 50 m

-·-·-·-·-·-·- Free space

D16

FIGURE 10

Field strength (dB(μV/m)) for 1 kW e.r.p.



Frequency: 450-1 000 MHz (Bands IV and V); land; 10% of the time;
50% of the locations; h_2 = 10 m; Δh = 50 m

-·-·-·-·-·- Free space

D17

APPENDIX B

Suggested Rule Changes

1. Section 90.7 Definitions. Add the following definitions to read as follows:

Adjacent Channel Power, (ACP): The average power measured in a specified bandwidth centered at a specified frequency offset from the assigned channel center frequency. For time division multiple access (TDMA) systems, the measurements are to be made under TDMA operation only during time slots when the transmitter is on.

Adjacent Channel Power Ratio, (ACPR): The ratio, expressed in dB, of the transmitter power in the desired channel divided by the Adjacent Channel Power for a particular bandwidth and frequency offset from the assigned channel center frequency. For time division multiple access (TDMA) systems, the measurements are to be made under TDMA operation only during time slots when the transmitter is on.

2. Section 90.543 Emission limitations. Modify in its entirety to read as follows:

Transmitters designed to operate in 764-776 MHz and 794-806 MHz frequency bands must meet the emission limitations in this section.

(a) The adjacent channel power ratio (ACPR) and adjacent channel power (ACP) requirements for transmitters designed for various channel sizes are shown in the following tables. Mobile station requirements apply to handheld, car mounted and control station units. The tables specify a minimum value for the ACPR as a function of the displacement from the channel center frequency and measurement bandwidth. In addition, the ACP for a mobile station transmitter at the specified frequency displacement must not exceed the value shown in the tables. For transmitters that utilize power control, the ACP requirement may be met at maximum power reduction. In the following tables, "(s)" indicates a swept measurement may be used.

6.25 kHz Mobile Transmitter ACPR & ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)	Maximum ACP (dBm)
6.25	6.25	40	not specified
12.5	6.25	60	-45
18.75	6.25	60	-45
25	6.25	60	-45
37.5	25	60	-45
62.5	25	65	-50
87.5	25	65	-50
150	100	65	-50
250	100	65	-50
350	100	65	-50
450	100	65	-50
550	100	65	-50

12.5 kHz Mobile Transmitter ACPR & ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)	Maximum ACP (dBm)
9.375	6.25	40	not specified
15.625	6.25	60	-45
21.875	6.25	60	-45
37.5	25	60	-45
62.5	25	65	-50
87.5	25	65	-50
150	100	65	-50
250	100	65	-50
350	100	65	-50
450	100	65	-50
550	100	65	-50

25 kHz Mobile Transmitter ACPR & ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)	Maximum ACP (dBm)
15.625	6.25	40	not specified
21.875	6.25	60	-45
37.5	25	60	-45
62.5	25	65	-50
87.5	25	65	-50
150	100	65	-50
250	100	65	-50
350	100	65	-50
450	100	65	-50
550	100	65	-50

50 kHz Mobile Transmitter ACPR & ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)	Maximum ACP (dBm)
50	50	30	not specified
100	50	50	-35
150	50	50	-35
200	50	50	-35
250	50	50	-35
300	50	50	-35
350	50	50	-35
400	50	50	-35
450	50	50	-35
500	50	50	-35
550	50	50	-35

100 kHz Mobile Transmitter ACPR & ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)	Maximum ACP (dBm)
75	50	30	not specified
125	50	50	-35
175	50	50	-35
225	50	50	-35
275	50	50	-35
325	50	50	-35
375	50	50	-35
425	50	50	-35
475	50	50	-35
525	50	50	-35
575	50	50	-35

150 kHz Mobile Transmitter ACPR & ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)	Maximum ACP (dBm)
100	50	30	not specified
150	50	50	-35
200	50	50	-35
250	50	50	-35
300	50	50	-35
350	50	50	-35
400	50	50	-35
450	50	50	-35
500	50	50	-35
550	50	50	-35

Mobile Transmitter ACPR & ACP Requirements: Transmit Band

Frequency (MHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)	Maximum ACP (dBm)
794-806*	100 (s)	70	-50

* Excluding ±600 kHz centered around the carrier

Mobile Transmitter ACPR & ACP Requirements: Receive Band

Frequency (MHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)	Maximum ACP (dBm)
Receive Band* 764-776 MHz	100 (s)	70	-50

* In direct mobile to mobile operation the receive band is 794-806 MHz and the limits apply there.

6.25 kHz Base Transmitter ACPR Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)
6.25	6.25	40
12.5	6.25	60
18.75	6.25	60
25	6.25	60
37.5	25	60
62.5	25	65
87.5	25	65
150	100	65
250	100	65
350	100	65
450	100	65
550	100	65

12.5 kHz Base Transmitter ACPR Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)
9.375	6.25	40
15.625	6.25	60
21.875	6.25	60
37.5	25	60
62.5	25	65
87.5	25	65
150	100	65
250	100	65
350	100	65
450	100	65
550	100	65

25 kHz Base Transmitter ACPR Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)
15.625	6.25	40
21.875	6.25	60
37.5	25	60
62.5	25	65
87.5	25	65
150	100	65
250	100	65
350	100	65
450	100	65
550	100	65

50 kHz Base Transmitter ACPR Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)
50	50	30
100	50	50
150	50	50
200	50	50
250	50	50
300	50	50
350	50	50
400	50	60
450	50	60
500	50	60
550	50	60

100 kHz Base Transmitter ACPR Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)
75	50	30
125	50	50
175	50	50
225	50	50
275	50	50
325	50	50
375	50	50
425	50	60

475	50	60
525	50	60
575	50	60

150 kHz Base Transmitter ACPR Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)
100	50	30
150	50	50
200	50	50
250	50	50
300	50	50
350	50	50
400	50	60
450	50	60
500	50	60
550	50	60

Base Transmitter ACPR Requirements: Transmit Band

Frequency (MHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)
764-776*	100 (s)	75

* Excluding ±600 kHz centered around the carrier

Base Transmitter ACPR Requirements: Receive Band

Frequency (MHz)	Measurement Bandwidth (kHz)	Minimum ACPR (dB)
794-806 MHz	100 (s)	95

(b) *Minimum ACPR measurement procedure:* The following are the procedures for making the transmitter ACPR measurements. For all measurements modulate the transmitter as it would be modulated in normal operating conditions. For time division multiple access (TDMA) systems, the measurements are to be made under TDMA operation only during time slots when the transmitter is on. All measurements are made at the transmitter's output port. For a transmitter that has an integral antenna, a suitable coupling device shall be used to couple the RF signal to the measurement instrument. The coupling device shall substantially maintain the proper transmitter load impedance. The ACP measurements may be made with a spectrum analyzer capable of making direct ACP measurements. "Measurement bandwidth", in the tables, implies an instrument that measures the power in many narrow bandwidths (e.g. 300 Hz) and integrates these powers to determine the power in the specified measurement bandwidth.

(1) *Setting the reference level:* If the transmitter is capable of automatic power control, set the power control for minimum power reduction. Using an instrument capable of ACP measurements, set the measurement bandwidth to the channel size. For example, for a 6.25 kHz transmitter, set the measurement bandwidth to 6.25 kHz; for a 150 kHz transmitter, set the measurement bandwidth to 150 kHz. Set the frequency offset of the measurement bandwidth to zero and adjust the center frequency of the instrument to the assigned center frequency to measure the average power level of the transmitter. Record this power level in dBm as the "reference power level".

(2) *Non-swept power measurement:* Using an instrument capable of ACP measurements, set the measurement bandwidth and frequency offset from the assigned center frequency as shown in the tables given in § 90.543 (a). If the transmitter is capable of automatic power control, set the power control for minimum reduction. Measure the ACP in dBm. Calculate ACPR by subtracting the measurements made in this step from the reference power level measured in the previous step. The ACPR values must be at least as great as the Minimum ACPR values given in the table for each condition above.

(3) *Swept power measurement:* Set a spectrum analyzer to 100 kHz resolution bandwidth, 1 MHz video bandwidth and sample mode detection. Set the reference level of the spectrum analyzer to the average value of the transmitter power. Sweep above and below the carrier frequency to the edge of the transmit frequency band, and through the receive frequency band as applicable. Calculate ACPR by subtracting the measurements made in this step from the reference power level set in this step. The ACPR values must be at least as great as the Minimum ACPR value given in the tables. In up to 6 bands of 50 kHz, centered at integer multiples of 50 kHz displacement from the channel center frequency, exceptions at up to 43+10log(P) dB reduced below the average carrier power (P) are allowed.

Note: The dynamic range of some spectrum analyzers may be limited to an unacceptable degree when using 100 kHz resolution bandwidth. In such cases the measurement may be made using 30 kHz resolution bandwidth and adding 5 dB to the measured ACP value to account for the difference in bandwidth.

(c) *Maximum ACP measurement procedure:* The following are the procedures for making the transmitter ACP measurements. For all measurements modulate the transmitter as it would be modulated in normal operating conditions. For time division multiple access (TDMA) systems, the measurements are to be made under TDMA operation only during time slots when the transmitter is on. All measurements are made at the transmitter's output port. For a transmitter that has an integral antenna, a suitable coupling device shall be used to couple the RF signal to the spectrum analyzer. The coupling device shall substantially maintain the proper transmitter load impedance. The ACP measurements may be made with a spectrum analyzer capable of making direct ACP

measurements. "Measurement bandwidth" implies an instrument that measures the power in many narrow bandwidths (e.g. 300 Hz) and integrates these powers to determine the power in the specified measurement bandwidth.

(1) *Non-swept power measurement*: Using an instrument capable of ACP measurements, set the measurement bandwidth and frequency offset from the assigned center frequency as shown in the tables given in § 90.543 (a). If the transmitter is capable of automatic power control, the power control may be set for maximum reduction. Measure the ACP in dBm. The ACP values must not be greater than the Maximum ACP values given in the table for each condition above.

(2) *Swept power measurement:* Set a spectrum analyzer to 100 kHz resolution bandwidth, 1 MHz video bandwidth and sample mode detection. Set the reference level of the spectrum analyzer to the average value of the transmitter power and note the absolute power. Sweep above and below the carrier frequency to the edge of the transmit frequency band, and through the receive frequency band as applicable. The response at frequencies greater than 600 kHz must be less than the values in the tables. In up to 6 bands of 50 kHz, centered at integer multiples of 50 kHz displacement from the channel center frequency, exceptions at up to 43+10log(P) dB reduced below the average carrier power (P) are allowed.

Note: The dynamic range of some spectrum analyzers may be limited to an unacceptable degree when using 100 kHz resolution bandwidth. In such cases the measurement may be made using 30 kHz resolution bandwidth and adding 5 dB to the measured ACP value to account for the difference in bandwidth.

(d) *Spurious emission limit.* On any frequency outside of the frequency ranges covered by the ACPR and ACP tables in this section, the power of any emission must be reduced below the average carrier power (P) by at least 43 + 10 log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz. However, for frequency ranges between 9 kHz and 150 kHz and 150 kHz measurement bandwidth

(e) *Authorized bandwidth.* Provided that the ACP requirements of this section are met, applicants may request any authorized bandwidth that does not exceed the channel size.