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FEDERAL COMMUNICATIONS COMMISSION
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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Amendment of Part 90	)	
of the Commission's Rules	)	PR DOCKET NO. 93-61
to Adopt Regulations	)	RM 8013
for Automatic Vehicle	)	
Monitoring Systems	)	

To: The Commission

COMMENTS OF PINPOINT COMMUNICATIONS, INC.

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COMMENTS OF PINPOINT COMMUNICATIONS, INC.

Pinpoint Communications, Inc. ("Pinpoint"), by its attorneys, hereby comments on the Notice of Proposed Rulemaking ("NPRM") in the above-captioned proceeding.[1]

I. SUMMARY

In the *NPRM*, the FCC proposes the adoption of permanent rules for automatic vehicle monitoring ("AVM") operations.[2] Among other things, the Commission tentatively concludes that it is possible for wide-area hyperbolic multilateration ("HML")[3] AVM systems to operate on a non-exclusive basis through the cooperation

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[1] *See* 8 F.C.C. Rcd 2502 (1993).

[2] The *NPRM* proposes to redefine and rename AVM as the Location and Monitoring Service ("LMS"). *Id.* at 2503. Pinpoint has no objection to this proposal, but will refer to the service in this pleading as AVM with respect to current and historical monitoring services and as LMS when referring to operations under any permanent rules that may be adopted herein.

[3] In the *NPRM*, the FCC proposes a dichotomy between "wideband pulse-ranging" and "narrowband" AVM systems for purposes of dividing the allocation. Pinpoint submits that this distinction is blurred by certain definitional problems. For example, local-area systems, such as

(continued...)

among co-channel licensees serving the same area. Pinpoint, the developer of an innovative and unique wide-area AVM system design, strongly urges the Commission to retain a shared spectrum approach. As exemplified herein, sharing among wide-area systems is both practical and feasible at this time. Concomitantly, wide-area systems can co-exist with local area operations. Accordingly, in several important particulars, Pinpoint respectfully submits that the public interest would be furthered if the Commission adopts a band plan incorporating sharing on a wider scale and technical rules different than those proposed in the *NPRM*.

First, the benefits of AVM to the public would be increased the more spectrum that is made available for *individual* wide-area systems. The primary reason for this is that the throughput of AVM systems increases exponentially rather than linearly as the bandwidth increases. Because sharing can be accomplished through time-sharing of the spectrum, as Pinpoint details below, this same maximum bandwidth would be available to *each* wide-area operation, with the attendant throughput advantages shared accordingly. In contrast, any grant of exclusivity to existing licensees, even if

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[3](...continued)
reader/tag systems used for automatic toll collection, may be wideband or narrowband depending on the application. Further, Pinpoint understands that, in a sense, toll tag technology may be deemed to be pulse-ranging. Accordingly, Pinpoint suggests that a more appropriate categorization, which better comports with the distinct manner in which AVM systems can share spectrum is a "wide-area/local-area" distinction. "Wide-area" systems are those that employ a technology permitting the automatic location of a vehicle using an infrastructure where the range of fixed sites is on the order of several miles or more. While a few direction-finding location systems are employed elsewhere, all wide-area vehicular system designs of which Pinpoint is aware employ HML techniques. "Local-area" area systems, in contrast, are those that operate over ranges of several hundred feet or less, and are typified by the reader/tag arrangement described in the *NPRM*. *NPRM* at 2502-3, 2504.

temporary, will lead to a *de facto* duopoly, suppressing competition, stifling innovation, increasing the costs of service, and reducing consumer choice.

Second, sharing of spectrum by wide-area operations with local-area (narrowband or wideband) systems is achievable consistent with a high quality of service. Contentions by some wide-area operators to the contrary are overexaggerated and part of attempts to secure exclusive use of spectrum.

Therefore, the Commission should adopt a band plan that maximizes the bandwidth available to wide-area systems, up to 26 MHz, and corresponding licensing and implementation rules. Such action would maximize the opportunities for market entry, promoting investment and development in new wide-area technologies and competition.

In order to implement sharing, the Commission should rely upon the resourcefulness and cooperation of wide-area licensees rather than rigid application of sharing regulations. Accordingly, Pinpoint proposes a licensing procedure whereby interested and qualified parties are given an equal opportunity to construct and operate an LMS system. Built into the procedure described by Pinpoint are incentives for cooperation and disincentives to speculation.

In addition to accommodating sharing among wide-area systems over as much of the AVM allocation as possible, the Commission should alter its proposed technical regulations to accomplish its objectives behind the complex, multi-layered allocation scheme at 902-928 MHz. For example, the power limitations for wide-area systems should take into account (1) the fact that reducing the spectral energy density of

wideband signals by spreading them over a wider bandwidth reduces their interference potential vis-a-vis narrowband signals and (2) the fact that 902-928 MHz as a band already shared among numerous users including many Part 15 devices will be characterized by relatively high (interference/background) noise levels. Accordingly, wideband wide-area base stations and mobile stations will need to operate with sufficient power to facilitate economic and high-quality AVM service.

II. INTRODUCTION AND STATEMENT OF INTEREST

Pinpoint, a Texas corporation headquartered in Dallas, has invested several years of intensive research and development to create ARRAY™, an integrated radiolocation and messaging system that accurately locates vehicles and provides two-way data status, instruction and other vehicle-related communications. ARRAY™, a wide-area HML AVM system, is designed to be high capacity and sufficiently robust to share spectrum with other AVM systems -- including both wide-area and local-area AVM systems, as well as government radiolocation systems, ISM equipment, and Part 15 radio frequency devices that operate in the 902-928 MHz band.

ARRAY™ will provide the necessary vehicle location and messaging infrastructure for a broad variety of important and useful applications. In addition to vehicle location, ARRAY™ will provide a platform for AVM services such as computer-assisted dispatch for business and public safety agencies, automobile road

service assistance, emergency communications services, computer assisted navigation along streets and highways, and business location identification services.[4]

More importantly, ARRAY™ is uniquely suited among all current AVM systems to further important national transportation policies established by the Intelligent Vehicle-Highway Systems Act of 1991 ("IVHSA"). The IVHSA, which mandates the development, operational testing, and implementation of intelligent vehicle-highway systems ("IVHS"), was enacted to effect advanced traffic management systems, enhanced traveler information systems, commercial vehicle operations, and advanced public transportation systems.[5]

By directly addressing the high congestion levels plaguing the nation's highways, IVHS promises to enhance the capacity, efficiency, and safety of the Federal highway system and to reduce the need for the seemingly endless construction of additional physical capacity. Through wide-area traffic management, IVHS will alleviate traffic congestion by continuously gathering and disseminating accurate information on traffic conditions that will allow for strategic routing of traffic away

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[4] For example, the AVM capabilities of ARRAY™ will enable drivers to request and receive automatic routing information through dashboard mounted terminals that will navigate them through unfamiliar areas or inform them of current traffic conditions. The simultaneous operation of ARRAY™'s positioning capabilities, automatic distress signal functions, and high speed data communications allows drivers in emergency situations who may not know their vehicles' location -- and may not want or be able to leave their car to seek the aid of strangers -- to send and receive location related messages summoning assistance from police, paramedics, and auto repair services. Thus, ARRAY™ will prove extremely valuable in enhancing public safety.

[5] The Commission extols the public interest benefits served by intelligent highways, and acknowledges the importance of AVM systems to help implement these intelligent highway systems. *NPRM* at 2505.

from congested roadways to less congested ones, dynamic control of traffic signals, and other enhancements to the free flow of traffic.

AVM and messaging technologies such as ARRAY™, designed to operate in the 902-928 MHz band, are best equipped to collect and distribute accurate, real-time traffic information. With its vehicle location capacity, two-way messaging capabilities, and long range communications characteristics, wide-band range-pulsing AVM systems such as ARRAY™ will best allow for the collection and distribution of accurate, real-time traffic information. Using wide-area mobile units as "probes" to sample traffic in congested and non-congested areas, AVM accurately and efficiently will poll the location of hundreds of thousands of vehicles at regular intervals, (such as twice a minute) to allow traffic information centers to accurately estimate the location, direction of travel, and speed of vehicles throughout a metropolitan area during peak-traffic conditions.

To achieve the objectives behind IVHS, AVM systems must poll an extremely high volume of vehicles on a frequent basis. In large metropolitan areas where traffic conditions are in a state of crisis, the number of vehicles implicated for meaningful IVHS applications is significant. Because it is a high capacity system, Pinpoint's ARRAY™ will be able to handle such large scale consumer applications. Other systems, such as PacTel's are not as high capacity nor as robust. If the full plethora of IVHS needs are to be met on a wide-area basis, PacTel alone cannot meet the challenge with its current technology. Thus, the Commission should continue to foster the

at the different base stations and uses HML calculations to accurately estimate the location of the mobile.[8]

Pinpoint's ARRAY™ system transmits ranging pulses that are expanded by spread spectrum techniques so that the peak pulse energy levels can be minimized. In the receiver, the expanded pulse is compressed, by a matching correlation technique, back into a (near) impulse, whose leading edge's arrival time is used to estimate range.

ARRAY™ is unique among existing and developing AVM systems because its

bandwidth by a factor of two to 16 MHz results in an increase in data rates and the number of positions fixed each hour by as much as a factor of eight. The cost of the mobile units, however, does not increase. The system's robustness is also enhanced because such an increase in bandwidth facilitates faster repeats in the case of a lost signal and improves immunity to interference by a factor of two.[10]

Pinpoint has applied for AVM licenses in twenty cities to establish its initial operations.[11] Barring any Commission decisions in this proceeding that would foreclose the opportunity for Pinpoint to operate ARRAY™ in the band most suitable for AVM, Pinpoint remains poised to deploy its system in a timely fashion.

III. THE COMMISSION SHOULD ADOPT RULES THAT MANDATE SHARING AMONG ALL AVM SYSTEMS AND THAT MAXIMIZE THE BANDWIDTH AVAILABLE TO WIDE-AREA SYSTEMS

Pinpoint agrees with the FCC that the entire 26 MHz of 902-928 should be opened up for use by AVM systems. However, rather than segregate the band into segments for "wideband" and "narrowband" technologies, the FCC should make available the entire band for all AVM technologies. Pinpoint makes this counterproposal on the basis of the following demonstrations. First, sharing would be in the public interest and would be feasible for wide-area AVM systems on a time-division basis with possible combinations of frequency division multiple access. Two,

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[10] The ARRAY™ System has been designed to make full use of the resolution available in the widest assignable bandwidths. See the statement of Louis Jandrell attached hereto as Exhibit A for a discussion of the factors affecting location update rates.

[11] These applications are pending. *See* File Nos. 347483-347502.

the throughput capacity of wideband wide-area systems increases exponentially in relation to increases in bandwidth. Three, wide-area systems can provide high-quality service in the presence of local-area operations.

A. SHARING OF SPECTRUM AMONG WIDE-AREA LICENSEES WOULD YIELD IMPORTANT PUBLIC INTEREST BENEFITS

an environment of experimentation leading to robust and competitive systems. To date, sharing has succeeded. It has led to a number of diverse AVM approaches among wide-area and local-area systems, such as ARRAY™ and PacTel Teletrac, in the first category, and AMTECH Corporation and Mark IV, in the latter.

Sharing in the AVM band, as the *NPRM* recognizes, would continue to serve the public interest: "non-exclusive licensing of LMS systems is the best means to promote competition within the LMS industry and continued technological advances in LMS services, possibly leading to more robust systems and more efficient spectrum sharing."[13] It is beyond question that sharing will promote competition, thereby furthering not only the FCC's goals, but one of the central objectives of the Communications Act of 1934 for private land mobile radio services.[14] Because wide-area systems typically spread over several megahertz of spectrum -- and Pinpoint demonstrates below that maximization of the bandwidth for wide-area systems yields important public benefits -- the number of licensees in any given area will be severely limited absent sharing.

2. The Commission's Temporary Exclusive Alternative Will Frustrate the Public Benefits of Sharing in the AVM Band. Is

currently issued, ultimately resulting in limiting the number of licensees to two in all areas of the country."[17] Indeed, even this understates the gravity of the situation. Two parties, PacTel and METS Inc./MobileVision ("MobileVision"), already are licensed at well over a thousand total sites for the two 8 MHz bands in *all* of the largest 50 metropolitan areas in the country, and many other besides.[18] Thus, according exclusivity to existing licensees, as proposed in the alternative, would be tantamount to authorizing PacTel and MobileVision each exclusive use of 8 MHz bands on a virtually nationwide basis. Figures 1 and 2 of Exhibit B demonstrate the vast areas of the country that would be relegated to the exclusive domain of these two licensees.

Allowing entry by other applicants after five years, as the *NPRM* proposes, is an empty gesture. By that time, PacTel and MobileVision systems would probably be firmly entrenched, and they would have no incentive to negotiate shared spectrum use with other licensees since they would be long-standing beneficiaries of a duopoly in all of the largest markets across the country. Moreover, their strong campaigns to obtain exclusivity to date are clear signs that they are unlikely at the end of five years to

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[17] *NPRM* at 2506.

[18] Opposition of Pinpoint, RM No. 8013, App. A (filed July 23, 1992) ("Pinpoint Opposition"); Reply Comments of Pinpoint, RM No. 8013, App. A (filed August 7, 1992) Attachment A ("Pinpoint Reply Comments"). It appears that Ameritech may no longer be directing MobileVision; MobileVision has announced that METS, Inc., has assumed control. Comments of MobileVision in Support of Teletrac's Petition to Deny the Applications of Pinpoint, n.1 at 1, File Nos. 347483-347502 (filed June 18, 1993).

cooperate with any new licensees that are obligated to protect them unless the FCC gives them incentives to do so.

This alternative proposal would therefore foreclose the entry of pioneers such as Pinpoint and others into the AVM market throughout large regions of the nation. License applications would be cut off for hundreds of locations. Unless other licensees were allowed to operate now in those markets in which PacTel or MobileVision have licenses, there is small probability that sharing will ever occur in the future. In short, a *de facto* nationwide market will have been created with obvious anticompetitive results.

Not only would the proposed exclusivity arrangement frustrate competition by barring additional entrants in a given market, it would dampen diverse technological approaches in furtherance of the radio art and a variety of service choices for consumers, goals reflected in the Communications Act of 1934, as amended.[19] Under the duopoly situation the incentives to develop and implement technological innovations would be severely limited. Concomitantly, consumer choice would be meager under a duopoly arrangement with no chance for additional entrants.[20] In short, exclusivity would lead to inefficient use of the spectrum, an ironic and tragic result given that the

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[19] 47 U.S.C. § 157.

[20] The limited choice of services in a duopoly situation would not be offset by the availability of other AVM systems such as GPS and Loran C. These other systems cannot offer the urban coverage available through wide-band HMI systems because of shadowing and obstruction in the case of GPS and

current sharing regime is on the threshold of ushering in vastly more efficient and compatible systems such as ARRAY™.

Furthermore, the introduction of exclusivity into the band as proposed would constitute an unprecedented step by the Commission, flying in the face of long-standing and established Commission policies regarding the allocation of frequencies on an exclusive basis. Pinpoint is unaware of any service established under Commission rules governing Private Radio Services where the Commission has conferred exclusivity on *existing* licensees to the complete exclusion of other licensees, as is proposed in the alternative here.[21] To the contrary, exclusivity has been granted on a prospective basis and almost always only after advance public notice of a cut-off date following the

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[21] While the Commission has recently proposed several novel exclusivity schemes in other Private Radio dockets, these proposals do not share the fundamentally anticompetitive, unfair and exclusionary characteristics of the proposal at issue. For example, in its Notice of Proposed Rule Making to increase channel capacity and promote more efficient use of frequency bands below 512 MHz allocated to the Private Land Mobile Radio Services, the Commission has proposed creation of a channel exclusivity option through exclusive use overlay. *See Replacement of Part 90 by Part 88 to Revise the Private Land Mobile Radio Services and Modify the Policies Governing Them*, 7 F.C.C. Rcd 8105 (1992) (*Notice of Proposed Rule Making*) Under this proposal, the Commission would temporarily freeze licensing on specific channels at specific locations if a licensee with an existing operation at that location obtained sufficient concurrence from existing large licensees. As the Commission itself notes, "the EUO option is an *opportunity* to obtain exclusivity." *Id.* at 8109 (emphasis in original). The exclusivity is not preordained by the Commission as it would be under the current proposal. Moreover, it is not granted to holders of bare licenses as PacTel and MobileVision by and large are. Further, it is done on a market-by-market basis on assignments of a small fraction of 1 MHz in width, rather then on a *de facto* nationwide basis on 8 MHz, here. Finally, there are numerous licenses in any given market under EUO rather than the two AVM wide-area licenses.

Similarly, the Commission has recently proposed to amend Part 90 of the rules governing private carrier paging "PCP" service in the 929-930 MHz band to grant channel exclusivity to qualified local, regional, and national paging systems. *See Amendment of the Commission's Rules to Provide Channel Exclusivity to Qualified Private Paging Systems at 929-930 MHz*, 8 F.C.C. Rcd 2227 (1993)

submission of an initial application for a license or the opening of an application window. In the latter situation, exclusive licensing might be on a first-come, first-served basis, but all license applications received on the same day will be considered simultaneously filed and mutually exclusive if there are an insufficient number of frequencies. Similarly, in affording exclusivity in other radio services, the Commission has not so grossly foreclosed the entry opportunities of other licensees as it proposes to do here.[22]

3. Sharing Is Both Practical and

demonstrates that through "coordination to avoid interference among co-channel users . . . performed by the licensees themselves,"[25] sharing is immediately feasible.

Pinpoint has consistently advocated the achieveability of sharing among wide-area systems.[26] In fact, based upon the requirements of the current AVM rules, Pinpoint has designed its system to accommodate sharing. Although sharing requires some commonality of knowledge and system elements, the resulting similarity of the systems will be extremely limited in scope, leaving open the potential for a variety of technological approaches to wideband AVM.[27]

Pinpoint advocates sharing among wide-area systems based on time division multiple access ("TDMA"). To accomplish TDMA sharing, the following conditions must be satisfied. First, each system must have its clock synchronized to a common

Similarly, there are several ways for co-channel licenses to agree upon a means of access control once synchronization has been achieved. A crude, but simple and certainly feasible, sharing method would be for each system to have access to the spectrum for the same length of time on a periodic basis. This approach was originally called "time-slicing" in the early days of mainframe computer sharing. Under time-slicing, access would be identical for each market participant on a "round robin" basis. The amount of time and the period between "time slices" would be determined by the number of participants and the tolerable response latencies of the systems. For example, if there were four systems, each one might have one-quarter second access every second, or one-half second every two seconds. Because each system clock would be synchronized to a common standard, there would be no interference regardless of the relative powers employed by the systems.

As systems mature and the number of subscribers increases, a drawback of the time-slicing method will be that it is potentially wasteful of "airtime." In other words, it will be spectrally inefficient to the extent that each operator may not need the entire interval assigned to it each time.

One way to make this basic TDMA system more spectrally efficient is to allow system operators to agree among themselves, on a bilateral or multilateral basis, to share information, via system computers, about the degree to which they use their time slots. Pursuant to agreement, one operator could permit another system to use any of the former's unused time slots or portions thereof -- on a real-time or anticipated basis. Over periods agreed upon by the licensees, say once a month, operators would settle

accounts among themselves for the time that they "sold" or "loaned/borrowed" to other licensees.

A more sophisticated solution to the problem of inefficient use under the simple "time-slicing" approach would be for co-channel licensees to agree to the use of a centralized "arbitrator" to schedule time in advance based upon operator requests.[28] In

systems, Pinpoint submits that the Commission should structure a negotiation among interested *and qualified* applicants.

PacTel, in a recent pleading, has suggested that spectrum sharing among licensees has no precedent except where some form of carrier-sense protocol was used or where a single system was shared by multiple licensees.[29] In fact TDMA by licensees operating their own systems has occurred along the lines proposed by Pinpoint. Specifically, private land mobile radio paging systems have shared on the basis of simple time division as well as through more sophisticated mechanisms involving a mutual agreed upon terminal that would provide access to a carrier's system on a "first in, first out basis."

Of course, the present moment presents a unique opportunity. Delaying mandated

4. The Commission's Forward Link Proposal Should Be Modified

One aspect of some existing wide-area systems is not conducive to sharing: the placing of high powered forward links near 905 and 925. Wide-area HML systems will require a forward link communicating from base stations to mobile receivers, as the Commission observes.[30] However, there are numerous ways to implement this requirement. Almost all of them are better than maintaining them at these frequencies.

The *NPRM* proposes that two 250 kHz wide sub-bands be designated for forward links, at 924.890-925.140 MHz and 904.375-904.625 MHz.[31] These high-powered narrowband forward links each would be located in the spectrum intended to be used by other wide-area licensees for radiolocation. As such, these high-power forward links would act as a significant source of interference and make wide-area wideband operations extremely difficult. Given that the forward link for wide-area operations centered in the 904-912 MHz sub-band would be located within the 918-926 MHz wide-area sub-band and vice versa under the Commission's proposal, they diminish the utility of the proposed wide-band allocations for use by anyone other than PacTel and MobileVision.

Suitable alternatives, fortunately, do exist. Pinpoint, for example, has solved the need for a forward channel through technology that uses signaling in the same

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[30] *NPRM* at 2505.

[31] *Id.* The proposal would make forward links currently authorized to PacTel and Ameritech a *de facto* standard.

channel employed for vehicle location. Assuming that some wide-area HML operators cannot incorporate such an innovation and require separate spectrum for forward-links, at least two solutions are preferable to the *NPRM* proposal. First, there are already up to forty channels available for private-carrier paging at 929 MHz. Forty additional channels are also available at 931 MHz for common carrier paging.[32] Second, the forward links could be moved near the edge of the band, say at 902.000 - 902.250 and 927.750 - 928.000 MHz so as to minimize the impact on other wideband systems.[33]

In short, there are numerous, better alternatives than placing the forward links where they might cause objectionable interference to wide-area systems. Accordingly, the proposed forward links should not be adopted. Wide-area licensees should be required to meet their forward link needs within their own spectrum allocation or on frequencies allocated to services that could support the necessary functionality. At most, the forward links should be at the AVM band edges.

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[32] PacTel and Southwestern Bell, for example, are major licensees in both bands. Moreover, PacTel has been urging the Commission to make available 25 kHz channels at 930 MHz for advanced messaging services. Inconsistently, however, PacTel has opposed according applicants more than 25 kHz for a single channel at 930 MHz. Reply of PacTel Paging, ET Docket 92-100 at 6 (filed June 16, 1992). At the same time, PacTel seeks to obtain up to ten such channels grouped together at 924.890-925.140 MHz.

[33] A third "separate spectrum" forward-link option may open up in the future with narrowband PCS in the 901-902 and 931-932 and 940-941 MHz bands, which the Commission has recently allocated in ET Docket No. 92-100 and in which one MHz of spectrum is being held in reserve.

B. WIDE-AREA WIDEBAND HML SYSTEMS SHOULD BE ALLOWED TO UTILIZE MORE SPECTRUM RATHER THAN LESS

In the *NPRM*, the Commission states that commenters "should address whether pulse-ranging LMS systems require eight megahertz and, if not, what minimum amount of spectrum is necessary to operate such a system."[34] This instruction was made in the context of FCC inquiries concerning the co-existence of local-area and wide-area systems. Pinpoint surmises that the FCC may be considering whether the "wideband-only" sub-bands, of which the *NPRM* proposes two, each 8 MHz in width, can be made smaller should NTIA not provide authorization to use the 912-918 MHz band for AVM or, presumably, the record demonstrate the need for local-area systems to have access to more than 10 MHz of spectrum.

Such an inquiry is appropriate if the assumption is made that the sharing of spectrum between wide-area and local-area systems is not feasible. As discussed in detail *infra*, wide-area systems can tolerate co-channel local-area wideband and narrowband systems and maintain a high quality of service. Accordingly, the issue is not so much what the minimum amount of spectrum required for successful operation of an AVM system as it is what amount of spectrum should be made available to individual systems to "improve the efficiency of spectrum use."[35] The short and proper answer is as much as possible.

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[34] *NPRM* at 2505.

[35] 47 U.S.C. § 332(a)(2) (1988).