

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

FCC 95-41

In the matter of	)	
	)	
Amendment of Part 90 of the	)	PR Docket No. 93-61
Commission's Rules to Adopt	)	
Regulations for Automatic	)	
Vehicle Monitoring Systems	)	

**REPORT AND ORDER**

**Adopted: February 3, 1995**

**Released: February 6, 1995**

By the Commission: Commissioner **Quello** concurring and issuing a statement;  
Commissioner Barrett dissenting and issuing a statement; Commissioners Ness and Chong  
issuing separate statements.

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## I. INTRODUCTION

1. In this Report and Order, we adopt rules for the future licensing and continued development of a number of services and equipment using the 902-928 MHz band. In recent years, Automatic Vehicle Monitoring (**AVM**) systems and unlicensed Part 15 devices have developed and proliferated in this band and are providing services that are valuable and in the public interest. These services range from licensed vehicle location and automatic toll collection systems to unlicensed devices used for utility meter reading and inventory control. Our allocation plan for the **902-928** MHz band includes 8 MHz of additional spectrum for AVM services and establishes new provisions for governing the interference obligations of Part 15 and amateur operations in this band. This plan balances the differing operational needs of these varied types of uses so that most AVM systems and Part 15 devices will be able to achieve their service objectives without impeding each other's use of the spectrum. We also modify and eliminate outdated regulations that have not kept pace with the technological evolution of AVM and establish a new service, the Location and Monitoring Service (**LMS**), that both encompasses the old AVM service and future advanced transportation-related services.

2. A key feature of our new spectrum allocation plan is the establishment of separate sub-bands for licensed LMS uses. We have provided three sub-bands for exclusive licensing of **wideband** "multilateration" LMS systems in addition to two sub-bands for the sharing of narrowband "non-multilateration" LMS systems. Subject to grandfathering certain existing AVM licensees, mutually exclusive applications for multilateration LMS licenses in the three sub-bands will be resolved through competitive bidding. We also clarify the status of licensed systems in the **902-928** MHz band in relation to other uses of the band, with distinctions made for amateur radio and unlicensed Part 15 users operating under certain, specified parameters. The new band plan, combined with the provisions for continued amateur and unlicensed Part 15 operation, will allow efficient and competitive use of the spectrum. Our decisions herein also provide certainty for all users of the band so they can invest in the equipment and facilities necessary to bring quality, low cost services to consumers.

## II. BACKGROUND AND EXECUTIVE SUMMARY

3. The Commission initiated the AVM service in 1974, when it adopted its **Report and Order** in Docket No. **18302**.<sup>1</sup> In the **1974 Order**, we found that AVM had the potential to accommodate a number of important functions, such as tracking and monitoring large fleets of vehicles and providing information to allow more **efficient** use of vehicles through better dispatch and routing information.<sup>2</sup> **We also noted that AVM systems had already been**

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<sup>1</sup> Report and Order, Docket No. **18302**, 30 RR **2d** 1665 (1974) (**1974 Order**).

<sup>2</sup> **Id.**

operating for several years on an experimental and developmental basis, allowing us to gain valuable information regarding advances in AVM **technology**.<sup>3</sup> While recognizing the technological progress made by **AVM**, we concluded that development of new vehicle monitoring technologies was also likely in the future, making it inadvisable to adopt permanent rules until more information was available regarding the viability of such new technologies. **Accordingly**, we decided to provide for the licensing of AVM systems on both a permanent and a developmental basis under "interim" rules.<sup>4</sup> These rules have remained in effect until now.

4. Our 1974 AVM rules provide for licensing of AVM systems in the 903-912 and **918-927** MHz bands, as well as in several bands below 512 MHz. While little licensing of AVM has **occurred** below 512 MHz, there has been significant AVM use of the 900 MHz bands in recent years. Existing AVM systems in these bands generally fall into one of two broad technological categories: multilateration systems and non-multilateration systems. Multilateration systems use spread-spectrum technology to locate vehicles (and other moving objects) with great accuracy throughout a wide geographic area. This technology is used, for example, by trucking companies to locate and track their vehicle fleets, by municipal governments to pinpoint the location of their buses,<sup>5</sup> and by entrepreneurs who are developing subscriber-based, stolen vehicle recovery **systems**.<sup>6</sup> Non-multilateration systems use narrowband technology to transmit data to and from vehicles passing through a particular location. This technology is now providing valuable services to state and local governments operating various types of automated toll collection systems -- with an estimated 500,000 cars currently served by such systems<sup>7</sup> -- and by the railroad industry in the monitoring of their

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<sup>3</sup> The Commission first licensed **AVM** on a developmental basis in **1968**. In 1972, the Commission sought additional information on the development of AVM since its **original inquiry** and proposed to adopt rules for **permanent** licensing. **See** Further Notice of Inquiry and Notice of Proposed Rule Making, Docket No. 18302, 35 FCC 2d 692 (1972).

<sup>4</sup> **1974 Report and Order** at para. 5.

<sup>5</sup> **See** Joe Dysart, *Bus 54, Where are You? Automatic Vehicle Locator System Used by Baltimore Mass Transit Administration*, Mass Transit (July 1991).

<sup>6</sup> **See** Teletrac petition at 614.

<sup>7</sup> Moshe Ben-Akiva *et al*, *The Case for Smart Highways; Intelligent Vehicle-Highway Systems*, Technology Review (July 1992) (noting that electronic toll collection devices have already been **implemented** in Dallas, Oklahoma and Louisiana); Terry Sweeney, *Wireless Net to Keep Traffic, Tolls Flowing*, Communications Week (Feb. 8, 1993) (describing plans for a California toll collection system, which is expected to reduce traffic, fuel costs and air pollution). Drivers simply purchase an electronically encoded tag that allows them to drive at a normal speed through the toll station. Electronic readers transmit a radio signal to passing cars, debit@ the tag or recording the identification of the tag for monthly billing. **Id.**; *For Whom the Card Tolls*, Electronics (July 25, 1994) at 9 (noting that 500,000 cars take advantage of automated toll systems).

systems' railway cars.<sup>8</sup>

5. It is expected that in the coming years both types of LMS systems will play an integral role in the development and implementation of the variety of radio advanced transportation-related services, known as "Intelligent Vehicle Highway Systems" (M-IS) or "Intelligent Transportation Systems" (ITS).<sup>9</sup> The ITS is a collection of advanced radio technologies that promise to improve the efficiency and safety of our nation's highways, reduce **harmful** automobile emissions, promote more efficient energy use, and increase national productivity.<sup>10</sup> For example, it is anticipated that ITS systems will increase traffic mobility and efficiency by notifying motorists of traffic delays and recommending alternate routes, adjusting the settings of traffic signals to prevent anticipated traffic jams, and providing navigational assistance to direct a car to its destination according to the most efficient route. ITS warning systems can also be used to notify drivers of impending collisions (or even take control of the vehicle to avoid a collision), and display electronic traffic and safety signals on a car's windshield when poor weather conditions impair drivers' vision of road-side signs. It is estimated that ITS will help reduce air pollution caused by automobiles and will cut wasteful fuel consumption. Traffic congestion, which costs the United States \$100 billion annually in lost productivity, will also be minimized by innovative ITS traffic management technologies. Finally, ITS is expected to create new economic and employment opportunities. Not all of these services, however, require or rely on the use of the 902-928 MHz band.

6. To recognize the expected growth of ITS, this **Report and Order** creates a new subpart in Part 90 for Transportation Infrastructure Radio Services (**TIRS**). The Location and Monitoring Service (**LMS**), which uses the **902-928** MHz band, constitutes the first service contained within the **TIRS** category. As we allocate additional spectrum or create new services intended to further the efficiency of the nation's transportation **infrastructure**,

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<sup>8</sup> See also, comments of **Amtech** Corporation (**Amtech**) at 3-5; Mark IV **IVHS** Division (Mark IV) at 1; and Hughes Aircraft Company (Hughes) at 4.

<sup>9</sup> The term "Intelligent Vehicle Highway System (**IVHS**)" refers to the collection of advanced radio technologies that, among other things, is intended to improve the efficiency and safety of our nation's highways. Recently, both government and industry entities have begun referring to these technologies by the term "Intelligent Transportation System (**ITS**)."

<sup>10</sup> See **Intermodal** Surface Transportation Efficiency Act of 1991, Pub. L. No. **102-240**, § **6052(b)**, **105 Stat. 1914, 2189** (1991) (**ISTEA**); H.R. Rep. No. **171(I)**, **102d Cong.**, 1st **Sess.** 11 (1991), *reprinted in* 1991 U.S. Code Cong. & Admin. News 1537; **IVHS** America, Strategic Plan for Intelligent Vehicle-Highway Systems **III-31-III-35** (May 1992) (**IVHS** Strategic Plan). **ISTEA** calls for the development of a national **IVHS** program employing advanced traffic management systems, advanced traveler information systems, advanced vehicle control systems, commercial vehicle operations and advanced public transportation systems. **ISTEA** at §§ 6053-58. Congress also imposed reporting requirements to monitor the progress made in developing and implementing the **IVHS** program. *Id.*

these new services will likely be regulated under the **TIRS**.<sup>11</sup> The **TIRS** will thus further Congress's goal of encouraging ITS by providing an organized and unified approach towards regulating spectrum for ITS-related services. Today's creation of the **TIRS** clearly demonstrates this agency's commitment to the continued integration of radio-based technologies into the nation's transportation infrastructure and our commitment to the development and implementation of the nation's intelligent transportation systems of the future.

7. AVM systems share their portion of the 902-928 MHz band with other **users**.<sup>12</sup> The band is allocated on a primary basis for use by Government radiolocation systems and Industrial, Scientific, and Medical (**ISM**) equipment, with Government fixed and mobile operations secondary to these users.<sup>13</sup> Amateur Radio Service licensees operate in the entire band, but on a secondary basis to the ISM, Government and **AVM** users. Part 15 uses are permitted in this band, but are secondary to all other uses, including **AVM** and amateur operations.

8. In 1989 and 1990, we also modified our rules to permit enhanced operation of spread spectrum-based radio devices throughout the **902-928** MHz band on an unlicensed basis, pursuant to Part 15 of our Rules.<sup>14</sup> Since modifying our rules to provide for enhanced Part 15 operations, a large number of equipment manufacturers and entrepreneurial companies have developed radio devices and implemented radio systems employing **spread-spectrum** technology in the 902-928 MHz band. It is estimated that several million Part 15 devices have been sold and are being used every day to provide a wide variety of valuable services to the American public. For example, consumers are now able to purchase cordless telephones operating in the band offering high quality voice **operations**,<sup>15</sup> wireless local area networks are being implemented in offices and buildings to enable tetherless voice and data

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<sup>11</sup> We recently adopted two proceedings that suggest potential spectrum allocations for **ITS-type** operations. In the Notice of Proposed Rule Making in ET Docket No. 94-32, we suggest the possible allocation of the 2390-2400 MHz or the 2300-2310 MHz bands for short range **ITS** services and in ET Docket No. 94-124, we suggest providing 3.2 GHz of spectrum (47.2 - 47.4 GHz, 76-77 GHz, 94.7-95.7 GHz, and 139 -140 GHz) for ITS-related automobile radar technologies.

<sup>12</sup> AVM services are allocated the 903-912 and 918-927 MHz portions of the **902-928** MHz band and are licensed on a shared basis.

<sup>13</sup> For additional information on Federal Government use in this band see Federal Government Spectrum Usage in the 902-928, 2400-2500, and 5725-5875 MHz Bands. This document is available from the National Technical Information Service, Springfield, VA, 22161, NTIS No. PB 93176739.

<sup>14</sup> See *Report and Order*, **Gen.** Docket No. 87-389, 4 FCC **Rcd** 3493 (1989) and *Report and Order*, **Gen.** Docket No. 89-354, 5 FCC **Rcd** 4125 (1990)).

<sup>15</sup> See Comments of the Consumer Electronics Group at 4.

transmission,<sup>16</sup> and utility companies are now able to read residential utility meters from the street or remote locations using Part 15 radio devices.<sup>17</sup> In addition to the enormous benefits to both businesses and consumers that will result from the continued growth in the use of the Part 15 industry, our nation's economy also benefits due to the continued development of **these** new, advanced radio technologies by American **companies**.<sup>18</sup>

9. On May 28, 1992, North American Teletrac and Location Technologies (Teletrac) filed a Petition for Rule Making requesting that we adopt permanent rules for licensing AVM systems.<sup>19</sup> On March 11, 1993, in response to Teletrac's petition, we adopted the **Notice of Proposed Rule Making (Notice)** in this proceeding to examine the future licensing and continued development of AVM systems.<sup>20</sup> In the **Notice**, we proposed to replace the existing interim rules for AVM with permanent rules. We also proposed to expand the technical parameters of the service to permit locating and monitoring of people and objects, as well as vehicles, and therefore proposed to rename the service as the Location and Monitoring Service (**LMS**). Additionally, we proposed to allocate the entire **902-928** MHz band for **LMS**, with separate allocations for multilateration LMS systems and **non-multilateration** LMS systems. We proposed that all LMS systems operate on a shared basis.

10. In response to our **Notice**, we received numerous comments and reply comments from LMS service providers, LMS licensees that use **LMS** systems to meet their own internal needs (such as railroad companies and local government entities), LMS users, manufacturers and users of Part 15 equipment, and Amateur operators. We solicited further comments and reply comments in response to **ex parte communications we received**.<sup>21</sup> Commenters offered a wide array of suggestions on the many complex issues raised in the **Notice**. Although we are adopting many of the proposals set forth in our **Notice**, the comprehensive record developed in this **proceeding** has led us to modify some of our proposals, especially as they concern the spectrum available for the different types of LMS systems, the licensing procedures for the band, and the general obligations of various users of the band.

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<sup>16</sup> **See e.g.,** Comments of **Cylink**.

<sup>17</sup> **See** Ex Parte Comments of **Cellnet** dated March 15, 1994, at 2.

<sup>18</sup> **See** Comments of Symbol Technologies at 34.

<sup>19</sup> RM-8013, filed May 28, 1992, and placed on Public Notice June 23, 1992, Report No. 1897. Teletrac's request was primarily **directed** at the tentative nature of "interim" rules as well as the exclusivity of AVM licenses.

<sup>20</sup> Notice of Proposed Rule Making, PR Docket No. **93-61**, **8 FCC Rcd.** 2502 (1993).

<sup>21</sup> **See** Public Notice, DA 94-129, PR Docket No. 9361, 59 Fed.Reg. 7239 (February 15, 1994).

11. Multilateration and non-multilateration **LMS** systems, amateur operations, and Part 15 devices will all play an important role in providing **valuable** services to the American public **in** the coming years. We believe that our decisions in this proceeding recognize this importance and **will** enable **all** of these services to make continued use of this spectrum. As detailed in our later discussion, commenters representing each of these services indicate the need for varying amounts of spectrum and varying degrees of interference protection from each other's operations in the band. We have therefore developed a spectrum plan that attempts to accommodate all of these users' requirements. The plan: 1) continues to permit secondary operations by unlicensed Part 15 and amateurs across the entire band, but affords users in these services a greater degree of protection to their operations; 2) enables **non-multilateration** LMS systems to operate on **spectrum** separate from multilateration systems; and 3) allocates spectrum on an exclusive basis for multilateration LMS licensees.

12. **In this Report and Order** we have therefore made the following decisions:

- Change the name of this service from the Automatic Vehicle Monitoring (**AVM**) to the Location and Monitoring Service (**LMS**) (see paragraph 1).

- Change the terminology used to refer to the two general categories of **LMS** technologies from "wideband" and "narrowband" to "multilateration" and "**non-multilateration**," respectively, (see paragraph 14).

- Permit multilateration LMS systems to locate any object -- animate or inanimate -- ancillary to their primary vehicular location and monitoring services (see paragraph 24).

- Permit LMS systems to transmit **and** receive status and instructional information, both non-voice and voice, related to the location and monitoring of a mobile unit and permit LMS systems to interconnect with the Public Switched Network (**PSN**) on a restricted basis (see paragraphs 26-27).

- Expand LMS license eligibility to all entities eligible to be licensed under Part 90 of our Rules and allow service in the **902-928** MHz band to be provided by LMS licensees to both individuals and the Federal Government on a commercial basis to paying subscribers. (see paragraph 28).

- **Clarify** what constitutes harmful interference to multilateration licensees by **unlicensed** Part 15 devices and amateur operations (see paragraphs 35-36).

- **Allocate an additional 8 MHz of spectrum in the 902-928 MHz band for LMS** use, permitting the entire band to be used for this purpose. Adopt a spectrum allocation scheme for the **902-928** MHz band that assigns separate sub-bands for multilateration and non-multilateration operations as follows (see paragraphs 46-49):

<u>Band (MHz)</u>	<u>System License</u>
<b>902.000 - 904.000</b>	Non-multilateration
<b>904.000 - 909.750</b>	Multilateration
<b>909.750 - 919.750</b>	Non-multilateration
<b>919.750 - 921.750</b>	Multilateration and Non-Multilateration
<b>921.750 - 927.250</b>	Multilateration
<b>927.250 - 928.000</b>	<b>Multilateration<sup>22</sup></b>

■ License exclusive multilateration LMS systems within each Major Trading Area (MTA)<sup>23</sup> and four additional MTA-like service area? in the three sub-bands designated above, and resolve mutually exclusive applications through competitive bidding (see paragraphs 50-57).

■ Grandfather base stations of multilateration system licensees authorized as of February 3, 1995 and constructed and in operation by April 1, 1996 (see paragraphs 61-64).

■ License non-multilateration systems on a shared basis in the three sub-bands designated above (see paragraphs 69-70).

■ Allow multilateration licensees to commence operations only after demonstrating interference with Part 15 operations is **minimized** (see paragraphs 81-82).

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<sup>22</sup> This **is** not considered a separate sub-band. Each licensee in the 904.000-909.75 MHz, 919.750-921.750 MHz and **921.750-927.250** MHz sub-bands will obtain a narrowband assignment at the top of the **902-928** MHz band for forward link operations, as follows: 927.250-927.500 MHz for the 921.750-927.250 MHz band; **927.500-927.750** MHz for the **919.750-921.750** band; and **927.750-928.000 MHz** for the 904-909.750 band.

<sup>23</sup> Rand McNally organizes the 50 states and the District of Columbia into 47 **MTAs**. See Rand-McNally Commercial Atlas and Marketing Guide, 3639, (123d ed. 1992). **PCIA** and Rand McNally have recently entered into an **agreement regarding** the use of Rand McNally's market area designations (i.e., Basic Trading Areas (**BTAs**) and Major Trading Areas (**MTAs**) for the licensing of various mobile radio services. LMS is not covered by this agreement. The listings of the Major Trading Areas, **including** the counties, **parishes and** census divisions that comprise each **MTA**, **are** available for public **inspection** in the Office of Engineering and Technology's Technical Information Center, 2nd **Floor**, **2000** M Street, N.W., **Washington**, D.C.

<sup>24</sup> The four additional regions are: (1) Guam and the Northern **Mariana** Islands; (2) the Commonwealth of Puerto Rico **and** the U.S. Virgin Islands; (3) **American** Samoa; and (4) Alaska will be treated as a single area **separate** from the Seattle MTA. This is consistent with our MTA-based service area definitions for **broadband** PCS (see 47 C.F.R. § 24.102) **and** for the Commercial Mobile Radio Services.



### III. DISCUSSION

#### A. Definitions

13. In the Notice, we characterized **LMS** systems as “wideband” and “**narrowband**.” A number of commenters, including Mark **IV**, Hughes, **Amtech**, and Pinpoint, suggest that **LMS** systems should be categorized as either “wide-area” or “local-area” rather than as “wideband” or “narrowband.”<sup>25</sup> These commenters state that because some “narrowband” systems require a bandwidth in excess of 2 MHz it would be inappropriate to categorize these systems as narrowband. Teletrac opposes such a change in terminology, claiming that it would be difficult to distinguish wide-area/local-area systems without reference to a specific coverage **standard**.<sup>26</sup>

14. While we agree that the **wideband/narrowband** terminology used in the Notice is imprecise and could be misleading, we believe that **characterizing** systems as “wide-area” or “local-area” could also lead to confusion because not all LMS systems have predetermined service contours. Therefore, to address commenters’ concerns, we shall refer to “wideband” pulse ranging systems as “multilateration” systems, and we shall refer to “narrowband” systems as “non-multilateration” systems. We define **multilateration** systems as systems that are designed to locate vehicles or other objects by **measuring** the difference of time of arrival, or difference in phase, of signals transmitted from a unit to a number of fixed points or **from** a number of fixed points to the unit to be located. We define non-multilateration systems as systems that employ any technology other than multilateration technology to transmit information to and from vehicles. Unlike a multilateration AVM system, which determines the location of a vehicle or object somewhere over a wide area, a typical **non-multilateration** AVM system uses an electronic device placed in a vehicle to transfer information to and/or from that vehicle. When the vehicle passes near one of the system’s stations, the station transmits an interrogating signal. The interrogating signal is then either modulated with **unit-specific** information and reflected back to the station’s receiver or the tag transmits its own signal in response to the interrogation. By dividing LMS into the broad multilateration and non-multilateration categories, we adopt a definitional framework that is flexible enough to accommodate all operational modes LMS is anticipated to evolve towards.

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<sup>25</sup> See Mark **IV** comments at n.2; Hughes **comments** at 6-7; **Amtech** comments at n.3; **Pinpoint** comments at n. 3.

<sup>26</sup> Teletrac reply comments at 31-33.

## B. Permanent LMS Operation in the 902-928 MHz Band

15. In addition to the current allocation within the 902-928 MHz band for AVM, this band is currently allocated for Industrial, **Scientific**, and Medical (ISM) equipment,<sup>27</sup> radiolocation, **fixed** and mobile by the Federal Government,<sup>28</sup> amateur **operations**,<sup>29</sup> and unlicensed operation of devices under Part 15 of the **Rules**.<sup>30</sup> In addition, we have initiated a proceeding exploring the possibility of making the middle portion of the 902-928 MHz band available for non-government wind profiler radar **systems**.<sup>31</sup> Because of the diversity of services that share this band, many commenters observe that changes in the rules that relate to one group of users could affect the other users of the band. A number of commenters **further** argue that it is premature to adopt permanent rules for LMS systems because many LMS system operators, Part 15 users, and amateur operators are implementing new **technologies**.<sup>32</sup> Other commenters urge us to take additional time to study the relative merits of the various services, devices, and technologies; still others argue that changes in the rules should be delayed to permit creation of a technical committee to study the sharing of the band among its various users.<sup>33</sup> Relatedly, the American Radio Relay League (ARRL) **filed** a petition for rule making, dated **January** 13, 1994, requesting a primary allocation of 902-904 and 912-918 MHz for the Amateur Radio **Service**.<sup>34</sup>

16. **Notwithstanding these concerns**, we believe **that delaying** implementation of permanent rules for LMS systems could jeopardize the continued development of this service. Although a number of companies have already developed **LMS** systems and are on the verge

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<sup>27</sup> **See** 47 C.F.R. § 18.305.

<sup>28</sup> **See** 47 C.F.R. § 2.106.

<sup>29</sup> **See** 47 C.F.R. § 97.301.

<sup>30</sup> **See** 47 C.F.R. §§ 15.243, 15.245, 15.247 **and** 15.249.

<sup>31</sup> **See** Notice of Proposed Rule **Making** and Notice of Inquiry, **Amendment** of section 2.106 of the Commission's Rules to Allocate Spectrum for Wind Profiler Radar Systems, **(NPRM/NOI)**, ET Docket 93-59, 8 FCC **Rcd** 2546 (1993).

<sup>32</sup> **See generally** comments of the Telecommunications **Industry** Association (**TIA**); the Part 15 Coalition (Coalition); Spectralink, the North American **Telecommunications** Association (**NATA**); the Domestic **Automation Company (DAC)**; **Itron**, Inc. (**Itron**); Symbol Technologies, Inc. (Symbol); Telxon Corporation (Telxon); Thomson Consumer Electronics (Thomson); **Norand** Corporation (Norand); and American Radio Relay League, Inc. (ARRL).

<sup>33</sup> Coalition comments at 12; **Interdigital** comments at 6-7; Spectralink comments at 5; **Uniplex** comments at 2; **and TIA** comments at 5.

<sup>34</sup> The Petition for Rule Making **filed** by the American Radio Relay League & cause it involves matters that are under consideration in this docket, was accepted as Comments in this **proceeding**.

of making services widely available, they argue that uncertainty about possible changes in our rules has deterred or prevented them from committing greater capital or obtaining **financing**.<sup>35</sup> In addition, LMS equipment manufacturers, state and local government entities, toll road operators, and Part 15 manufacturers and users require regulatory certainty. Further postponement of final decisions regarding our LMS rules would make it **difficult** for users of the band to plan the long-term development of their products or **services**.<sup>36</sup> Establishing permanent rules for LMS will also provide opportunities for new entrants into location and monitoring businesses. Accordingly, we find that it is in the public interest and consistent with Commission precedent to adopt permanent rules for location and monitoring services.

17. A number of other commenters argue that even if permanent rules are adopted, the Commission should find a permanent home for some or all LMS systems in another frequency band. For example, Lockheed, a manufacturer of narrowband LMS equipment, **argues that the 902-928 MHz band is an inappropriate place for LMS systems and proposes use of the 5.8 GHz band.** Saab requests an exclusive allocation in the 24502470 MHz band for an Electronic Toll and **Traffic Management (ETTM) Service** claiming that this is neither a narrow-band nor a wide-band LMS service.<sup>37</sup> The Part 15 Coalition also suggests that **LMS services be moved to the 2390-2400 MHz band that is part of the 50 MHz transferred to the FCC by NTIA.**<sup>38</sup> Other commenters suggest that we should restrict or eliminate multilateration LMS systems in the **902-928 MHz band** and instead promote alternative location technologies such as Global Positioning Satellite (GPS), **LORAN**, dead reckoning, or cellular **systems**.<sup>39</sup>

18. We conclude not only that the **902-928 MHz band** should continue to be made available for LMS services, but that the 8 MHz within the band not previously allocated to AVM should also now be available for LMS. Although prior AVM operation in the band has **occurred** under interim rules, we have always regarded the band as a permanent home for

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<sup>35</sup> **See**, for example, Ex **Parte** Comments of **MobileVision** dated August 12, 1994 at 2.

<sup>36</sup> Teletrac **comments** at 4; **MobileVision** reply comments at 3.

<sup>37</sup> SCG **comments** at 3-5; **Sensormatic** comments at 17-20; Part 15 Coalition comments at 13-15; **Saab-Scania Combitech** (Saab) comments at 11; and Lockheed comments at 4. **ETTM** systems do fall into the "non-multilateration" LMS category (**see para. 14 supra.**) and as such are adequately **accommodated** in our licensing plan.

<sup>38</sup> Comments of the Part 15 Coalition at 8-9; Further Comments of the Part 15 Coalition.

<sup>39</sup> AT&T comments; **TIA** comments at 24; and **NATA** comments at 11-13.

AVM.<sup>40</sup> The 903-912 and **918-927** MHz segments of this band are currently the only spectrum specifically allocated for AVM use and there exists no other low-cost, **consumer-oriented** spectrum where AVM service providers operate their systems without facing concerns similar to those present in this band. The **902-928** MHz band is ideally suited for location services due to the propagation characteristics of the band that permit widespread coverage of a market area without the use of an inordinate number of base stations. In addition, while some commenters argue that GPS or terrestrial-based communications systems with location capabilities are more spectrally efficient," we are not persuaded that LMS should be eliminated from the **902-928** MHz band on this basis. The alternative technologies put forward by commenters have disadvantages as well as advantages in comparison to LMS. For example, GPS and LORAN-based systems used in fleet tracking permit a vehicle to determine its location, but a separate communications link is required to transmit this information back to a dispatch location. Similarly, **Lojack, Inc. (Lojack)** manufactures a vehicle location system that operates on a single channel in the 170 MHz band, but this system requires use of **direction-finding** antennas to locate the vehicle. By contrast, multilateration LMS systems use larger amounts of spectrum, but can both receive "**fixes**" on large numbers of vehicles and transmit messages back to such vehicles from a central source -- all within one integrated system.

19. We further conclude that the public will be best served by expanding the current AVM allocation of 18 MHz to include an additional 8 MHz so that LMS will be permitted to use the entire **902-928** MHz band. This will allow development of diverse LMS services and technologies. LMS providers are already developing systems with differing capacities, and future designs may surpass the capacity of systems available today. In addition, we believe that developing a diversity of LMS services is important to promote competition and continued technological advances. Promoting alternative technologies will provide consumers choices of a variety of locating services, enabling them to address their individual communications needs. The demand and need for greater capacity, capability and alternatives will grow. Thus, providing additional spectrum for LMS systems within the **902-928 MHz** band allows for development of the full scope of location and monitoring techniques.<sup>42</sup>

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<sup>40</sup> In the Report and Order in Docket 18302, we stated that the interim nature of the rules was to allow continued development of AVM systems under a flexible licensing arrangement and to allow the rules to be fine tuned as additional **information** is gained regarding the operation of various types of AVM systems. Report and Order, Docket No. 18302, at **paras. 5 and 10, 30 RR 2d 1665** (1974).

<sup>41</sup> See Comments of the Portland Amateur Radio Club (PARC), Technology Radio Amateur Club (TRAC), the Part 15 Coalition, **Spectralink** Corporation (Spectralink), American Telephone and Telegraph Company (AT&T), and **NATA**.

<sup>42</sup> See Report and Order, Docket No. 18302 at **para. 10, 30 RR 2d 1665** (\$4).

### C. Eligibility and Permissible Uses

20. As discussed in the Notice, LMS systems have the potential to offer a wide array of services that go beyond the mere tracking of **vehicles**.<sup>43</sup> We therefore proposed to expand the permissible uses of LMS to include the location of all animate and inanimate **objects**.<sup>44</sup> In addition, we proposed expanding the types of entities eligible to acquire LMS service to include individuals and the Federal Government,” and we proposed to allow LMS service to be rendered on a for-profit basis.<sup>45</sup> We requested comment on whether these proposals to expand eligibility and permissible uses would create unacceptable congestion of the 902-928 MHz band.”

21. In response to the Notice, providers of multilateration LMS services contend that there are significant potential public benefits to expanding LMS beyond vehicle location **alone**.<sup>46</sup> Southwestern Bell Mobile Systems (SBMS) urges that the **definition** of **LMS** be further expanded to permit messaging and data **transmissions** to **fixed** units and units for which location and monitoring is not being **provided**.<sup>47</sup> Additionally, certain multilateration providers have requested that it be made clear that LMS will be permitted to provide interconnected service to the public switched network (**PSN**).<sup>48</sup> Other commenters, however, such as IVHS America and the United States Department of Transportation (DOT), argue that LMS should remain primarily a vehicle-oriented service, with an emphasis on **ITS**-related **communications**.<sup>49</sup> Part 15 manufacturers and users and amateur operators also **contend** that expansion of the possible uses of LMS will result in more intensive use of the band, thus leading to severe spectrum **congestion**.<sup>50</sup>

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<sup>43</sup> Notice 8 FCC **Rcd** 2502, 2503 (1993).

<sup>44</sup> Id. at para 9.

<sup>45</sup> Id. at para. 7.

<sup>46</sup> &at para. 8.

<sup>47</sup> Id.

<sup>48</sup> Teletrac comments at 9-10; **MobileVision** comments at 4143; SBMS comments at 3-7; and Location Services **comments** at 6.

<sup>49</sup> SBMS **comments** at 3-7.

<sup>50</sup> Ex Parte Comments of **MobileVision**, Teletrac and Uniplex dated December 12, 1994, at 2.

<sup>51</sup> M-IS America **comments** at 16; DOT reply **comments** at 15.

<sup>52</sup> See comments of **Sensormatic** Electronics (Sensormatic); TIA; the Part 15 Coalition; Interdigital Communications (**Interdigital**); Spectralink; **NATA**; DAC; **Itron**; **Symbol**; **Telxon**; Thomson; **Norand**; the Alarm Industry Communications Committee (Alarm Industry); ARRL; PARC;

22. Commenters **also** express diverse views on whether LMS licensees should be allowed to provide for-profit service. SBMS and Southern California Gas Company (SCG) support offering multilateration LMS as a subscriber-based private radio **service**.<sup>53</sup> **MobileVision** also supports permitting LMS licensees to provide services to paying subscribers, stating that such licensing "recognizes the massive capital cost incumbent in deploying the type of extensive **infrastructure** required for an LMS system of appropriate scope and scale to effectively **serve** a market."<sup>54</sup> On the other hand, the American Radio Relay League (ARRL) and the Part 15 Coalition oppose allowing multilateration LMS licensees to provide subscriber-based service."

23. We recognize the concerns of the Part 15 and amateur communities that the expansion of permissible uses of the LMS service will result in more intensive use of the 902 - 928 MHz band. Unfettered interconnection and messaging in the LMS could not only increase the potential for harmful interference to other users of the band, but detract from the intended purpose of the LMS allocation. Based on these concerns, we conclude that while a limited expansion of potential applications of LMS is **warranted**, operational restrictions should be imposed to **maintain** the coexistence of the many varied users of the band. We **find** therefore that it is appropriate to impose: 1) limitations on the provision of **non-vehicular** location services; 2) restrictions on messaging services and interconnection and; 3) a prohibition against message **and** data **transmissions** to **fixed** units and units for which location and monitoring is not being provided. We believe that these restrictions strike an equitable balance between the needs of LMS service providers and those of the Part 15 users and manufacturers and amateur operators, and additionally ensure that LMS systems are utilized primarily for location service and not as a general messaging or interconnected voice or data service. To ensure compliance with these restrictions, we may request, and licensees shall supply, whatever records or information necessary to demonstrate that these provisions are being followed.

24. Accordingly, we will allow non-vehicular location services to be rendered only by multilateration LMS systems whose **primary** operations involve the provision of vehicle location services. This limited expansion of permissible LMS uses recognizes the general capability of multilateration systems to cover a wide area and perform location determinations for any type of object within that area. We believe that non-multilateration systems, however, should continue to be used for vehicle monitoring only because the

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and **TRAC**.

<sup>53</sup> **See Comments** of SBMS dated June 29, 1993, at 4; and Comments of **SGC** dated June 29, 1993, at 2-3 ("private carrier" support, but outside of **902-928** MHz).

<sup>54</sup> **MobileVision** Comments dated **June** 29, 1993, at **40-41**.

<sup>55</sup> **See** Comments of ARRL dated June 29, 1993, at 11-12; and **Comments** of the Part 15 Coalition at 16.

spectrum they occupy has a heavier concentration of amateur radio operators, Part 15 devices and Federal Government radiolocation operations than other portions of the band. We are concerned that permitting non-multilateration systems to provide this additional service will cause more intensive use of the sub-band, to the detriment of these other users.

25. While we expand the potential applications of LMS as described above, we decline to allow LMS to be used for the type of messaging proposed by Southwestern Bell. We agree with numerous commenters who argue that creating such a broad messaging and data service would be an inappropriate use of this **spectrum**.<sup>56</sup> The LMS service is a mobile location and monitoring service. We do not intend to expand use of this band so that it becomes primarily a **fixed**, point-to-multipoint or point-to-point messaging service. Our rules make adequate provision elsewhere for this type of communications.” The 902-928 MHz band, however, is the only allocation for location services that provides **sufficient** spectrum to accommodate the types of advanced location and monitoring systems currently being implemented. Although there are other methods and spectrum available to determine the location of a unit, these other methods do not offer the same capabilities or potential as systems developed in the **902-928 MHz band**.<sup>58</sup>

26. We do not intend for this service to be used for general messaging purposes. Accordingly, we will require that all messaging be associated with the location or monitoring of the vehicle or unit. We will permit communications necessary to provide accurate, timely and complete status and instructional information relating to the vehicle being located or the occupant(s) of the vehicle, including voice communications. Thus, LMS systems will be permitted to transmit status and instructional messages, either voice or non-voice, so long as they are related to the location or monitoring functions of the system. We find that such use of **LMS** will be invaluable to the implementation of ITS of the **future**.<sup>59</sup>

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<sup>56</sup> **TIA comments** at 6; Interdigital comments at 3; Alarm Industry comments at 7; **Ademco** comments at 4; Consumer Electronics Group of the Electronic Industry Association (**EIA/CEG**) **comments** at 5; and Proxim, Inc. (Proxim) comments at 3. Uniplex notes that the NPRM requires that messages be related to the unit being located but urges that tighter restrictions be placed on messages, Uniplex comments at 3.

<sup>57</sup> See generally, Parts 21 and 94 of our Rules, 47 C.F.R. Part 21 and 94.

<sup>58</sup> See para. 18, supra.

<sup>59</sup> Both **IVHS** America and DOT **emphasized** the need for sufficient communications capacity to implement ITS services, including Advanced **Traffic** Management Systems, Advanced Traveler Information Systems, Advanced Vehicle Control Systems, Commercial Vehicle Operations, and Advanced Public Transportation Systems. See comments of **IVHS** America and DOT. See also Strategic Plan for Intelligent Vehicle Highway Systems in the United States, prepared by **IVHS** America. **Implementation** of such an array of ITS services will require substantial **communications** capacity and a combination of various technologies to provide **sufficient location and** traffic management information in many different circumstances.

27. In addition, we will permit limited **LMS interconnection**.<sup>60</sup> We will permit “store and forward” interconnection, where either (1) **transmissions** from a vehicle or object being monitored are stored by the **LMS** provider for later transmission over the PSN, or (2) **transmissions** received by the **LMS** provider from the PSN are stored for later transmission to the vehicle or object being monitored. We will not permit real-time interconnection between vehicles or objects being monitored and the PSN, except for emergency communications related to a vehicle or a passenger in a **vehicle**.<sup>61</sup> Additionally, the vehicle or object being monitored may only send or receive real-time interconnected communications to or from entities eligible in the Public Safety or Special Emergency Radio **Services**<sup>62</sup> or a system dispatch point. Finally, the requirement discussed above that all messages be associated with the location or monitoring of the vehicle continues to apply. We believe these limitations on interconnection will serve to impede the proliferation of interconnected voice and data communications by **LMS** systems while also providing them the flexibility to better serve the subscribers to the **service**.<sup>63</sup>

28. Finally, we **find** it in the public interest to allow LMS licensees to make service available to individuals and the Federal Government in addition to Part 90 eligibles. This step will effectively enable LMS operators to serve all members of the public, thus increasing the potential for the public to benefit from the expansion of ITS services. In addition, because many LMS systems will entail construction of extensive **infrastructure** over wide geographic areas, we also find it in the public interest to permit LMS to be offered to paying subscribers. By **permitting** LMS offerings to be **structured** as commercial **subscriber-based** service, we afford licensees a realistic means of underwriting system development.

#### D. Accommodation of **Secondary** Users in the **902-928** MHz Band

29. As **noted** above, there are **currently** five separate user groups sharing the **902-928** MHz band. In addition, the relative hierarchy among these users is well established. The **902-928** MHz band is allocated for primary use by the Federal Government for Radiolocation, Fixed and Mobile services and by users of **Industrial, Scientific, and Medical (ISM)** devices. Use of the **spectrum** by government fixed and mobile and AVM **systems** is secondary to both of these uses. The **remaining users of the 902-928 MHz band, licensed** amateur radio operators and users of Part 15 equipment, operate on a **secondary** basis to all

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<sup>60</sup> We note that Part 15 devices performing functions similar or identical to those of licensed **LMS operations are not restricted from interconnecting with the PSN**.

<sup>61</sup> **Emergency** communications may include information about a medical condition that **requires** immediate attention or the mechanical breakdown or **failure** of an automobile.

<sup>62</sup> **See 47 C.F.R. Part 90, Subparts B and C. This would also permit “911” interconnection** where this service is available.

<sup>63</sup> **See** Ex Parte Comments of **MobileVision** dated **December 14, 1994**, at **5-6**.



other uses, including **AVM**. In the Notice, we requested comment on whether LMS systems would be able to share the band with these other classes of users. The Notice also sought comment on whether a warning label should be **required** on LMS instruction manuals, operator manuals, and brochures to warn potential **LMS** users that **LMS** systems are secondary to Federal Government users and to ISM equipment? The Notice also requested comment on potential alternatives to LMS sharing with other user categories, "short of removing Part 15 users and amateur operations from the band, restricting where such users could operate in the band, or placing stricter limitations on the operation of such users in this band."<sup>65</sup>

30. The Federal Government and ISM users did not comment on sharing of the band, and LMS manufacturers and users generally did not express concern about continued sharing of the spectrum with either the Federal Government or ISM equipment. The American Radio Relay League (ARRL), however, **requests** that we provide a primary allocation in a portion of the **902-928 MHz** band for amateur **operations**.<sup>66</sup> The Interagency Group requests that LMS systems providing electronic toll **and** traffic management (**ETTM**) services be given co-primary status with Federal Government and ISM users, claiming that this is required to "instill confidence" in **ETTM** users that their long-term use of this band is **assured**.<sup>67</sup> We do not believe that these considerations warrant disturbing the primary status of Federal Government and ISM operations in relation to other uses of the band. Therefore, under the rules adopted today, LMS licensees **will** continue to operate on a secondary basis to Federal Government users and ISM equipment. Further, we **conclude** that no primary allocation for amateur operations in the requested sub-bands is **warranted**. Although the ARRL states that there has been "rapid increases in amateur **use**",<sup>68</sup> that "the **Amateur** Radio Service is increasingly looking to the **902-928 MHz band**,"<sup>69</sup> and that "amateur use of the band has been growing",<sup>70</sup> the only quantitative support that it provides is that there are 16 known manufacturers of amateur equipment for this band and that there are 20 amateur stations in

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<sup>64</sup> Notice at **para. 24**, 8 FCC **Rcd. 2502, 2506** (1993).

<sup>65</sup> 8 FCC **Rcd 2502, 2506-2507** (1993), as revised by Erratum, 8 FCC **Rcd 3233** (1993).

<sup>66</sup> See footnote 34, supra. The ARRL requests a primary allocation in the 902-904 MHz and 912-918 MHz bands. Also, by letter to **Chairman**, Reed E. **Hundt**, dated October 4, 1994, ARRL asks that the Commission not extend any substantive accommodation for Part 15 entities that is not extended as well to the Amateur service.

<sup>67</sup> Interagency Group **comments** at 11-12.

<sup>68</sup> ARRL **Petition for Rule Making** at 3.

<sup>69</sup> ARRL **Petition for Rule Making** at 10.

<sup>70</sup> ARRL **Petition for Rule Making** at 9.

Rochester, New York using the band.” There are, on the other hand, a large number of various uses of this band with quantitatively **known** combined (and competing) requirements. They include the existence of more than 4 million Part 15 devices and 500,000 **non-multilateration** LMS tag readers. **ARRL’s** petition thus fails to adequately justify a change in the allocation status for the Amateur Radio Service in any portion of this band.

31. In the Notice, we proposed that a warning label be required on all LMS instruction manuals, operator manuals, and brochures to warn potential LMS users that **LMS** systems are secondary to Government radiolocation and to ISM equipment and that, as a result, such systems may suffer from “undesired operation.” Notice at **para. 24**, 8 FCC **Rcd.** 2502, 2506 (1993). We have decided not to require such a warning label. Many wireless telecommunications systems operate on spectrum that is also allocated for other uses and are susceptible to varying degrees of interference. We generally do not place warning labels on these systems. To do so in this instance might unfairly label **LMS** as an inferior service to other similarly-situated services, quite possibly deterring growth of the service and reducing the likelihood of prompt public benefit from its use. Moreover, LMS providers have an inherent incentive to **minimize** the deleterious effects of interference to provide reliable service and to attract and retain a loyal customer base. We do warn **LMS** licensees and users, however, that many LMS systems in the 902-928 MHz band will be sharing the band with one another, and operating on a secondary basis to Federal Government users and ISM equipment. Systems operating in such an environment are always subject to the possibility of interference, and must comply with our criteria for co-channel sharing where applicable.

32. The relationship between LMS, especially multilateration systems, and Part 15 uses of the **902-928** MHz band presents more complex issues, as the comments indicate. There are millions of Part 15 devices in operation throughout the United States today and this number is expected to increase in the future. Because Part 15 devices operate at extremely low power and each has a limited area of operation, the record indicates that they can coexist more easily with non-multilateration LMS systems, which also operate with relatively short **range**.<sup>72</sup> Conversely, Part 15 commenters generally contend that they will not be able to effectively share the spectrum with multilateration LMS systems.” These commenters believe that Part 15 devices and **multilateration** LMS cannot coexist in the same band because the high power multilateration **transmissions** will overpower and desensitize their low power,

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<sup>71</sup> ARRL Petition for Rule Making at note 18.

<sup>72</sup> Ex Parte **Comments** of **Amtech** dated **March 29, 1994**, at 8-9.

<sup>73</sup> See Ex Parte Comments of Ademw dated March 15, 1994 at 5-11; Ex Parte Comments of Part 15 Coalition dated August 12, 1994 at 3; Ex Parte Comments of the Ad Hoc Gas Distribution Utilities Coalition dated August 12, 1994 at 7; Ex Par&e Comments of **Itron** dated August 12, 1994 at 1.

unlicensed operations.” Additionally, Part 15 commenters believe that with **unrestricted** use of high power services, the noise floor will increase throughout the band. They claim that this increase of noise in the band, without a limitation in the power and location of the multilateration **transmissions**, would make their sensitive receivers -- which must accurately detect low-power signals -- obsolete and unusable anywhere in the 902-928 MHz **band**.<sup>75</sup> Multilateration **LMS** commenters argue that operation of some Part 15 devices is likely to cause harmful interference to LMS systems. Examples of potential interference sources identified by multilateration operators include anti-shoplifting field disturbance sensors that operate under Section 15.245 of the rules and certain video links that operate under Section 15.249 of the **rules**.<sup>76</sup> Multilateration parties also contend that harmful interference is likely to be caused by Part 15 devices that either transmit continuous signals or transmit from antennas placed at relatively high out-of-doors elevations. On the other hand, multilateration proponents do not believe that interference is likely to be received from any other type of Part 15 operations?

33. Commenters have suggested a number of solutions to mitigate potential harmful interference, including 1) limiting the permissible uses for the LMS service, 2) moving the LMS service to another band, 3) elevating Part 15 devices to w-equal status with LMS systems, 4) retaining existing rules until a joint technical committee can be established to study the feasibility of sharing, and 5) giving amateur operators primary status in a part of the **band**.<sup>78</sup> In ex parte comments **filed** in mid-August 1994, some LMS commenters discussed additional alternatives for continuing to allow Part 15 operations in the 902-928 MHz **band while seeking to minimize** possible interference to **LMS** operations. These commenters focused on establishing thresholds that would determine whether Part 15 devices were causing harmful interference to **LMS** systems, based on criteria such as field strength limits, height of outdoor antennas used by Part 15 devices, the directional gain of antennas associated with Part 15 devices, and the **existence** of field disturbance sensors operating under Section 15.245 of our rules.<sup>79</sup> Part 15 commenters, however, had little, if any,

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<sup>74</sup> See Ex Parte Comments of the Part 15 Coalition dated August 12, 1994, at 4.

<sup>75</sup> See e.g., Ex Parte Comments of **Cellnet & KNOGO** dated **August 19, 1994**, at 3.

<sup>76</sup> Letter from **AirTouch** Teletrac, Pinpoint Communications, **Inc.**, Uniplex and **MobileVision**, L.P., to Ralph A. **Haller, Chief**, Private Radio Bureau, dated June 23, 1994.

<sup>77</sup> See ex parte comments of Teletrac, **MobileVision**, Pinpoint and Uniplex, dated June 23, 1994 at 5.

<sup>78</sup> See Ex Parte Comments of **Metricom** and Southern California Edison Company dated August 12, 1994 at 4; Ex Parte Comments of Symbol Technologies at 34; Ex Parte Comments of Part 15 Coalition dated August 12, 1994 at 6-7; Petition for Rule **Making** filed by the American Radio Relay League (ARRL) on January **13, 1994** at 1.

<sup>79</sup> See Further Comments of **AirTouch** Teletrac, **MobileVision** and SBMS dated August 12, 1994.

support for these types of interference threshold **criteria**.<sup>80</sup>

34. We recognize the important contribution to the public that both Part 15 technologies and amateur operators provide in the **902-928** MHz frequency band. For example, Part 15 devices currently operating in the 902-928 MHz band provide **valuable** services such as automated meter reading, inventory control, package tracking and shipping control, alarm services, local area networks, and cordless telephones. These devices allow businesses to operate more effectively and efficiently, without the regulatory complexities of many licensed services. The amateur service is used by technically inclined private citizens world-wide to engage in self-training, information exchange, and radio experimentation. It is at the forefront of communications technology and has been instrumental in the development of land mobile systems, hand held radios, and satellite communications. In times of disaster when normal communications are disrupted, amateur systems often alert the world to the disaster and provide assistance in relief operations. By the actions in this proceeding we seek to **maximize** the ability of Part 15 and amateur operations to coexist with the operation of **LMS** systems.

35. We also conclude that effective sharing of this band between amateur and Part 15 users and multilateration **LMS** systems does not require a change in the relative status between these two allocations and uses, as some parties have suggested. Rather, we have decided to balance the equities and value of each use without undermining the established relationship between unlicensed operations and licensed services. Thus, we affirm that unlicensed Part 15 devices in the **902-928** MHz band, as in any other band, may not cause **harmful** interference to and must accept interference from all other operations in the **band**;<sup>81</sup> persons operating unlicensed Part 15 devices have no vested or recognizable right to continued use of any given frequency;” and finally, an operator of an unlicensed Part 15 device is **required** to cease operations upon notification by a Commission representative that the device is causing harmful interference and may not resume operations until the condition causing the harmful interference has been **corrected**.<sup>83</sup> Furthermore, the amateur radio service will retain its status as a licensed, secondary service.

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<sup>80</sup> **See Ex Parte Comments** of ADEMCO, Axxon Corp., C&K Systems, Gas Utilities, **ITRON**, **Metricom & Southern** Cal Edison, **NavGuard/Summit** Telewm, Sensormatic, Symbol Technologies, Tatung Telewm, Teatherless Access, TIA, Uniplex Corp., **Utilicom**, UTC, **WINFORUM** and WISE Communications, August 1994.

<sup>81</sup> 47 C.F.R. § 15.5(b).

<sup>82</sup> 47 C.F.R. § 15.5(a).

<sup>83</sup> 47 C.F.R. § 15.5(c).

36. Amateur **and Part** 15 operations will continue to be secondary to services with a higher allocation status. They may continue to operate as their licenses and/or the rules permit. To accommodate their concerns about their secondary status in light of multilateration LMS, however, we are adopting rules that define and clarify what constitutes harmful interference from their secondary operations. **Harmful** interference is **defined** as **"(a)ny** emission, radiation or induction that endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with this chapter."<sup>84</sup> To promote cooperative use of the 902-928 **MHz** band we are elaborating on this standard to define what is not harmful interference **from** both amateur operations and **unlicensed** Part 15 devices to multilateration LMS systems. This "negative definition" will promote effective use of the 902-928 MHz band by the various services by clearly establishing the parameters under which licensed Amateurs and unlicensed users of Part 15 devices may operate without risk of being considered sources of harmful interference to services with a higher allocation status. Part 15 and amateur operators who voluntarily operate within the following parameters will not be subject to harmful interference complaints from multilateration **LMS** systems at 902-928 MHz. Thus, we are adopting rules that provide that a Part 15 device will **not** be deemed to be causing interference to a multilateration LMS system if it is otherwise operating in accordance with the provisions of 47 C.F.R. Part 15 and it meets at least one of the following conditions:

- (a) it is a Part 15 field disturbance sensor operating under Section 15.245 of the rules and it is not operating in the 904909.750 or **919.750-928.000 MHz sub-bands**;<sup>85</sup> or
- (b) it does not employ an outdoor antenna; or
- (c) if it does employ an outdoor antenna, then if
  - (1) the directional gain of the antenna does not exceed 6 **dBi**, or if the directional gain of the antenna exceeds 6 **dBi**, it reduces its transmitter output power below 1 watt by the proportional amount that the directional gain of the **antenna** exceeds 6 **dBi**;<sup>86</sup> and
  - (2) either

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<sup>84</sup> 47 C.F.R. § 15.3(m). See also 47 C.F.R. § 2.1.

<sup>85</sup> SBMS and **MobileVision** stated they supported this field disturbance sensor limitation as an interference determinant. See Ex Parte Comments of SBMS dated August 12, 1994, and **Ex Parte** Comments of **MobileVision** dated August 12, 1994. Multilateration entities **concur** that the majority of interference complaints from Part 15 devices **concern** field disturbance sensors and long **range** video links. See the LMS Consensus Position on Part 15 Interference dated June 22, 1994; see also the Ex Parte Letter from **Teletrac** to the Chief, **Private** Radio Bureau, dated June 21, 1994.

<sup>86</sup> See 47 C.F.R. Section 15.247.

- (A) the antenna is 5 meters or less in height above ground; or
- (B) the antenna is more than 5 meters in height above ground but less than or equal to 15 meters in height above ground and either:
  - (i) adjusts its transmitter output power below 1 watt by  $20 \log(h/5)$  dB, where h is the height above ground of the antenna in meters; or
  - (ii) is providing the **final** link for communications of entities eligible under Subparts B or C of Part 90 of the rules.

Amateur operations in this band meeting these same parameters concerning antenna location, gain, and height as well as transmitter output power will also not be considered as sources of **harmful** interference. Conversely, Part 15 and Amateur operations not meeting these parameters **and** seriously degrading, obstructing or repeatedly interrupting the operation of a multilateration system, will be deemed to be causing harmful interference and, thus, upon Commission notification, be required to cease operations until the condition causing the interference has been corrected. We emphasize, however, that Part 15 or Amateur use is not restricted from operating beyond these parameters. Part 15 and Amateur operations can continue to operate as long as interference is not caused and are limited only by the technical parameters contained in the rules applicable to their **respective** services.

37. We agree with SBMS that the appropriate threshold for determining that Part 15 devices are presumptively **not** causing harmful interference to multilateration LMS systems is whether they are operating above 1 watt, because 1 watt "is approximately the level at which some **current** LMS devices transmit, and is well above most cordless phones and other personal Part 15 **devices**."<sup>87</sup> Under our rules, the transmitter output power of a Part 15 device is not permitted to be more than 1 watt. An antenna less than 5 meters in height driven by a transmitter with 1 watt or less of output power will only affect LMS operations that are relatively close. A higher antenna, however, has the capability to affect a larger number of LMS operations. This is why, between 5 **and** 15 meters, we adopt the stated formula to adjust the Part 15 transmitter output power. This assures that between 5 and 15 meters an outdoor antenna has the equivalent effect on multilateration LMS operations of a **5-meter** antenna using no more than 1 watt transmitter output power. (We have not applied this sliding power reduction scale to devices directly serves public safety and special emergency eligibles so as to **minimize** the effect on communications involving the safety of life or property.) Height and transmitter power alone, however, are not the only components of a transmitted signal. The directional gain of the antenna also affects the radiated power, and thus the signal strength at the affected receiver. **"If a 6 dBi antenna is used, pointing in the direction of the LMS site, then the received signal level, at the LMS site, will be 6 dB higher than if a 0 dBi antenna were used."**<sup>88</sup> We conclude, therefore, that use of a Part 15 outdoor antenna with a directional gain of equal to or less than 6 **dBi**, or a Part 15 outdoor

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<sup>87</sup> Ex Parte Comments of SBMS dated August 12, 1994.

<sup>88</sup> Ex Parte Comments of **MobileVision** dated August 12, 1994, at **Annex 1**, page 4.

antenna with a **directional gain** of greater than 6 **dBi** having a proportional transmitter output power reduction, constitutes an appropriate threshold at which there is little likelihood of desensitization of the receiver(s) at an LMS site. Finally, because multilateration entities concur that most Part 15 interference to multilateration LMS systems is likely to be from field disturbance sensors and long range video **links**,<sup>89</sup> we will not make any presumption of interference-free operations for these devices when they operate in exclusive-use bands.

38. In view of the technical diversity of the many LMS systems in existence and the multiplicity of Part 15 devices that will eventually be placed in operation, we conclude that the above **standards** will not provide solutions to all interference problems, and this agency may not be able to resolve all interference problems that may arise between unlicensed Part 15 and LMS systems. As such, multilateration LMS systems that experience interference from an amateur or Part 15 transmission may face two different scenarios. Under the first scenario, where the interference is from an amateur or Part 15 system operating within the parameters set forth in paragraph 36, the interference is not considered to be harmful. The multilateration LMS system experiencing the interference has no recourse by way of complaint to the Commission. It may only attempt to resolve the interference by modifying its own system or by obtaining the voluntary cooperation of the amateur operator or Part 15 user. Under the second scenario, where the interference is from an amateur or Part 15 **transmission** that does not fall within the parameters set forth in paragraph 36, the multilateration LMS system experiencing the interference may have recourse by way of complaint to the Commission if voluntary measures fail to resolve an interference **problem**.<sup>90</sup> To assure that our limited resources are used efficiently and effectively, the complaint must identify the exact source of the **interference**. A Part 15 user that is causing harmful interference may resolve such a complaint by **voluntarily** adhering to the parameters stated above. Alternatively, the Part 15 user causing harmful interference may choose other courses of action, including: (1) reducing power sufficiently to avoid causing harmful interference; (2) lowering antenna height sufficiently to avoid causing harmful interference; (3) changing antenna directionalization to avoid causing harmful interference; (4) any combination of 1-3; (5) reaching an accord with the complaining LMS system; or (6) terminating operations. We do not envision readily solving all interference problems because of the technical diversity of the many LMS systems in existence and the multiplicity of Part 15 devices in operation, but believe that the vast majority of equipment and services can operate successfully in this band.

39. We believe that the **procedures** described above afford the best opportunities for amateur, Part 15 and multilateration LMS operations to coexist in the 902-928 MHz frequency band.. Manufacturers of Part 15 devices whose equipment may cause harmful interference to multilateration systems may choose to restrict the operating frequency of their

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<sup>89</sup> **See** the LMS Consensus Position on Part 15 Interference dated June 22, 1994; **see also** the Ex Parte Letter from **Teletrac** to the Chief, Private Radio Bureau, dated June 21, 1994.

<sup>90</sup> See footnote 210 for a discussion of the nature of harmful interference to an LMS system.

devices to the **902-904** and **909.750-919.750 MHz** sub-bands that will not be occupied by multilateration systems. Additionally, the 24002483.5 MHz band may prove to be useful to Part 15 operations that may not be accommodated successfully in the 902-928 MHz band (see discussions of the 2402-2417 MHz band in the Notice of Proposed Rulemaking in ET Docket 94-32).

#### E. Spectrum Allocation Plan

40. Currently, LMS systems can be licensed on a permanent basis at 904-912 and 918-926 **MHz** and on a developmental basis at **903-904** and **926-927 MHz**.<sup>91</sup> In the Notice, we proposed that LMS systems be licensed on a permanent basis throughout the **902-928 MHz** band, and that the band be divided into five sub-bands: **902-904**, 904-912, 912-918, 918-926, 926-928 **MHz**.<sup>92</sup> We further proposed that multilateration systems be licensed in the 904-912 and 918-926 **MHz** sub-bands and that non-multilateration systems be licensed in the **902-904**, 912-918, and 926-928 MHz **sub-bands**.<sup>93</sup>

41. Most entities providing or developing **LMS** systems support licensing LMS systems throughout the **902-928 MHz band**.<sup>94</sup> Part 15 and amateur operators **uniformly** oppose our proposal to expand LMS use to all of the **902-928 MHz** band. The Part 15 Coalition originally proposed that LMS systems be **restricted** to the existing two 8 megahertz bands and that each multilateration system be authorized for only 4 **MHz** each. Other commenters, such as **NATA**, DAC, and the Alarm Industry, propose that the total amount of spectrum for all LMS **services** be reduced to 8 **MHz**.<sup>95</sup> AT&T proposes that **LMS** systems be licensed only in the two 8 megahertz sub-bands **currently** allocated for LMS and that the rules be changed to eliminate multilateration systems, permitting only non-multilateration systems in the bands.”

42. Teletrac, **MobileVision**, Location **Services**, and SBMS support our proposal to

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<sup>91</sup> See Section 90.239 of the Rules, 47 C.F.R. § 90.239.

<sup>92</sup> Notice at para. 15, 8 FCC Rcd 2504 (1993).

<sup>93</sup> Id.

<sup>94</sup> See **Teletrac comments** at 20; **MobileVision comments** at 29-32; Mark IV comments at 6; **Location Services comments** at 4-5; **AT/comm** comments; Hughes **comments** at 6-7; **Amtech** comments at 2; Pinpoint comments at 2-3; and SBMS comments at 10.

<sup>95</sup> **NATA** comments at 12; DAC **comments** at 14; Alarm Industry **comments** at 9.

<sup>96</sup> Comments of AT&T.



create separate sub-bands for multilateration and non-multilateration systems.<sup>97</sup> Amtech and Pinpoint advocate shared use of the entire 902-928 MHz band by both multilateration and non-multilateration systems to **maximize** the capacity of multilateration systems and provide sufficient spectrum for non-multilateration systems **requiring** larger amounts of **spectrum**.<sup>98</sup> Texas Instruments/MFS proposes that multilateration systems be allocated only one 8 megahertz sub-band and that the rest of the band be available for non-multilateration use.<sup>99</sup> IVHS America and the DOT support our proposed division of the band, but would also permit multilateration and non-multilateration systems to have immediate access to each other's spectrum on a secondary basis and, after six years, would allow any unlicensed spectrum to be available for primary use by either multilateration or non-multilateration systems.<sup>100</sup> Mark IV and the Interagency Group would permit only electronic toll and traffic management (ETTM) systems to have access on an equal basis with multilateration systems on the proposed multilateration spectrum.<sup>101</sup> Several commenters have submitted studies to **illustrate** the difficulties that multilateration and non-multilateration systems would have in sharing the same **spectrum**.<sup>102</sup> Only two commenters, Amtech and Pinpoint, claim that such sharing is feasible and present a detailed sharing plan.<sup>103</sup>

43. In addition to requesting comment on the appropriate use of spectrum in the 902-928 MHz band for multilateration and non-multilateration LMS systems, we also **made** proposals and solicited comment on how multilateration systems, in particular, should be licensed. Specifically, we proposed that multilateration systems be licensed on a shared basis in the 904-912 and 918-926 MHz bands and that licensees be responsible for coordinating

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<sup>97</sup> See Teletrac wmmments at 20; MobileVision wmmments at 29; Location Services **comments** at 5; and SBMS **comments** at 10 [SBMS supports further dividing the sub-bands proposed for use by multilateration systems].

<sup>98</sup> Pinpoint **comments** at 9; Amtech **comments** at 7-14. Amtech, in its August 12, 1994 **comments**, indicates that ". . . at a minimum, the rules should accommodate the use of two 6 MHz channels for read-write **tages**." **Comments** at 2.

<sup>99</sup> Texas Instruments Incorporated/MFS Network Technologies, Inc. (TI/MFS) wmmments at 11-13.

<sup>100</sup> IVHS America wmmments at 20; DOT reply wmmments at 16-17.

<sup>101</sup> See Interagency group **comments** at 11-12; and Mark IV reply **comments** at 6-8.

<sup>102</sup> Teletrac **comments** at Appendix 2; MobileVision reply **comments** at appendix 3.

<sup>103</sup> See Amtech wmmments at 17-35; and Pinpoint wmmments at 9-39. Although Mark IV supports permitting co-equal access to **spectrum** for multilateration and at least ETTM non-multilateration systems, it does not provide a detailed sharing plan and does not evaluate the effects that non-multilateration systems would have on multilateration systems.

among themselves to avoid interference.<sup>104</sup> We also offered an alternative that systems be licensed on an exclusive basis for five years, after which licensing would be on a shared basis with any new licensees required to protect **incumbents**.<sup>105</sup>

44. Several multilateration parties oppose our proposal to license these systems on a shared basis, claiming that it is not technically or economically feasible to share spectrum on a co-equal basis with other multilateration **licensees**.<sup>106</sup> Two commenters that are developing multilateration systems, Pinpoint and Uniplex, support shared licensing, albeit on a limited basis? SBMS, while opposing shared use of spectrum for multilateration systems, would divide the two 8-megahertz bands into four 4-megahertz bands licensed on an exclusive **basis**.<sup>108</sup> The commenters agree that sharing of **spectrum** among multilateration licensees would require the use of an interference avoidance measure, such as time **sharing**.<sup>109</sup> Time sharing would reduce system capacity since it requires the use of guard bands and other additional system overhead that represent additional uses of capacity that do not contribute to the content of the message.<sup>110</sup> With each addition of a new multilateration system, the quality of service provided by incumbent **operators** would **diminish** due to **increases in system** delays and time **required** for a subscriber to access the **system**.<sup>111</sup> In a shared environment, the multilateration interference tolerance threshold would be more likely to be violated, causing the time of arrival to be distorted for the return signal and therefore, not accurately providing location services.<sup>112</sup> Finally, if there is more than one multilateration system using the same **frequency** band, it would be extremely **difficult** to have adequate power control

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<sup>104</sup> Notice at **para.** 65, 8 FCC **Rcd** 2502, 2506 (1993).

<sup>105</sup> Id.

<sup>106</sup> Comments of Teletrac at 24-39; Comments of **MobileVision** at 33-36; Comments of Southwestern Bell Mobile Systems (SBMS) at 12-14; and Comments of Location Services at 4. We hereby grant **SBMS's** Motion to Accept Supplement to Reply Comments because it serves the public interest and best ensures the proper dispatch of Commission business to develop a full and **complete** record in this **proceeding**. See 47 U.S.C. § 154(j).

<sup>107</sup> See Comments of Pinpoint at **9-20**; Ex Parte Comments of **Pinpoint** dated August 3, 1994; Ex Parte Comments of Uniplex dated September **30, 1994** (supporting Pinpoint's August 3, 1994 position).

<sup>108</sup> SBMS **comments** at **12-14**.

<sup>109</sup> See Pinpoint **comments** at 17.

<sup>110</sup> See Ex **Parte Comments** of SBMS dated March 29, 1994, at 16-17.

<sup>111</sup> See Ex **Parte Comments** of Teletrac dated **March 15, 1994**, at **2**, Ex **Parte Comments** of SBMS dated **March 29, 1994**, at 16-17.

<sup>112</sup> See Comments of **MobileVision** at 33-4, Reply Comments of Mobile&ion at 12-13.

among users from disparate systems. Without adequate power control, overall system capacity would suffer.<sup>113</sup> Sharing could also require the establishment of **standards** to which all of the systems would have to conform. With different technologies employed by the various systems being proposed, we are not in a position, nor are we inclined, to set such **standards**. For these reasons, we conclude that sharing in the multilateration segment of this service is neither practical nor desirable from either a technical or regulatory standpoint.

45. Some commenters also provided economic analyses of the impact of sharing on competition in the multilateration LMS market over the **long-term**.<sup>114</sup> Teletrac opposed sharing, pointing to various substantial **fixed** costs and technical difficulties to argue that a market with open entry to shared spectrum would not necessarily sustain more than two **firms**. Teletrac suggested that the close coordination among licensees needed to make sharing spectrum successful could inhibit vigorous competition. Teletrac also argued that exclusive licensing would not allow licensees to exercise market power because of the availability of alternative location services. SBMS, on the other hand, argues that sharing may be economically beneficial because it would encourage competition and technical innovation. SBMS also expressed concern that exclusive spectrum assignments would make the multilateration LMS market a natural monopoly.

46. We believe that both multilateration and non-multilateration systems will play an important role in achieving a nationwide ITS **infrastructure and** that a sufficient amount of spectrum must be available to enable both types of systems to **develop**.<sup>115</sup> We also agree with commenters that to enable both multilateration and **non-multilateration** systems to develop **effectively**, we should create separate allocations for the two types of systems to the extent possible.<sup>116</sup> Further, we believe that, for the most part, non-multilateration systems can share **spectrum** with one another if they are separated from multilateration operations (see paragraph 66, infra). separated, as discussed earlier, we believe that there are technical, operational and economic justifications supporting our decision to provide exclusive spectrum for exclusive assignments for multilateration systems.

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<sup>113</sup> See Ex Parte Comments of SBMS dated October 19, 1994, Final Report of the Mobile and Portable Radio Research Group at 35.

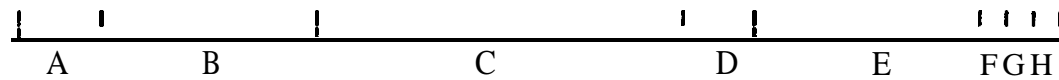
<sup>114</sup> See Comments of North American Teletrac and Location Technologies, Inc. (Teletrac), Reply comments of Mob&vision, L.P., Pinpoint Communications, Inc., and supplemental reply comments of SBMS.

<sup>115</sup> IVHS America comments at 13-15; DOT reply comments at 12-15.

<sup>116</sup> MFS/TI, in its August 12, 1994 comments suggests that multilateration use, "... even on a **secondary** basis [to non-multilateration use] would prove to be unworkable in day-today operations" and could "... present an untenable situation for non-multilateration systems with **primary** use over the band." Comments at 8 and 9.

47. Accordingly, **we** adopt a spectrum plan that: 1) allocates the entire **902-928** MHz frequency band for LMS systems, generally separating multilateration and **non-multilateration** operations; 2) allocates spectrum for non-multilateration systems licensed on a shared basis; and 3) allocates spectrum that may be authorized exclusively to a single multilateration licensee.

**Spectrum Plan for the 902-928 MHz Band**



A:	<b>902.000 - 904.000</b>	Non-Multilateration
B:	<b>904.000 - 909.750</b>	Multilateration
c:	909.750 - 919.750	Non-Multilateration
D:	919.750 - 921.750	Multilateration and Non-Multilateration
E:	921.750 - 927.250	Multilateration
F:	927.250 - 927.500	Narrow band associated with sub-band E
G:	927.500 - 927.750	Narrow band associated with sub-band D
H:	927.750 - 928.000	Narrow band associated with sub-band B

48. Bands B, D and E will be assigned on an exclusive basis to multilateration systems. Bands A, C and D will be licensed on a shared basis to non-multilateration systems. **Licensees of Bands B, D and E will be assigned narrow bands H, G and F, respectively.** We believe this allocation scheme will significantly increase the diversity of use in the entire **902-928** MHz band, as described below, in furtherance of the public interest. Specifically, the plan provides opportunities for implementation and operation of multiple multilateration technologies and service providers through the allocation of three blocks of spectrum (Bands B and H; E and F; and D and **G**).<sup>117</sup> The comments indicate that some multilateration systems can operate in roughly 2 **MHz**,<sup>118</sup> others require 4-6 **MHz**,<sup>119</sup> and still others need more **spectrum**<sup>120</sup> to provide effective **LMS** service. Through this licensing plan, it is our intent to provide a framework for each of these technologies to flourish. For example, systems requiring 2 MHz could be accommodated in Bands D and G, **those requiring 4-6 MHz can be accommodated in Bands B and H or Bands E and F, and** those requiring additional spectrum will be permitted to aggregate bands to obtain up to a total of 8 MHz in a given region through the aggregation of Bands D and G and Bands E and

<sup>117</sup> Previously, two 8 **megahertz bands** had been available for use by multilateration systems. **See** 47 C.F.R. § 90.239(c).

<sup>118</sup> **Ex Parte** Comments of SBMS dated August 12, 1994, at 5.

<sup>119</sup> **See, e.g.,** Comments of Teletrac and Mobile Vision.

<sup>120</sup> **See, e.g.,** **Ex Parte** Comments of Pinpoint, June 27, 1994, at 4 and note 4.

49. The plan also accommodates the **needs** of non-multilateration systems by providing a total of 14 **MHz** for such systems rather than the 10 **MHz** of spectrum proposed in the Notice (see footnote 98, supra). Of this 14 **MHz**, 10 **MHz** is contiguous spectrum at 909.750-919.750 **MHz** that is not shared with multilateration systems, which should address the spectrum requirements of most non-multilateration systems.” In addition, **non-multilateration** systems may obtain up to a 12 **MHz** block of contiguous spectrum by also **using the 2 MHz** of spectrum at 919.750-921.750 **MHz** (Band D). Although this 2 MHz block will be shared on a co-equal basis with multilateration systems, it will nonetheless provide opportunities for non-multilateration systems that require additional spectrum to operate effectively. <sup>123</sup>

## F. Geographic Areas for Exclusive Licenses

50. In the Notice, we sought comment on how to license spectrum to multilateration **LMS systems**.<sup>124</sup> In the Notice of Proposed Rulemaking in PP Docket No. 93-253, we asked for comment on the appropriateness of awarding **LMS** licenses through competitive **bidding**.<sup>125</sup> Finally, after adopting the Notice in this docket, we sought specific comment on certain alternative licensing aspects, such as the use of Basic Trading Areas (**BTAs**) in defining the license service **area**.<sup>126</sup>

51. Teletrac favors **BTAs** over **MSAs/RSAs** for **multilateration LMS** licensing “because the coverage area customers seek for tracking and emergency services extends

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<sup>121</sup> Licensees may not be authorized to operate on more than one of the multilateration bands in a given **MTA**, except **that** they will be permitted to aggregate Bands D and G and Bands E and F.

<sup>122</sup> Mark IV has indicated that its non-multilateration systems can operate in the 912-918 MHz range. Comments of Mark IV dated June 29, 1993, at 8-10. **MFS/TI** has indicated **that** “it may be Possible for AVI (non-multilateration) technologies to operate in as little as 10 **MHz** of (contiguous) bandwidth.” Comments of **MFS/TI** dated August 12, 1994, at 8.

<sup>123</sup> See Amtech comments at 9. **Amtech** states that two-way data transmission between a moving vehicle and a fixed location will require large bandwidths. See also TI/MFS ex parte comments filed December 2, 1993, at 5 and Hughes comments at 6.

<sup>124</sup> See Notice of Proposed Rule Making, PR Docket No. 93-61, 8 FCC Rcd 2502 (1993) at paragraph 21.

<sup>125</sup> See, Notice of Proposed Rule Making, PP Docket No. 93-253, 8 FCC Rcd 7635, para 145, n. 153 (1993).

<sup>126</sup> See Public Notice, DA 94-129, PR Docket No. 93-61, 59 Fed.Reg. 7239 (February 15, 1994).

beyond city limits to the broader metropolitan area where people are likely to commute, conduct business, or routinely **drive**.<sup>127</sup> SBMS favors **MSAs/RSAs** over **BTAs** because, it claims, (1) the Commission has had favorable experience with **MSAs/RSAs** in licensing cellular systems, (2) **BTAs** do not coincide with cellular service areas, to the detriment of **cellular** entities that are would-be **LMS** providers, (3) **MSAs/RSAs** are widely known and easily ascertainable, and (4) no private party or **entity** has ever attempted to control dissemination of maps or listings which depict or define these **areas**.<sup>128</sup> SBMS also argues that allowing existing licensees to expand to the borders of their **BTAs** could have **anti-competitive** implications.<sup>129</sup> Symbol Technologies believes that choosing **BTAs** for **LMS** would result in a congruency of service areas for **LMS** and PCS that would allow **LMS** providers to be de facto PCS providers and directly compete with PCS.<sup>130</sup>

52. We generally agree with Teletrac's view that the geographic scope of LMS systems logically correlates to areas in which there are centers of consumption of durable goods. We also find, however, that LMS has the potential to serve larger areas; vehicle location and monitoring will be useful for the individual motorist and for fleets of vehicles, and for short-range travel as well as long-range travel. For this reason, we conclude that Major Trading Areas (**MTAs**) as defined in the 1993 Rand McNally Commercial Atlas and Marketing Guide<sup>131</sup> and four additional MTA-like service **areas**,<sup>132</sup> unlike the smaller **BTAs**, provide a more suitable regulatory construct for multilateration licensing. While it is clear that multilateration systems will benefit from being centered upon areas of commerce and trade, use of **MTAs** will give systems greater capacity to accommodate large numbers of prospective users of location services. This will promote competition, encourage the advancement of new technologies, and result in better and speedier service to the public. We will thus provide for one exclusive multilateration system license in each MTA in the sub-bands **identified** for exclusive assignments (i.e., Bands B and H, D and G, and E and F). Multilateration licensees on these exclusive assignments will be allowed to construct stations anywhere within their **MTAs**, subject to technical and operational considerations discussed in paragraph 87-98, infra.

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<sup>127</sup> Comments of **PacTel** Teletrac dated **March 15, 1994**, at 8.

<sup>128</sup> Comments of SBMS dated **March 15, 1994**, at 5. SBMS makes reference to "**PCIA**, Rand McNally Settle Out-of-Court On Use of **BTA/MTA** Listings," **Washington Telecom Week**, February 18, 1994, at 2-3.

<sup>129</sup> Comments of SBMS dated **March 15, 1994**, at 14-16.

<sup>130</sup> Comments of Symbol Technologies, Inc. in Response to the Public Notice of February 9, 1994, at 7-8 (note 9).

<sup>131</sup> See footnote 23, supra.

<sup>132</sup> See footnote 24, supra.

## G. Competitive Bidding for Exclusive Multilateration LMS Licenses

53. In response to the Notice of Proposed Rule Making in PP Docket No. 93-253, we received comment on the issue of whether mutually exclusive applications for AVM systems should be resolved by competitive bidding.<sup>133</sup> Teletrac and SBMS oppose use of competitive bidding to license in this service. These parties contend that the statutory requirement that auctionable spectrum be exclusively assigned and principally used to serve paying subscribers is not met because LMS operations are secondary to ISM and Federal Government use of the band. Amtech and Pinpoint, who oppose competitive bidding for LMS licenses for other reasons, argue that LMS's secondary status does not in and of itself statutorily preclude competitive bidding.

54. In the Second Report and Order in PP Docket No. 93-253, we concluded that it was premature to authorize competitive bidding for AVM systems during the pendency of PR Docket No. 93-61, because "the likelihood of mutually exclusive applications" was unknown or was debated by the commenters.<sup>134</sup> However, in light of our decision to grant exclusive multilateration LMS licenses within three sub-bands, and because they will be used to offer for-profit, subscriber-based services, we conclude that competitive bidding should be used to grant exclusive licenses where mutually exclusive applications are accepted for filing. Use of competitive bidding in such cases meets the general statutory criteria for auctioning licenses set forth in Section 309(j)(2) of the Act.<sup>135</sup> The statute permits auctions where: (1) mutually exclusive applications for initial licenses or construction permits are accepted for filing by the Commission; (2) the principal use of the spectrum will involve, or is reasonably likely to involve, the receipt by the licensee of compensation from subscribers in return for enabling those subscribers to receive or transmit communications signals utilizing the licensed frequencies; and (3) the public interest objectives of Section 309(j) would be served by subjecting mutually-exclusive applications in the service to competitive bidding."

55. We conclude that the above requirements are satisfied, thus making competitive bidding available for licensing within certain band segments. First, in accordance with the statute, the licensing scheme we adopt herein allows for mutual exclusivity among applicants for initial licenses. Specifically, we have rejected the option of allowing multilateration LMS

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<sup>133</sup> Several commenters to that proceeding oppose grant of non-multilateration licenses by competitive bidding. See, e.g., Comments of Hughes Transportation Management, Interagency Group and Amtech.

<sup>134</sup> See Second Report and Order, PP Docket No. 93-253, 9 FCC Rcd 2348, 2351-2, (1994).

<sup>135</sup> See 47 U.S.C. § 309(j)(2). See also H.R. Rep. 111, 103d Cong. 1st Sess. 254 (1993).

<sup>136</sup> A comprehensive discussion of these principles for determining whether licenses may be auctioned is set forth in the Second Report and Order in PP Docket No. 93-253, 9 FCC Rcd 2398 (1994) at paras. 11-67.

systems to operate in an unlimited shared use environment and have instead decided to grant only one licensee the use of each of three sub-bands for multilateration LMS in each MTA. (see paragraphs 4446, ~~Wera~~) do not believe that the likely existence of some grandfathered AVM multilateration operations alters this conclusion. See para. 61, *infra*. **Because** no more than one multilateration licensee will be permitted in any single sub-band in an MTA (hereinafter “MTA licensee”), we anticipate that mutually exclusive applications will be filed. We also conclude that the use of the spectrum by other services does not preclude the applicability of the competitive bidding process. Shared spectrum for which we exclude competitive bidding is “where mutual exclusivity between applications cannot exist because channels must be shared by multiple licensees.. . . [W]e proposed to exclude these services from competitive bidding because there can be no mutual exclusivity.”<sup>137</sup> That is not the case here, where in all likelihood there will be mutually exclusive applications for each exclusive MTA license. The relevant statutory prerequisite, as set forth in Section 309(j) of the Budget Act, is that “mutually exclusive applications are accepted for filing.” This standard does not require that the relevant spectrum be completely unoccupied by other services.

56. Second, as the statute requires, the “principal use” of the spectrum is reasonably likely to involve MTA licensees receiving compensation from subscribers in return for those subscribers receiving or transmitting signals. We have concluded that this requirement allows us to evaluate classes of licenses, rather than individual licenses, in determining the “principal use” of spectrum.<sup>138</sup> Thus, while MTA licensees may be secondary in the band to government and ISM operations, the “principal use” test, as we have interpreted it, permits us to conclude that the principal uses of multilateration LMS are **primarily** subscriber-based offerings.<sup>139</sup>

57. In addition, we believe that use of a competitive bidding procedure for the licensing of these services satisfies the public interest objectives for auctioning set forth in Section **309(j)(3)** of the Act. Specifically, use of competitive bidding to award MTA licenses, as compared to other licensing methods, will speed the development and deployment of new services to the public with minimal **administrative** or judicial delays, and encourages efficient use of the spectrum as **required** by Section 309(j)(A) and **(D)**. Furthermore, in accordance with Section **309(j)(3)(B)**, we believe that competitive bidding will promote access to multilateration services and technologies and **disseminate** licenses among a wide variety of applicants by encouraging participation by all interested or qualified bidders. Finally, we conclude that competitive bidding will recover for the public a portion of the value of the

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<sup>137</sup> **In** the Matter of Implementation of Section **309(j)** of the **Communications Act – Competitive Bidding**, Second Report and Order, PP **Docket** No. **93-253**, 9 **FCC Rcd** 2348 at **para. 13** (1994).

<sup>138</sup> **See** Second Report and Order in PP Docket N. 93-253, FCC **94-61**, 9 **FCC Rcd** 2348 at **para. 34** (1994).

<sup>139</sup> Comments of Pinpoint at 5; Comments of SBMS at 4.



**spectrum**, as envisioned in Section 309@ (3)(C). Specific rules and procedures for competitive bidding for **this** spectrum, including rules and **procedures** for designated entities, will be established in a separate proceeding. We will not accept applications for multilateration LMS licenses until after these rules and **procedures** have been established.

#### H. Construction Period for LMS Systems

58. In the Notice, we proposed that LMS systems be constructed and placed in operation within eight months of the date a license is granted, which is the current **standard** for **AVM** licensees under Part 90.<sup>140</sup> The majority of **commenters** that addressed this issue support our proposal so long as provision is made for extended implementation periods for local governments or especially large and complex **systems**.<sup>141</sup> **MobileVision** supports a five-year construction period with **construction benchmarks** for multilateration systems but states that eight months is appropriate for non-multilateration **systems**.<sup>142</sup> **SBMS** supports a 12-month construction **period**.<sup>143</sup>

59. Most non-multilateration installations use relatively few transmitters in a limited number of locations. Accordingly, we shall retain the **current requirement** that these systems be constructed and placed in operation within eight months. We will consider a non-multilateration LMS system to be **constructed** and placed in operation if at least one base station has been constructed **and** the system is providing **service** to at least one mobile radio unit. As they may do currently, a local government entity **requiring** more than eight **months** to construct a non-multilateration LMS system because of the system's size and complexity can request **extended** implementation in accordance with Section 90.155(b) of our Rules.

60. We recognize that multilateration LMS systems, because they will be licensed on an MTA basis, will likely be larger and more complex than non-multilateration **LMS** systems. Rather than imposing benchmarks and reporting **requirements** on these systems for all or part of their license term, we will require a multilateration LMS licensee authorized to operate throughout an **MTA** to construct a **sufficient** number of base stations that utilize multilateration technology to provide multilateration location service to a **substantial** portion of at least one BTA in that MTA within twelve months after initial **authorization**.<sup>144</sup> LMS

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<sup>140</sup> Notice at para. 26, 8 FCC Rcd. 2502, 2507 (1993). See 47 C.F.R. § 90.155.

<sup>141</sup> **Hughes comments** at 15; **Amtech comments** at 35-36; **Mark IV comments** at 14; **IVHS America comments** at 19; **Interagency Group comments** at 10.

<sup>142</sup> **MobileVision comments** at 46-49.

<sup>143</sup> **SBMS comments** at 22.

<sup>144</sup> This requirement is comparable to the substantial service requirement for 10 MHz PCS licensees set forth in Memorandum Opinion and Order, GEN Docket No. 90-314, 9 FCC Rcd 5108,

systems not constructed and placed in operation in a timely fashion (i.e., within 8 months for non-multilateration systems and within twelve months, as described above, for multilateration systems) will cancel automatically.

### **I. Grandfathering Provisions for Existing Multilateration AVM Licensees**

61. As of February 3, 1995, we will no longer accept applications for the operation of multilateration LMS systems in the 904-912 and 918-926 MHz bands under our current rules. To ensure that our new licensing scheme does not impose undue hardship on existing, operating multilateration AVM systems, we will adopt certain grandfathering provisions which will allow them to continue to operate their systems under the current rules. We **will** also confer grandfathering provisions on multilateration AVM licensees who have not yet **constructed** their systems so that such licensees may construct and operate their licensed stations **under** our newly adopted rules.

62. A grandfathered multilateration AVM station will be considered constructed and placed in operation if it is built in accordance with its authorized parameters and is regularly interacting with one or more other stations to provide location service, using multilateration technology, to one or more mobile units. See 47 C.F.R. § 90.155. Specifically, LMS multilateration stations will only be considered **constructed** and placed in operation if they are part of a system that can interrogate a mobile, receive the response at 3 or more **sites**, compute the location from the time of arrival of the responses and transmit the location either back to the mobile or to a subscriber's **fixed** site. A grandfathered **multilateration** AVM station will receive no protection or exclusivity based upon mileage separation or service area criteria, but instead **will** operate on a **co-equal** shared basis with stations of any other grandfathered licensee or the exclusive MTA licensee operating in the same sub-band. We have concluded that sharing of **spectrum** among **unlimited** numbers of **multilateration** licensees is not technically feasible (see paragraph 44, supra), and thus we have not adopted rules that would permit the sharing of **spectrum** among multiple multilateration systems over an entire **MTA**. However, given the very small number of multilateration licensees **currently** authorized, in any given MTA **there will ultimately be, at most, one or two grandfathered licensees operating in the same spectrum as the eventual MTA licensee**. In such limited cases, we expect cooperative arrangements for sharing among these licensees to be reached. Where this is not possible or achieved, MTA licensees may build their systems in areas geographically removed **from** grandfathered stations, or may attempt to acquire existing systems from the **grandfathered** licensee(s) in their licensed area.

63. To attain grandfathered status, existing multilateration AVM licensees must **Ne**, within thirty days of the effective date of the rules adopted in this **&port and Order**, applications to **modify** their licenses to comply with the new band plan. These applications to modify must identify which new sub-band or sub-bands (*i.e.*, Band B and H, Band D and

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¶ 155 (1994).

G, or Band E and **F**) they intend to operate their licensed **multilateration** AVM stations in, once their applications to modify have been authorized. We will not restrict multilateration AVM licensees to selecting a particular sub-band or sub-bands for their modified **authorization**, but will permit these licensees to choose the spectrum band(s) -- not to exceed a total of 8 **MHz** -- that best meets with their future LMS requirements. The application to modify a license to comply with the new band plan may also include a **modification** to specify an alternate site, so long as the alternate site is 2 kilometers or less from the site specified in the original license.<sup>145</sup> Further, at the time that existing multilateration AVM licensees **file** these applications to **modify**, they **must** certify that either (1) their multilateration AVM system has been constructed and is operational as of February 3, 1995, or (2) that it is not constructed at that time. Multilateration AVM systems that **are** constructed and operational as described above will be given until April 1, 1998 to convert to the spectrum identified in their modified LMS system license. Such licensees may continue to operate their multilateration AVM systems under either the old rules or the new rules during the process of converting their systems during this period. Licensees of constructed and operational multilateration AVM systems that do not file applications to modify within this **30-day** period will be permitted to continue operations under the provisions of Section 90.239 **until** April 1, 1998 or the end of their original license term, whichever occurs first, at which time such licenses will cancel automatically and will not be renewed.

64. Multilateration AVM licensees for stations not constructed as of February 3, 1995 must construct and operate their modified LMS systems on the spectrum identified in their modified LMS system license by April 1, 1996. These licensees will not be allotted the lengthy transition period that licensees of constructed and operational systems are provided (i.e., until April 1, 1998) because they do not have an existing, operating **infrastructure** that will require this additional time for conversion. Licenses for stations not constructed under the old rules as of February 3, 1995 will terminate 30 days after the effective date of the new rules unless timely applications to **modify** are filed. Parties may file applications to modify those licenses that they plan to construct by April 1, 1996.<sup>146</sup> We have provided a transition period that we believe is appropriate for construction and operation for current licensees to attain grandfathered status. Because this spectrum will be subject to competitive bidding, we must balance our wish to accommodate the desired construction schedules of existing multilateration AVM licensees against the need for prospective bidders to be able to evaluate the likely **value** of the spectrum upon which they will be bidding.

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<sup>145</sup> See **generally** Implementation of Sections 3(n) and 332 of the Communications Act, Regulatory **Treatment** of Mobile Services, GN **Docket** No. 93-252, PR Docket No. 93-144, PR Docket No. 89-553, **Third** Report and Order, FCC 94-212, released Sept. 23, 1994, at **para.** 356.

<sup>146</sup> We note that **Airtouch** and Mobilevision have offered to limit the number of licenses they construct to 20 percent of the unbuilt licenses they hold. While we are not adopting this 20 percent limit, we expect all licensees to file modification applications only for those **unbuilt** licenses that realistically can be constructed by April 1, 1996. If the number of modification **applications** submitted **significantly** varies **from** the number built, we will consider appropriate measures.

## J. Licensing of Non-Multilateration Systems

65. We proposed that non-multilateration systems be licensed in the **902-904**, 912-918, and 926-928 MHz bands.<sup>147</sup> Mark IV believes that 6 MHz of contiguous spectrum at 912-918 MHz is sufficient for its type of system.<sup>148</sup> MFS Network Technologies/Texas Instruments recommend 12 or 14 MHz of contiguous spectrum for non-multilateration systems, but indicate that 10 MHz may be **sufficient**.<sup>149</sup> **Amtech** states that a minimum of 12 MHz of contiguous spectrum is required for non-multilateration systems, because these **systems need 6 MHz** wide channels and two such channels are necessary for high-speed operation at most toll booth locations.”

66. We also proposed that non-multilateration systems be licensed on a shared basis with licensees responsible for coordinating use to avoid **interference**.<sup>151</sup> Lockheed proposes licensing of non-multilateration systems based on a fixed mileage **separation**.<sup>152</sup> Mark IV supports the use of frequency coordinators to coordinate the assignment of **spectrum**.<sup>153</sup> **NABER** proposes that it be designated as the frequency coordinator for non-multilateration **LMS systems**.<sup>154</sup> We are adopting our proposal to license non-multi&ration LMS systems on a shared basis because these systems generally cover relatively short distances, and licensing based on a **fixed** mileage separation would limit **re-use** of spectrum and thereby limit the potential uses of these systems. We also decline to designate a frequency coordinator for this service. Many non-multilateration licenses have been issued and many stations have been placed in operation without such a formal coordination process and there appear to be no negative consequences. Considering the limited coverage of these systems and the expanded amount of **spectrum** available under the allocation plan we have adopted, it should not be difficult for non-multilateration systems to share their sub-bands.

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<sup>147</sup> Notice at **para. 25**, 8 FCC **Rcd. 2502, 2507** (1993).

<sup>148</sup> Comments of Mark IV M-IS Division dated June 29, 1993, at 8.

<sup>149</sup> Ex **Parte Comments** of MFS Network **Technologies/Texas Instruments** dated August 12, 1994.

<sup>150</sup> Ex Parte Comments of **Amtech** dated August 12, 1994.

<sup>151</sup> Notice at **para. 25**, 8 FCC **Rcd. 2502, 2507** (1993).

<sup>152</sup> Lockheed comments at 4. Mark IV supported a **fixed milage** separation in its comments but modified its support in reply comments. Mark IV comments at 8-9, reply comments at 8.

<sup>153</sup> Mark IV reply **comments** 8-10.

<sup>154</sup> NABER comments at 6-7.

67. The **Interagency** Group, with the support of Mark IV, proposes that local governments be able to obtain blanket licenses for non-multilateration **systems**.<sup>155</sup> We decline to adopt a blanket licensing scheme for non-multilateration systems. In a shared use environment, it is important that applicants and other co-channel users **know** exactly where systems are located if they are to avoid interference. If we issue blanket licenses, it will be difficult for the Commission or the public to ascertain the exact location of LMS transmitters.

68. Finally, we proposed that existing non-multilateration systems licensed to operate in spectrum allocated for use by multilateration systems be **required** to move their operations within three years of the effective date of any new **rules**.<sup>156</sup> SBMS and Location Services support this proposal.<sup>157</sup> Both Teletrac and **Amtech** favor grandfathering existing **non-multilateration** systems, although Teletrac would only do so for systems licensed prior to the initiation of this **proceeding**.<sup>158</sup>

69. **As** discussed earlier, we have modified our proposal to provide for shared use of the 902.000-904.000 and **909.750-921.750** MHz bands by non-multilateration LMS systems, thus allocating a total of 14 MHz that will be available for non-multilateration operations. Although a non-multilateration licensee could be **required** to share 2 MHz of this **spectrum** (at **919.750-921.750** MHz) with an MTA multilateration licensee, we believe that the benefit to those non-multilateration systems **requiring** a minimum of 12 MHz of contiguous **spectrum to operate** remains **substantial** and warrants this overlap.

70. In addition, because we have concluded that sharing between multilateration and non-multilateration systems is generally inadvisable (see paragraph 46, supra), we are **requiring** that licenses for non-multilateration systems in spectrum other than the 902.000-904.000 and **909.750-921.750** MHz bands must be modified by April 1, 1998, to specify operation solely in those bands and to operate **consistent** with the rules we are adopting by this **Report and Order**. This is consistent with our decision to require multilateration systems to relocate their operations within the same time period. Similarly, authorizations not so modified within this period will cancel automatically.

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<sup>155</sup> Comments of Interagency Group at 12; Reply Comments of Mark IV at 6-8.

<sup>156</sup> Notice at para. 16, 8 FCC Rcd. (1993).

<sup>157</sup> SBMS comments at 12; Location Services at 5.

<sup>158</sup> Teletrac comments at 22-23; Amtech comments at 36-38.

## K. Multilateration System Operations

71. From review of the lengthy record in this proceeding, we have determined that multilateration systems have two distinct methods of operation. One type of **multilateration** system utilizes a low power, **wideband** location pulse originating from the mobile units and a high powered, narrowband interrogation and control signal emanating from the fixed/base stations. These systems also utilize **narrowband** transmissions, **within** the band that is used for the location pulse, for two-way voice and data communications between fixed/base stations and mobile units. Another kind of multilateration system operates in a **different** manner, utilizing **wideband transmissions** for: the location pulse from the mobiles, the interrogation and control signal from the fixed/base stations and the two-way messaging between the fixed/base stations and the mobile units. As we understand these two types of multilateration systems, there are three basic elements used to accomplish location and monitoring functions: forward link, reverse links and communication links. Forward links originate at the **fixed/base** site and are used to control and interrogate mobile units. In contrast, reverse links are signals transmitted from **the** mobile units or **fixed** station **to fixed/base** stations to determine the location of the mobiles or from fixed stations to other **fixed/base** stations for system synchronization and testing purposes. Communication links **connect** fixed/base stations and mobile units and are utilized for two-way messaging related to the location or monitoring functions of the system. In addition, multilateration systems use these three basic elements either in what we will refer to as the “narrowband” or the “broadband” portion of the **LMS** band. The narrowband portion we will **define** as the 250 **kHz** sub-bands (i.e., the sub-bands **927.250-927.500**, **927.500-927.750** and **927.750-928.000** MHz) and we will define the broadband portion as the **sub-bands** 904.000-909.750, 919.750-921.750 and **921.750-927.250** MHz. Each of the three basic elements are **discussed** below in accordance with their location in the narrowband or broadband portion of the LMS band, along with how they are considered in our overall regulation of multilateration systems.

### Narrowband Segment

#### a) Narrowband Forward Links

72. In the **Notice**, we observed that many multilateration systems are designed using forward **links** to contact units to be located.<sup>159</sup> Consistent with existing systems, we proposed that multilateration licensees authorized to operate in the 904-912 **MHz** sub-band be licensed to operate their forward links in the 250 **kHz** of **spectrum** between 924.890 and 925.140 MHz and that multilateration licensees authorized to operate in the **918-926 MHz** sub-band be licensed to operate their forward links in the 250 **kHz** of **spectrum** between 904.375 and 904.625 **MHz**.<sup>160</sup>

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<sup>159</sup> **Notice** at **para.** 19, 8 FCC **Rcd** 2502, 2405 (1993).

<sup>160</sup> **Notice** at **para.** 19, 8 FCC **Rcd** 2502.2505 (1993).

73. Teletrac is the only **commenter** that supports the proposed location of the forward links, claiming that it will be adversely affected otherwise because its systems now employ forward links in the manner proposed in the **Notice**.<sup>161</sup> **MobileVision** favors placing the forward links within a licensee's authorized sub-band rather than in the other multilateration **LMS** sub-band as proposed.<sup>162</sup> Location Services proposes keeping the forward links in the opposite sub-band but would move the links to the edges of each **sub-band**.<sup>163</sup> SBMS prefers that the forward links be placed as far from **wideband** frequencies as practical and assigned exclusively.<sup>164</sup> Pinpoint prefers a **wideband** forward link that operates over an entire multilateration system sub-band.<sup>165</sup> **Amtech** recommends placement of the forward links at the edges of the **902-928 MHz** band or make licensees use alternative spectrum for forward links, such as common carrier or private carrier paging **spectrum**.<sup>166</sup> Symbol, **ITRON** and **TIA** urge that multilateration LMS forward links be placed at the upper edge of the **902-928 MHz** band if Part 15 devices are to be **accommodated**.<sup>167</sup> Other Part 15 commenters expressed fear of being "drowned out" by high powered forward links, particularly **wideband** forward **links**.<sup>168</sup>

74. Although there is no identification of forward links in our current rules, we will define a forward link as any signal transmitted to a mobile unit to be located by a multilateration LMS system.<sup>169</sup> We will also dedicate a portion of spectrum in the **902-928 MHz** band where narrowband forward links may be used by the multilateration systems that require them for their operations. Thus, in accordance with our band plan for multilateration systems, multilateration licensees will be authorized to use only the following spectrum for **narrowband** forward links:

The **904.000-909.750 MHz** band narrowband forward link is **927.750-928.000 MHz**

The **919.750-921.750 MHz** band narrowband forward link is **927.500-927.750 MHz**

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<sup>161</sup> Teletrac Comments at 51, Reply Comments at 33-35.

<sup>162</sup> **MobileVision** Comments at 43-44.

<sup>163</sup> Location Services Comments at 5-6.

<sup>164</sup> Ex Parte Comments of SBMS, dated August 12, 1994.

<sup>165</sup> Ex Parte Comments of Pinpoint dated September 19, 1994, Ex Parte Comments of Pinpoint dated September 15, 1994.

<sup>166</sup> **Amtech** Comments at 31-32.

<sup>167</sup> Further Comments of **ITRON**, Symbol and **TIA** dated August 12, 1994.

<sup>168</sup> See Itron comments, dated August 12, 1994.

<sup>169</sup> See Section 90.7 of our rules.

The **921.750-927.250** MHz band narrowband forward link is 927250427.500 MHz

The placement of narrowband forward links at the upper edge of the **902** to **928 MHz** band meets the requirements of the majority of the multilateration industry and also accommodates the needs of Part 15 **interests**.<sup>170</sup> We have provided the flexibility requested by these various commenters, with two of the narrowband forward links placed in spectrum apart from the licensee's multilateration sub-band (e.g., the 927.50X7.75 and **927.75-928** MHz forward links) and the third forward link (**927.25-927.50** MHz) placed adjacent to its related multilateration sub-band.

75. Based upon comments from entities that employ narrowband forward links, we believe that 250 **kHz** for each multilateration system is a suitable amount of spectrum for narrowband forward **links**.<sup>171</sup> Furthermore, because narrowband forward link **transmissions** will be situated in the uppermost portion of the **902-928 MHz** band -- and thus somewhat removed from the operations of other licensed and unlicensed services in the band -- a relatively greater power level for this use should be permitted. We therefore will allow narrowband forward links to operate with a maximum power of 300 watts **ERP**.

### Broadband Segment

#### a) **Wideband Forward Links**

76. Pinpoint and Uniplex have expressed interest in employing a **wideband** forward link, which, like the narrowband **forward** link, would be used to communicate with mobile units. However, unlike the narrowband forward link, a **wideband** forward link would operate over a multilateration system's entire authorized **sub-band**.<sup>172</sup> Part 15 users uniformly oppose this request on the grounds that such **transmissions** are likely to cause interference to Part 15 devices. **Itron**, for example, points out that the high powered **wideband** forward link could adversely affect the operations of Part 15 devices because it would "present an essentially constant signal at any particular geographic **location**."<sup>173</sup> Pinpoint, however, asserts that its

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<sup>170</sup> Ex Parte Comments of **Teletrac** dated August 12, 1994; Mobilevision **Comments** at 4344; Location Services Comments at **5-6**; Ex Parte **Comments** of Southwestern Bell dated August 12, 1994; **Amtech** Comments at 31-32; Further **Comments** of **ITRON**, Symbol and TIA dated August 12, 1994.

<sup>171</sup> Ex Parte Comments of SBMS dated August **12, 1994**, Ex Parte Comments of **Teletrac** dated August 12, 1994, Ex Parte **Comments** of **MobileVision** dated August 12, 1994.

<sup>172</sup> **Ex Parte Comments** of Pinpoint dated September **19, 1994**, Ex **Parte** Comments of **Uniplex** dated September 30, 1994.

<sup>173</sup> See **e.g.**, Ex Park Comments of **ITRON** Inc. at p. 3, dated August 12, **1994** and Symbol Technologies, dated August 12, 1994.



system, which is based on the use of the **wideband** forward link, would pose far less of an interference threat to users of the **902-928 MHz** band than that caused by a certain, currently deployed Part 15 data distribution system.<sup>174</sup> We will permit the authorization of **wideband** forward links, but note that multilateration operations are conditioned on further testing as described in paragraphs 81-82, infra.

b) Reverse Links

77. As **discussed** above, a multilateration signal transmitted to the **fixed/base stations** will be referred to as a "reverse link" and is utilized by both types of multilateration systems. These signals are **contained within** the broadband segment of the multilateration allotment and are primarily location pulses originating **from** mobile units **and** used for determination of the position of mobile units. Such **transmissions** may also originate from other **fixed/base** stations for the purpose of system synchronization or testing. **These transmissions** are likely to occur less **frequently** and more randomly than the above-mentioned forward links and are therefore less likely to cause interference to Part 15 operations. However, as pointed out by one commenter, reverse link **transmissions could** present significant problems to Part 15 operations depending on the power levels, duty cycles and density of mobile **units**.<sup>175</sup> Reverse links are an essential part of any multilateration LMS system and therefore must be accommodated. However, in order to limit the potential for interference from such **transmissions**, we will limit the **maximum** power level of reverse links to 30 watts ERP. This is a sufficient amount of power to enable mobile units to provide an adequate signal to fixed sites for location, synchronization **and** testing purposes.

c) Communication Links

78. As noted by multilateration service **providers**,<sup>176</sup> there is an additional **transmission** that multilateration systems **utilize** for two-way messaging that we will refer to as a "**communication link**." The communication link emanates from the **fixed/base** stations and mobile units ancillary to the location and monitoring function of the multilateration system and provides status and **instructional** information relating to the vehicle being located or the **occupant(s)** of the vehicle. Additionally, these links may be interconnected with the PSN to enable **emergency communications**.<sup>177</sup> Moreover, the method of **transmission** of the communication link differs between **multilateration** systems, the differences centering on the

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<sup>174</sup> See comments filed by Pinpoint Communications, Inc., dated September 19, 1994.

<sup>175</sup> See letter from Metricom, Inc., Alarm Industry Communications committee, Electronic Industries Association, Itron, Inc., Part 15 Coalition, Sensormatic Electronics Corporation, Southern California Edison, and Telecommunications Industry Association., dated August 12, 1994.

<sup>176</sup> See e.g., Ex Parte Comments of MobileVision dated December 14, 1994, at 1-2.

<sup>177</sup> See paragraphs 26 **and** 27, supra.

size of the channel(s) **being** used.

i) **Narrowband Communication Links**

79. Narrowband wmmunication links are used in certain multilateration systems to provide voice and data wmmunications within the broadband portion of their allocation of **spectrum**. Additionally, the narrowband wmmunication link differs from a **wideband** communication link in that it uses small (e.g., 25 **kHz**) channels to accomplish its messaging **functions**. These narrowband **transmissions** are a valuable asset and are may enhance the economic viability and flexibility of these particular multilateration **systems**.<sup>178</sup> However, as we did for reverse links in order to limit their **interference** potential, we will also limit the maximum power of narrowband communication links to 30 watts ERP. This limitation encompasses wmmunication links that originate at fixed/base stations as well as mobiles. Due to the fact that these **transmissions** should only occur sporadically or in the event of an emergency, we believe that this power level should serve to limit interference to Part 15 operations. However, we note that multilateration licenses are conditioned on additional testing as discussed in paragraphs 81-82.

ii) **Wideband Communication Links**

80. Certain multilatcration systems use **wideband** wmmunication links, integrated with accompanying **wideband** forward links, to provide messaging within the broadband segment. This **wideband** link differs from narrowband communication **links** because it transmits a direct sequence spread spectrum signal across the entire sub-band (e.g. all of the 904.000-909.750 MHz sub-band) instead of signals on small channels within the **sub-band**. Although these links are perceived to represent greater **interference** potential to Part 15 **devices**,<sup>179</sup> we **conclude** that these **wideband links** should be authorized. As noted earlier, however, **multilateration** system licenses are wnditioned on additional testing as discussed in paragraphs 81-82.

**Testing of \_\_\_\_\_ M \_\_\_\_\_ u \_\_\_\_\_**

81. **In comments, a number of parties to this proceeding have expressed the desire** and need for additional testing to demonstrate the feasibility of multiple services coexisting in the **902-928** MHz band, in particular the multilateration LMS users and the operators of Part 15 devices. Our record contains a **significant** amount of information on the issue of mutual coexistence between these parties, which was submitted in the form of theoretical analyses, **demonstrations and testing (See Appendix B)**. **This record shows that certain aspects and** elements of **these** various systems **and** services create a greater potential for **interference** than

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<sup>178</sup> **See Ex Parte Comments** of Mobilevision dated December 14, 1994, at 5.

<sup>179</sup> **See e.g., Ex Parte Comments** of **Cellnet** and **KNOGO** dated August 19, 1994, at 4.

others.<sup>180</sup> The band plan adopted in this item was crafted on the basis of this extensive record. In addition, these submissions were used to establish technical limitations or criteria on the operations of the various systems, to **minimize** the potential for interference and provide a more **conductive** environment for sharing of the band by the disparate services.

82. The record of this proceed@ **contains substantial** technical analysis supporting the band plan we now adopt. We are persuaded, however, that additional testing **could** provide users of the band with data that **could** contribute to "fine-tuning" system operations. Therefore, to ensure that the coexistence of the various services in the band is as successful as possible and to identify whether further refinements in our rules are necessary, we will condition grant of each MTA **multilateration** license on the licensee's ability to demonstrate through actual field tests that their systems do not cause unacceptable levels of interference to Part 15 devices. To provide such protection and to facilitate band sharing and **minimize** interference to Part 15 operations, multilateration licensees may employ any one of a number of technical refinements, i.e., limiting duty cycle, pulse duration power, etc. It is our expectation that such testing be accomplished through close cooperation between multilateration systems users and operators of Part 15 systems.

#### **L. LMS Below 512 MHz**

83. In the Notice, we proposed that the expanded **definition** of LMS would apply to below 512 **MHz** systems, but that licensees of such systems would not be permitted to provide service to individuals or to provide service on a private carrier basis. NABER is the only wmmenter that addressed **LMS** operation below 512 MHz. NABER requests **clarification** of several points **pertaining** to these systems, including coordination **requirements** and co-channel separation **requirements** between **LMS** systems and **non-LMS** systems used for voice operations.<sup>181</sup> NABER also notes that proposed Section **90.105(b)(3)(i)** discusses loading criteria for systems operating with single frequencies, **two-frequency** mode, and pairs of frequencies, but that Section **90.105(b)(3)(ii)** only discusses separation criteria for operations using single **frequencies** or two frequencies. NABER suggests that because the loading criteria are the same, we apply the same separation criteria for single **frequency** operations to operations using pairs of frequencies.

84. Section 90.175 of our Rules provides that applicants for frequencies below 512 **MHz** must generally obtain a frequency recommendation from a frequency coordinator. We

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<sup>180</sup> Many of these submissions have focused on concerns regarding the use of **wideband** forward links for multi&ration systems, the **location** of such links **in** the baud, and the appropriate power levels for both forward and reverse link **transmissions**.

<sup>181</sup> NABER **comments**. NABER also requests clarification as to the effect our "**Refarming**" proceeding (PR Docket 92-235, Notice of Proposed Rule Making, 7 FCC Rcd 8105 (1992)) will have on LMS systems. No final action has yet been taken in the **Refarming proceeding**. **Ultimately**, LMS **systems** below 512 MHz will have to adhere to any decisions reached **in** that proceed&

conclude that LMS applicants should be subject to these same coordination requirements when applying for these frequencies. Accordingly, applicants for LMS systems below 512 MHz must meet the coordination requirement of Section 90.175(a) of our Rules, 47 C.F.R. § 90.175(a). Applicants will use the frequency coordinator for the radio service in which they have established their eligibility. We will also require LMS systems **authorized** below 512 **MHz** to modify their licenses under the same conditions as other land mobile licensees. This means that a modification application will have to be **filed** for changes in the number of base, **fixed**, control, or mobile transmitters.”

85. Section **90.105(b)(3)(i)** only discusses using pairs of frequencies in the 470-512 **MHz** band. Because these frequencies are only available within **80** km (50 miles) of 13 major urban areas, applying a 120 km (75 miles) separation between **non-LMS** voice systems and LMS systems would severely restrict LMS use of this **spectrum**. Pairs of frequencies in the 470-512 MHz band will be assigned in accordance with the allocation plan for the band as described in Subpart L, 47 C.F.R. Part 90, Subpart L, except that the 200 mobile unit loading criteria will apply and an LMS system will not be authorized to share a channel utilized by a non-LMS licensee operating a voice system unless an agreement with the licensee is reached. Accordingly, the **co-channel** separation between **LMS** systems and **co-channel non-LMS** voice systems in the 470-512 MHz band will be 64 km (40 miles), except on Channel 15 in Chicago, Channel 20 in Philadelphia, and Channel 17 in **Washington** where the minimum co-channel separation is 32 km (20 miles). See 47 C.F.R. § 90.313.

86. We also adopt our proposal to extend the definition of LMS to below-512 **MHz** systems. We are not, however, expanding uses of **LMS** systems below 512 **MHz** to provide service to individuals or to provide service on a commercial basis. Such **commercial** uses of **LMS** would be inconsistent with the nature of the spectrum below 512 **MHz**, which is intended primarily for the use of private land mobile radio (**PLMR**) communications to enable private land mobile eligibles to provide for their own internal wmmunications needs. Moreover, the frequency bands below 512 **MHz** on which LMS systems are licensed are shared **PLMR frequencies**. Many of these channels are already unacceptably crowded. We are **currently** wnsidering rule changes to **increase** channel capacity and promote more efficient use of **PLMS frequencies** below 512 **MHz**.<sup>183</sup> Permitting LMS systems authorized below 512 **MHz** to provide service on a commercial basis, or to provide service to individuals, would only exacerbate this **spectrum** congestion.

## M. Technical Issues

87. In the **Notice**, we proposed a number of technical **requirements** for LMS systems to **minimize** the possibility of both **co-channel** and adjacent-channel interference and we proposed that equipment be type accepted to ensure compliance with these **standards**. The

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<sup>182</sup> See 47 C.F.R. § 90.135(a).

<sup>183</sup> See Notice of Proposed Rule Making, PR **Docket** No. 92-235, 7 **FCC** **Rcd** 8105 (1992).

following technical **criteria** will be applied to licensees of LMS systems. Our proposals, commenters' responses, and our decisions are discussed below.

**88. Type Acceptance.** We proposed that LMS equipment be required to be type accepted.<sup>184</sup> This proposal was supported by Teletrac, **MobileVision**, SBMS, Mark IV, and Location **Services**.<sup>185</sup> Teletrac proposes that we require the equipment to be authorized through the notification process one-year **from** the adoption date of this **Report and Order** while SBMS suggests type acceptance after **18-months**.<sup>186</sup> Location **Services** suggests that licensees be permitted to operate new equipment on a commercial basis for 18 months before such equipment must be type accepted.<sup>187</sup> We are adopting our proposal to require type acceptance. We decline to adopt Teletrac's proposal that we only require equipment **"notification."**<sup>188</sup> Considering the mobile nature of most LMS transmitters and that new, advanced technologies will be employed in this equipment, we find that the **stricter** regulatory oversight of having equipment type accepted rather than "notified" is justified. Accordingly, all LMS equipment imported or marketed after April **1, 1996**, must be type accepted for use under Part **90** of our Rules, 47 C.F.R. Part 90. This **includes** the "transmitting tags" used in certain **non-multilateration** systems. If, however, these units meet the requirements of Part 15 of our Rules, 47 C.F.R. Part **15**, they may be authorized under that Part. **By** delaying the requirement for type acceptance, we effectively adopt Location Services' proposal for a grace period in which to operate **LMS** equipment without authorization, albeit for a lesser period than 18 months. As **discussed** in the **Notice**,<sup>189</sup> licensees still in the developmental stages that do not wish to seek type acceptance may be licensed on a developmental basis in accordance with Subpart Q of Part **90**.<sup>190</sup>

**89. Emissions.** We proposed that no restriction be placed on the type of emission that may be authorized for LMS operation in the 902-928 MHz **band**.<sup>191</sup> **MobileVision and**

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<sup>184</sup> **Notice** at para. 29, 8 FCC **Rcd** 2502, 2507 (1993).

<sup>185</sup> Teletrac wmmments at 48; **MobileVision** wmmments at SO; SBMS wmmments 23; Mark **IV** wmmments at 13; and Location Services wmmments at 3.

<sup>186</sup> Teletrac wmmments at 48; SBMS **comments** at 23.

<sup>187</sup> Location Services comments at 3.

<sup>188</sup> Teletrac wmmments at 48.

<sup>189</sup> **Notice** at para. 29, 8 FCC **Rcd** 2502, 2507 (1993).

<sup>190</sup> 47 C.F.R. Part 90 Subpart Q.

<sup>191</sup> **Notice** at para. 30, 8 FCC **Rcd** 2502, 2507 (1993). **See** Section 2.201 of **the Rules**, 47 C.F.R. § 2.201, for a description of emission designators.

SBMS support this proposal.<sup>192</sup> Teletrac supports this proposal only if multilateration systems are required to be physically separated.<sup>193</sup> Teletrac claims that, in the absence of geographic separation, stricter limits on emissions are required to prevent interference between multilateration systems.<sup>194</sup> We are adopting our proposal to place no limits on the type of emission that can be authorized for LMS systems. Allowing any types of emissions will enable any type of location or monitoring technology or ancillary service to develop without restrictions. We will limit the likelihood of interference through appropriate power, frequency tolerance and emission mask limitations. Moreover, exclusive licensing of multilateration systems in MTAs in each of the three respective sub bands should ameliorate concerns of co-channel multilateration LMS interference.

**90. Bandwidth.** We proposed to limit the bandwidth of LMS systems as follows:

for 904-912 and 918-926 MHz -- maximum 8 MHz  
for 902-904 and 926-928 MHz -- maximum 2 MHz  
for 912-918 MHz -- maximum 6 MHz<sup>195</sup>

MobileVision supports the maximum bandwidths proposed while Pinpoint opposes limiting the maximum permissible bandwidth within the 902-928 MHz band.<sup>196</sup> In conformance with the band plan we have adopted, we are adopting maximum permissible bandwidths as follows:

For Multilateration systems:

for 904.000-909.750 MHz -- maximum 5.750 MHz  
for 919.750-921.750 MHz -- maximum 2.000 MHz  
for 921.750-927.300 MHz -- maximum 5.750 MHz<sup>197</sup>  
for 919.750-927.750 MHz -- maximum 8.000 MHz<sup>198</sup>

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<sup>192</sup> MobileVision comments at 50; SBMS comments at 24.

<sup>193</sup> Teletrac comments at 49.

<sup>194</sup> Id.

<sup>195</sup> Notice at para. 30, 8 FCC Rcd. 2502, 2507 (1993).

<sup>196</sup> MobileVision Comments at 49; Pinpoint Comments at 23-26.

<sup>197</sup> This includes 5.5 MHz multilateration bandwidth and adjoining, associated 0.25 MHz forward link.

<sup>198</sup> This bandwidth capability only exists for licensees aggregating the ad.. 2 MHz and 5.5 MHz multilateration bands and includes the adjoining, associated forward link bands.

For Narrow Band Links:

for **927.250-927.500** MHz -- maximum 250 **kHz**  
for **927.500-927.750** MHz -- maximum 250 **kHz**  
for **927.750-928.000** MHz -- maximum 250 **kHz**

For Non-multilateration systems:

for 902.000-904.000 MHz -- maximum 2.000 **MHz**  
for **909.750-921.750** MHz -- maximum 12.000 **MHz**

While we establish these maximum permissible bandwidths, applicants for non-multilateration LMS systems should request only the minimum amount of bandwidth necessary to meet their operational needs.

**91. Frequency Tolerance.** We proposed a frequency tolerance for transmitters in the 904-912 and 918-926 **MHz** bands of 0.0005 percent and proposed that no minimum **frequency** tolerance be established for transmitters in the **902-904**, 912-918, and 926-928 **MHz bands**.<sup>199</sup> The frequency tolerance for these systems would be specified on the station's authorization. **MobileVision**, SBMS, Mark TV, and Hughes support the proposed frequency **tolerance** of 0.0005 percent for multilateration systems and support having no specific **frequency** tolerance for non-multilateration systems.<sup>200</sup> Teletrac argues that tighter frequency tolerances are required and recommends a tolerance of 0.00025 percent for both multilateration **and** non-multilateration **systems**.<sup>201</sup> We agree with Teletrac that tighter frequency tolerances **are** justified to help reduce the **potential** for interference to systems operating on adjacent **frequencies** and that this argument **extends** to non-multilateration as well as multilateration systems. Additionally, as Teletrac points out, the frequency **tolerance it has proposed is more liberal than that required for other services in the 900 MHz band**. Accordingly, we are adopting a frequency tolerance of 0.00025 percent for both multilateration and non-multilateration systems.

**92. Effective Radiated Power.** We proposed a maximum peak effective radiated power (**ERP**) for any **LMS** systems operating in the **902-928** **MHz** band of 300 **watts**.<sup>202</sup>

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<sup>199</sup> Notice at para. 30, 8 FCC Rcd. 2502, 2507 (1993).

<sup>200</sup> **MobileVision** comments at 49; SBMS **comments** at 24; Mark **IV** **comments** at 13; Hughes comments at 13.

<sup>201</sup> Teletrac **comments** at 49.

<sup>202</sup> Notice at para. 30, 8 FCC Rcd 2502, 2507 (1993). The current maximum power for multilateration systems is 1 **kW** peak envelope power (**PEP**) transmitter output **power**. See existing 47 C.F.R. § 90.239(e)(2)(i).

SBMS supports our proposed 300 watt peak **ERP**.<sup>203</sup> **MobileVision** opposes any reduction in permissible power. AT&T and Hughes support a 30 watt ERP power limit for **non-multilateration** systems with 10 meter and 15 meter antenna height restrictions **respectively**.<sup>204</sup> **Amtech** and Pinpoint support various power limits for different systems based a shared use of the entire **band**.<sup>205</sup> Mark IV supports a field strength limit of 1 **mV/m** at 3000 meters with a maximum antenna height of 10 meters for non-multilateration systems rather than a limit on peak **ERP**.<sup>206</sup>

93. As discussed **earlier**,<sup>207</sup> we will limit the maximum ERP of multilateration LMS system narrowband forward links, which operate between 927.250-928.000 MHz, to 300 watts. However, we will limit maximum power for **transmissions** of multilateration system base and mobile stations outside the **927.250-928.000** MHz sub-band to 30 watts maximum ERP. Limiting base and mobile stations' power levels will reduce the potential for interference between co-channel multilateration systems<sup>208</sup> and **will** reduce the likelihood of interference to any other operations in the **902-928** MHz band. In addition, we are limiting the peak ERP of non-multilateration systems to 30 watts and limiting the antenna height above ground of these systems to 15 meters. Reducing the maximum power and antenna height of non-multilateration systems will allow non-multilateration systems to share spectrum more easily with other non-multilateration systems **and** with users of Part 15 devices and **will permit greater frequency reuse for these systems**.

94. currently, facilities authorized in the private radio services are categorically excluded from our rules **requiring** an environmental **assessment** to demonstrate that a facility complies with **standards concerning** human exposure to radiofrequency radiation. (See Second Report and Order, in Gen. Docket No. **79-144**, **2 FCC Rcd** 2064 (1987); and Erratum to FCC Rcd 12-526 (1987).d for **evaluating** the environmental effects of radiofrequency radiation, however, are **currently** under review in **ET** Docket No. 93-62 (See Notice of Proposed Rule Making, ET Docket No. **93-62**, **8 FCC Rcd**. No. 93-62 (1993)). In that proceed@ we note that some of the current categorical exclusions may be inconsistent with the **new guidelines** being **considered**. We wish to emphasize here that **LMS** systems will be **required** to **comply** with any **requirements** adopted in **ET Docket** No. 9342.

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<sup>203</sup> SBMS comments at 24.

<sup>204</sup> AT&T **comments** at 7-8; Hughes **comments** at 7-9.

<sup>205</sup> **Amtech** **comments** at 33-3s; Pinpoint **commas** at 31-34.

<sup>206</sup> **Mark IV** **comments** at 13.

an See discussion of Forward Links, **paragraphs** 73-76.

<sup>208</sup> We **contemplate** that this issue will have **significance** in **MTAs** where **exclusive** LMS licensees must co-exist with **grandfathered** LMS licensees.



#### 95. Interference Criteria for Co-Channel Multilateration Licensees.

Exclusive MTA multilateration LMS licensees and co-channel grandfathered multilateration LMS licensees must not **interfere** with one another. Similarly, exclusive MTA multilateration **LMS** licensees must also ensure that they do not cause interference to exclusive co-channel **MTA licensees in adjacent MTAs**. To **help** reduce the likelihood for interference between adjacent MTA licensees, we will impose a 47 **dBuV/m** field strength limit at the MTA boundary on signals transmitted from the base stations of **MTA licensees**.<sup>209</sup> If differences arise over whether interference has been caused, we will expect the particular licensees to cooperate with one another to resolve these disputes. Should the Commission have to become involved in any disagreements among licensees, we may employ a wide variety of tools to resolve such disputes.<sup>210</sup> These tools **could** include, but are not limited to, **requiring** use of a common controller or **mandating** a particular time sharing arrangement. If, however, we determine that an **LMS** licensee has not cooperated in developing a suitable **mechanism to minimize harmful** interference, or that a licensee's system design renders it **extraordinarily** sensitive to **interference**, we may authorize the other licensee to operate its LMS system regardless of **interference** caused to the **LMS** system that failed to cooperate or that has a system design highly susceptible to **interference**.

**96. Emission Mask.** We proposed that emissions anywhere within a licensee's authorized bandwidth not be **required** to be attenuated but that any emissions outside of the authorized bandwidth be attenuated by at least  $55 + 10\log(P)$  dB where P is the highest emission (in watts) of the transmitter inside the authorized **bandwidth**.<sup>211</sup> This requirement applies to both multilateration and non-multi&ration systems. We also requested comment on whether multilateration systems should be required to **distribute** power evenly throughout

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<sup>209</sup> We note that in adopting this 47 dBuV/m limit, we are not determining that this field strength will **necessarily** result in reliable service for all **multilateration** systems. It is merely a level that may not be exceeded by **MTA** licensees and **is** thus **established** for interference planning purposes only. (**see Second Report and Order, Amendment** of the Commission's Rules to Establish New Personal Communications Services, GEN Docket No. 90-314, FCC 93-451, released **October 22, 1993** at paragraph 177).

<sup>210</sup> Disputes over harmful interference (as descrii in **Section 90.173(b)** of our Rules) are typically resolved on a **case-by-case** basis. For these services, while absolute blocking of a licensee's **transmissions throughout a large region** would constitute the only clear-cut **case of** harmful interference (**see** Section 90.7 for definition of harmful **interference** under 47 C.F.R. Part 90), it is Possible that **lesser degrees** of interference could **diminish** the **accuracy** or reliability of certain **multilateration systems in a** limited portion of a system's area of operation. The degree to which lesser **amounts** of **interference** would be considered harmful cannot be **determined** in advance, and there can be no **guarantee** that licensees will be **unconditionally protected** from interference of this type. Because of these unique **characteristics** of multilateration systems, we decline to specify what will be considered to **constitute** harmful interference to such systems.

<sup>211</sup> **Notice** at para. 30, 8 FCC Rcd. 2507 (1993).

their authorized band.<sup>212</sup>

97. Mark IV M-IS was the only **commenter** that supports a requirement that power be evenly distributed across a licensee's authorized bandwidth. Both Mark IV **IVHS** and Teletrac believe that only emissions outside of the **902-928 MHz** band (rather than any emissions outside of a licensee's authorized bandwidth) should be attenuated by  $55 + 10\log(P)$  dB. Mark IV **IVHS** would require that frequencies outside of the licensee's authorized bandwidth only be attenuated by  $30 + 10\log(P)$  dB, while Teletrac would just require that 99 percent of the power be within the licensee's **authorized** bandwidth. **MobileVision** would require that spurious spread spectrum emission should not exceed  $100 + 10\log P$  dBW/Hz and the level of any spurious discrete emission could not exceed  $55 + 10\log P$  dBW. **SBMS** would merely require that the first side-lobe be 20 dB below main lobe and each following side-lobe be progressively reduced by 10 dB out to the third lobe. **Amtech** and Pinpoint provide recommendations for various power, height and emissions limits for different systems and supports establishment of robustness and sharing requirements.

98. We will require licensees to attenuate their emissions by  $55 + 10\log(P)$  dB at the edges of the specified LMS subbands. The licensed **frequency** band edges for multilateration systems for which emissions must be attenuated are 904, 909.75, 919.75, 921.75, 927.50, **927.75 and 928 MHz**. If the 919.75-921.75 **and 921.75-927.25 MHz subbands** are aggregated by a single licensee, the emission mask limitations at the band edges at 921.75 and 927.50 **MHz** may be ignored. The licensed **frequency** band edges for non-multilateration systems for which emissions must be attenuated are 902, **904**, 909.75 and 921.75 MHz. These emission limitations will assure that multilateration and non-multi&ration systems will not interfere with each other and that operations below 902 **MHz** and above 928 MHz are protected.

#### IV. CONCLUSION

**99.** Given the plethora of diverse users that share the **902-928 MHz** band, this has been an especially difficult proceeding. While we strongly support and wish to encourage the continued development **and** deployment of an **LMS industry**, we also recognize the valuable services being provided by other users of this **spectrum**. We believe that the rules we have adopted herein fairly balance these diverse interests. While we have not been able to satisfy **all of the concerns** of **all** of the parties in this proceeding, we reviewed extensive **comments and replies to the Notice as well as a very large number of ex parte filings in this docket and serious** consideration was given to each position. Given the diverse and often mutually exclusive **interests** of the many parties that participated, our decisions were the best that could be achieved. The rules **will** allow for the continued growth of **LMS services and**

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<sup>212</sup> **Id.**

advance Congress' goal of developing an intelligent transportation system infrastructure. At the same time, we have attempted to ensure that other users of the band, including Amateur operators and users of Part 15 devices, will be able to co-exist with LMS.

100. We have taken the long-term beneficial action of creating the Transportation **Infrastructure** Radio Service. By creating this new **service** at this early date in ITS development, we will be able to take an organized approach to regulating spectrum and services related to ITS and transportation infrastructure in general.

## **V. FINAL REGULATORY FLEXIBILITY ANALYSIS**

101. Pursuant to the Regulatory Flexibility Act of 1980, the Commission's final analysis is as follows:

### **Need and Purpose of the Action**

102. The rules adopted herein will enhance use of the **902-928** MHz band for location and monitoring systems. These rules replace the existing interim rules that govern automatic vehicle monitoring systems. The new rules create a more stable environment for **LMS** system licensees and provides much needed flexibility for operators of such systems.

### **Issues Raised in Response to the Initial Regulatory Flexibility Analysis**

103. **There** were no comments submitted in response to the Initial Regulatory Flexibility Analysis.

### **Significant Alternatives Considered and Rejected**

104. All significant alternatives are **discussed** in this **Report** and Order.

## **VI. PAPERWORK REDUCTION**

105. The proposal contained herein has been analyzed with respect to the Paperwork Reduction Act of 1980 and found to contain no new or modified form, information collection and/or record keeping, labeling, disclosure, or record retention requirements; and will not increase or decrease burden hours imposed on the public.

## VI. ORDERING CLAUSES

**106.** Accordingly, IT IS ORDERED that, **pursuant** to the **authority of Sections 4(i), 302, 303(r), and 332(a)(2)** of the Communications **Act** of 1934, as amended, 47 U.S.C. §§ 154(i), 302, 303(r), and 332(a), Parts 2 and 90 of the Commission's Rules, 47 C.F.R. Parts 2 and 90, ARE AMENDED as **set** forth in **Appendix A** below, effective [thirty days after publication in the **Federal** Register].

**107.** The Petition for Rule Making filed on January 13, 1994 by the American Radio Relay League IS DENIED.

**108.** For **further** information **concerning** this **Report and Order**, contact Thomas S. Dombrowsky, Martin D. **Liebman** or **John J. Rorkowski** of the Wireless Telecommunications Bureau at (202) 418-0620.

## FEDERAL COMMUNICATIONS COMMISSION

**William F. Caton**  
**Acting Secretary**

## Appendix A

Parts 2 and 90 of Chapter I of Title 47 of the Code of Federal Regulations are amended as follows:

### **PART 2 - FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS**

1. The authority citation for Part 2 continues to read as follows:

Authority: Sec. **4, 302, 303, and 307** of the Communications Act of 1934, as amended, 47 U.S.C. Sections **154, 154(i), 302,303,303(r), and 307**, unless otherwise noted.

2. Section 2.106 is amended by adding "Private Land Mobile (90)" to the FCC use designators in the entry for **902-928** MHz in the table and by revising footnotes US218 and US275 to read as follows:

#### **§ 2.106 Table of Frequency A&cations**

\* \* \* \* \*

<b>International table</b>	<b>United States table</b>	<b>FCC use designators</b>
* * *	Government Non-Government	R&part(s) <b>Special-use frequencies</b>
* * * * *		
* * *	<b>902-928 RADIOLOCATION</b>	<b>902-928</b> Private Land 915 $\pm$ 13 MHz Mobile (90) Industrial, Amateur (97) scientific, and medical frequency.
	<b>707</b> US215 US218 US267 US275 <b>G11 G59</b>	<b>707</b> US215 US218 US267 US275

\* \* \* \* \*

US218 The band 902-928 MHz is available for Location and Monitoring Service (**LMS**) systems subject to not causing harmful interference to the operation of all Government Stations authorized in these bands. These systems must tolerate interference **from** the

49. The plan also accommodates the needs of non-multilateration systems by providing a total of 14 MHz for such systems rather than the 10 MHz of spectrum proposed in the Notice (see footnote 98, supra). Of this 14 MHz, 10 MHz is contiguous spectrum at 909.750-919.750 MHz that is not shared with multilateration systems, which should address the spectrum requirements of most non-multilateration systems.” In addition, non-multilateration systems may obtain up to a 12 MHz block of contiguous spectrum by also using the 2 MHz of spectrum at 919.750-921.750 MHz (Band D). Although this 2 MHz block will be shared on a co-equal basis with multilateration systems, it will nonetheless provide opportunities for non-multilateration systems that require additional spectrum to operate effectively.<sup>123</sup>

## F. Geographic Areas for Exclusive Licenses

50. In the Notice, we sought comment on how to license spectrum to multilateration LMS systems.<sup>124</sup> In the Notice of Proposed Rulemaking in PP Docket No. 93-253, we asked for comment on the appropriateness of awarding LMS licenses through competitive bidding.<sup>125</sup> Finally, after adopting the Notice in this docket, we sought specific comment on certain alternative licensing aspects, such as the use of Basic Trading Areas (BTAs) in defining the license service area.<sup>126</sup>

51. Teletrac favors BTAs over MSAs/RSAs for multilateration LMS licensing “because the coverage area customers seek for tracking and emergency services extends

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<sup>121</sup> Licensees may not be authorized to operate on more than one of the multilateration bands in a given MTA, except that they will be permitted to aggregate Bands D and G and Bands E and F.

<sup>122</sup> Mark IV has indicated that its non-multilateration systems can operate in the 912-918 MHz range. Comments of Mark IV dated June 29, 1993, at 8-10. MFS/TI has indicated that “it may be possible for AVI (non-multilateration) technologies to operate in as little as 10 MHz of (contiguous) bandwidth.” Comments of MFS/TI dated August 12, 1994, at 8.

<sup>123</sup> See Amtech comments at 9. Amtech states that two-way data transmission between a moving vehicle and a fixed location will require large bandwidths. See also TI/MFS ex parte comments filed December 2, 1993, at 5 and Hughes comments at 6.

<sup>124</sup> See Notice of Proposed Rule Making, PR Docket No. 93-61, 8 FCC Rcd 2502 (1993) at paragraph 21.

<sup>125</sup> See, Notice of Proposed Rule Making, PP Docket No. 93-253, 8 FCC Rcd 7635, para 145, n. 153 (1993).

<sup>126</sup> See Public Notice, DA 94-129, PR Docket No. 93-61, 59 Fed.Reg. 7239 (February 15, 1994).

beyond city limits to the broader metropolitan area where people are likely to commute, conduct business, or routinely drive."<sup>127</sup> SBMS favors **MSAs/RSAs** over **BTAs** because, it claims, (1) the Commission has had favorable experience with **MSAs/RSAs** in licensing cellular systems, (2) **BTAs** do not coincide with cellular service areas, to the detriment of cellular entities that are would-be LMS providers, (3) **MSAs/RSAs** are widely known and easily ascertainable, and (4) no private party or entity has ever attempted to control dissemination of maps or listings which depict or define these **areas**.<sup>128</sup> SBMS also argues that allowing existing licensees to expand to the borders of their **BTAs** could have anti-competitive implications.<sup>129</sup> Symbol Technologies believes that choosing **BTAs** for **LMS** would result in a congruency of service areas for LMS and PCS that would allow LMS providers to be de facto PCS providers and directly compete with **PCS**.<sup>130</sup>

52. We generally agree with Teletrac's view that the geographic scope of **LMS** systems logically correlates to areas in which there are centers of consumption of durable goods. We also find, however, that LMS has the potential to serve larger areas; vehicle location and monitoring will be useful for the individual motorist and for fleets of vehicles, and for short-range travel as well as long-range travel. For this reason, we conclude that Major Trading Areas (**MTAs**) as defined in the 1993 Rand McNally Commercial Atlas and Marketing Guide<sup>131</sup> and four additional MTA-like service **areas**,<sup>132</sup> unlike the smaller **BTAs**, provide a more suitable regulatory construct for multilateration licensing. While it is clear that multilateration systems will benefit from being centered upon areas of commerce and trade, use of **MTAs** will give systems greater capacity to accommodate large numbers of prospective users of location services. This will promote competition, encourage the advancement of new technologies, and result in better and speedier service to the public. We will thus provide for one exclusive multilateration system license in each MTA in the sub-bands identified for exclusive assignments (i.e., Bands B and H, D and G, and E and F). Multilateration licensees on these exclusive assignments will be allowed to construct stations anywhere within their **MTAs**, subject to technical and operational considerations discussed in paragraph 87-98, infra.

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<sup>127</sup> Comments of **PacTel Teletrac** dated March 15, 1994, at 8.

<sup>128</sup> Comments of SBMS dated March 15, 1994, at 5. SBMS makes reference to "**PCIA**, Rand McNally Settle **Out-of-Court** On Use of **BTA/MTA** Listings," **Washington Telecom** Week, February 18, 1994, at 2-3.

<sup>129</sup> **Comments** of SBMS dated March 15, 1994, at 14-16.

<sup>130</sup> **Comments** of Symbol Technologies, Inc. in Response to the Public Notice of February 9, 1994, at 7-8 (note 9).

<sup>131</sup> See footnote 23, supra.

<sup>132</sup> See footnote 24, supra.

## G. Competitive Bidding for Exclusive Multilateration LMS Licenses

53. In response to the Notice of Proposed Rule Making in PP Docket No. 93-253, we received comment on the issue of whether mutually exclusive applications for AVM systems should be resolved by competitive **bidding**.<sup>133</sup> Teletrac and SBMS oppose use of competitive bidding to license in this service. These parties contend that the statutory requirement that auctionable spectrum be exclusively assigned and principally used to serve paying subscribers is not met because LMS operations are secondary to ISM and Federal Government use of the band. **Amtech** and Pinpoint, who oppose competitive bidding for **LMS** licenses for other reasons, argue that **LMS's** secondary status does not in and of itself statutorily preclude competitive bidding.

54. In the Second Report and Order in PP Docket No. 93-253, we concluded that it was premature to authorize competitive bidding for AVM systems during the **pendency** of PR Docket No. **93-61**, because "the likelihood of mutually exclusive applications" was unknown or was debated by the commenters.<sup>134</sup> However, in light of our decision to grant exclusive multilateration LMS licenses within three sub-bands, and because they will be used to offer for-profit, subscriber-based services, we conclude that competitive bidding should be used to grant exclusive licenses where mutually exclusive applications are accepted for filing. Use of competitive bidding in such cases meets the general statutory criteria for auctioning licenses set forth in Section **309(j)(2)** of the Act.<sup>135</sup> The statute permits auctions where: (1) mutually exclusive **applications** for initial licenses or construction permits are accepted for filing by the Commission; (2) the principal use of the **spectrum** will involve, or is reasonably likely to involve, the receipt by the licensee of compensation **from** subscribers in return for enabling those subscribers to receive or transmit communications signals utilizing the licensed frequencies; and (3) the public **interest** objectives of Section **309(j)** would be served by subjecting mutually-exclusive applications in the service to competitive **bidding**.<sup>136</sup>

55. We conclude that the above **requirements** are satisfied, thus making competitive bidding available for licensing within certain band segments. First, in accordance with the statute, the licensing scheme we adopt herein allows for mutual exclusivity among applicants for initial licenses. Specifically, we have rejected the option of allowing multilateration LMS

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<sup>133</sup> Several **commenters** to that **proceeding** oppose grant of non-multilateration licenses by competitive bidding. See, e.g., Comments of Hughes Transportation Management, Interagency Group and **Amtech**.

<sup>134</sup> See **Second Report and Order**, PP Docket No. **93-253**, 9 FCC **Rcd** 2348, 2351-2, (1994).

<sup>135</sup> See 47 U.S.C. § 309(j)(2). See also H.R. Rep. 111, 103d **Cong.** 1st **Sess.** 254 (1993).

<sup>136</sup> A comprehensive discussion of these principles for **determining** whether licenses may be auctioned is set forth in the **Second Report and Order** in PP Docket No. **93-253**, 9 FCC **Rcd** 2398 (1994) at **paras. 11-67**.



systems to operate in an unlimited shared use environment and have instead decided to grant only one licensee the use of each of three sub-bands for **multilateration** LMS in each MTA. (see paragraphs ~~44-46~~, ~~infra~~) We do not believe that the likely existence of some grandfathered AVM multilateration operations alters this conclusion. See **para. 61**, **infra**. Because no more than one multilateration licensee will be permitted in any single sub-band in an MTA (hereinafter “MTA licensee”), we anticipate that mutually exclusive applications will be **filed**. We also conclude that the use of the spectrum by other services does not preclude the applicability of the competitive bidding process. Shared spectrum for which we exclude competitive bidding is “where mutual exclusivity between applications **cannot** exist because channels must be shared by multiple licensees.. . . [W]e proposed to exclude these services from competitive bidding because there can be no mutual exclusivity.”<sup>137</sup> That is not the case here, where in all likelihood there will be mutually exclusive applications for each exclusive MTA license. The relevant statutory prerequisite, as set forth in Section **309(j)** of the Budget Act, is that “mutually exclusive applications are accepted for filing.” This standard does not require that the relevant spectrum be completely unoccupied by other services.

56. Second, as the statute requires, the “principal use” of the spectrum is reasonably likely to involve MTA licensees receiving compensation from subscribers in return for those subscribers receiving or transmitting signals. We have concluded that this requirement allows us to evaluate classes of licenses, rather than individual licenses, in **determining** the “principal use” of spectrum.<sup>138</sup> Thus, while MTA licensees may be secondary in the band to government and ISM operations, the “principal use” test, as we have interpreted it, permits us to conclude that the principal uses of **multilateration** LMS are primarily subscriber-based offerings.<sup>139</sup>

57. In addition, we believe that use of a competitive bidding procedure for the licensing of these services satisfies the public interest objectives for auctioning set forth in Section **309(j)(3)** of the Act. Specifically, use of competitive bidding to award MTA licenses, as compared to other licensing methods, will speed the development and deployment of new services to the public with minimal **administrative** or judicial delays, and encourages efficient use of the spectrum as **required** by Section 309(j)(A) and **(D)**. Furthermore, in accordance with Section **309(j)(3)(B)**, we believe that competitive bidding will promote access to multilateration services and technologies and disseminate licenses among a wide variety of applicants by encouraging participation by all interested or qualified bidders. Finally, we conclude that competitive bidding will recover for the public a portion of the value of the

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<sup>137</sup> In **the** Matter of Implementation of Section 309(j) of the Communications Act – **Competitive Bidding**, Second Report and Order, PP **Docket** No. 93-253, 9 FCC **Rcd** 2348 at **para. 13** (1994).

<sup>138</sup> **See** Second Report and Order in PP Docket N. 93-253, FCC **94-61**, 9 FCC **Rcd** 2348 at **para. 34** (1994).

<sup>139</sup> Comments of Pinpoint at 5; Comments of SBMS at 4.

**spectrum**, as envisioned in Section 309(j)(3)(C). Specific rules and procedures for competitive bidding for this spectrum, including rules and procedures for designated entities, will be established in a separate proceeding. We will not accept applications for multilateration **LMS** licenses until after these rules and **procedures** have been established.

## H. Construction Period for LMS Systems

58. In the Notice, we proposed that LMS systems be **constructed** and placed in operation within eight months of the date a license is granted, which is the current **standard** for AVM licensees under Part 90.<sup>140</sup> The majority of commenters that addressed this issue support our proposal so long as provision is made for extended implementation periods for local governments or especially large and complex **systems**.<sup>141</sup> **MobileVision** supports a **five-year** construction period with **construction** benchmarks for multilateration systems but states that eight months is appropriate for non-multilateration **systems**.<sup>142</sup> **SBMS** supports a **12-month construction period**.<sup>143</sup>

59. Most non-multilateration **installations** use relatively few transmitters in a limited number of locations. Accordingly, we shall retain the current **requirement** that these systems be **constructed** and placed in operation within eight months. We will consider a **non-multilateration** LMS system to be **constructed** and placed in operation if at least one base station has been constructed and the system is providing service to at least one mobile radio **unit**. As they may do **currently**, a local government entity **requiring** more than eight months to construct a non-multilateration LMS system because of the system's **size** and complexity can request extended implementation in accordance with Section 90.155(b) of our Rules.

60. We **recognize** that multilateration LMS systems, because they will be **licensed** on an MTA basis, will likely be larger and more complex **than** non-multilateration LMS systems. Rather than imposing benchmarks and reporting **requirements** on these systems for all or part of their license term, we will require a multilateration LMS licensee **authorized** to operate throughout an MTA to construct a sufficient number of base stations that utilize multilateration technology to provide multilateration location service to a **substantial** portion of at least one BTA in that MTA within twelve months after initial **authorization**.<sup>144</sup> LMS

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<sup>140</sup> Notice at para. 26, 8 FCC Rcd. 2502, 2507 (1993). See 47 C.F.R. § 90.155.

<sup>141</sup> **Hughes comments** at 15; **Amtech comments** at 35-36; **Mark IV comments** at 14; **IVHS America comments** at 19; **Interagency Group comments** at 10.

<sup>142</sup> **MobileVision** comments at 4649.

<sup>143</sup> **SBMS** comments at 22.

<sup>144</sup> **This requirement** is comparable to the **substantial service requirement** for 10 MHz PCS licensees set forth in Memorandum Opinion and Order, GEN Docket No. 90-314, 9 FCC Rcd 5108,

systems not constructed and placed in operation in a timely fashion (i.e., within 8 months for non-multilateration systems and within twelve months, as described above, for **multilateration** systems) will cancel automatically.

### **I. Grandfathering Provisions for Existing Multilateration AVM Licensees**

61. As of February 3, 1995, we will no longer accept applications for the operation of multilateration **LMS** systems in the **904-912** and 918-926 MHz bands under our current rules. To ensure that our new licensing scheme does not impose undue hardship on existing, operating multilateration AVM systems, we will adopt certain grandfathering provisions which will allow them to continue to operate their systems under the current rules. We will also confer grandfathering provisions on **multilateration** AVM licensees who have not yet constructed their systems so that such licensees may construct and operate their licensed stations **under** our newly adopted rules.

62. A grandfathered multilateration AVM station will be considered constructed and placed in operation if it is built in accordance with its authorized parameters and is regularly interacting with one or more other stations to provide location service, using multilateration technology, to one or more mobile units. See 47 C.F.R. § 90.155. Specifically, **LMS** multilateration stations will only be considered **constructed** and placed in operation if they are part of a system that can interrogate a mobile, receive the response at 3 or more sites, compute the location from the time of arrival of the responses and transmit the location either back to the mobile or to a subscriber's fixed site. A **grandfathered multilateration** AVM station will receive no protection or exclusivity based upon mileage separation or service area criteria, but instead will operate on a **co-equal** shared basis with stations of any other grandfathered licensee or the exclusive MTA licensee operating in the same sub-band. We have concluded that sharing of **spectrum** among **unlimited** numbers of multilateration licensees is not technically feasible (see paragraph 44, supra), and thus we have not adopted rules that would permit the sharing of **spectrum** among multiple multilateration systems over an entire **MTA**. However, given the very small number of multilateration licensees **currently** authorized, in any given MTA there will ultimately be, at most, one or two **grandfathered licensees operating in the same spectrum as the eventual MTA licensee**. In such limited cases, we expect cooperative arrangements for sharing among these licensees to be reached. Where this is not possible or achieved, MTA licensees may build their systems in areas **geographically** removed from grandfathered stations, or may attempt to acquire existing systems **from** the grandfathered **licensee(s)** in their licensed area.

63. To attain grandfathered status, existing multilateration AVM licensees must **file**, within thirty days of the effective date of the rules adopted in this **Report and Order**, applications to modify their licenses to comply with the new band plan. These applications to modify must **identify** which new sub-band or sub-bands (*i.e.*, Band B and H, Band D and

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¶ 155 (1994).

G, or Band E and **F**) they intend to operate their licensed multilateration AVM stations in, once their applications to modify have been authorized. We will not restrict multilateration AVM licensees to selecting a particular sub-band or sub-bands for their modified authorization, but will permit these licensees to choose the **spectrum** band(s) -- not to exceed a total of 8 MHz -- that best meets with their future **LMS** requirements. The application to modify a license to comply with the new band plan may also include a modification to specify an alternate site, so long as the alternate site is 2 kilometers or less from the site **specified** in the original license.<sup>145</sup> Further, at the time that existing multilateration AVM licensees **file** these applications to modify, they **must** certify that either (1) their multilateration AVM system has been constructed and is operational as of February 3, 1995, or (2) that it is not constructed at that time. Multilateration AVM systems that **are** constructed and operational as described above will be given until April 1, 1998 to convert to the spectrum identified in their modified LMS system license. Such licensees may continue to operate their multilateration AVM systems under either the old rules or the new rules during the process of converting their systems during this period. Licensees of constructed and operational multilateration AVM systems that do not file applications to modify within **this 30-day** period will be permitted to continue operations under the provisions of Section 90.239 **until April 1, 1998** or the end of their original license term, whichever occurs first, at which time such licenses **will** cancel **automatically** and will not be renewed.

64. Multilateration AVM licensees for stations not constructed as of February 3, 1995 must construct and operate their modified LMS systems on the spectrum identified in their modified **LMS** system license by April 1, 1996. These licensees will not be allotted the lengthy transition period that licensees of constructed and operational systems are provided (i.e., until April 1, 1998) because they do not have an existing, operating **infrastructure** that will require this additional time for conversion. Licenses for stations not constructed under the old rules as of February 3, 1995 will terminate 30 days after the effective date of the new rules unless timely applications to modify are **filed**. Parties may **file** applications to modify those licenses that they plan to construct by April 1, 1996.<sup>146</sup> We have provided a transition period that we believe is appropriate for construction and operation for current licensees to attain grandfathered status. Because this spectrum will be subject to competitive bidding, we must balance our wish to accommodate the desired construction schedules of existing **multilateration** AVM licensees against the need for prospective bidders to be able to evaluate the likely value of the spectrum upon which they will be bidding.

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<sup>145</sup> See generally **Implementation** of Sections 3(n) and 332 of the Communications Act, **Regulatory Treatment** of Mobile Services, GN Docket No. 93-252, PR Docket No. 93-144, PR Docket No. 89-553, Third Report and Order, FCC 94-212, released Sept. 23, 1994, at **para.** 356.

<sup>146</sup> We note that **Airtouch** and **Mob&vision** have offered to limit the number of licenses they **construct** to 20 percent of the **unbuilt** licenses they hold. **While** we are not adopting this 20 percent limit, we expect **all** licensees to **file** modification applications only for those **unbuilt** licenses that **realistically can be constructed** by April 1, 1996. If the number of modification applications submitted **significantly** varies from the number **built**, we **will** consider appropriate **measures**.

## J. Licensing of Non-Multilateration Systems

65. We proposed that non-multilateration systems be licensed in the **902-904**, 912-918, and 926-928 MHz bands.” Mark IV believes that 6 MHz of contiguous spectrum at 912-918 MHz is sufficient for its type of system.<sup>148</sup> MFS Network Technologies/Texas Instruments recommend 12 or 14 MHz of contiguous spectrum for non-multilateration systems, but indicate that 10 MHz may be **sufficient**.<sup>149</sup> **Amtech** states that a minimum of 12 MHz of contiguous spectrum is required for non-multilateration systems, because these systems need 6 MHz wide channels and two such channels are necessary for high-speed operation at most toll booth locations.”

66. We also proposed that non-multilateration systems be licensed on a shared basis with licensees responsible for coordinating use to avoid **interference**.<sup>151</sup> Lockheed proposes licensing of non-multilateration systems based on a fixed mileage **separation**.<sup>152</sup> Mark IV supports the use of frequency coordinators to coordinate the assignment of **spectrum**.<sup>153</sup> **NABER** proposes that it be designated as the frequency coordinator for non-multilateration LMS **systems**.<sup>154</sup> We are adopting our proposal to license non-multilateration LMS systems on a shared basis because these systems generally cover relatively short distances, and licensing based on a **fixed** mileage separation would limit **re-use** of spectrum and thereby limit the potential uses of these systems. We also decline to designate a frequency coordinator for this service. Many non-multilateration licenses have been issued and many stations have been placed in operation without such a formal coordination process and there appear to be no negative consequences. Considering the limited coverage of these systems and the expanded amount of spectrum available under the allocation plan we have adopted, it should not be difficult for non-multilateration systems to share their sub-bands.

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<sup>147</sup> **Notice at para. 25, 8 FCC Rcd. 2502, 2507 (1993).**

<sup>148</sup> **Comments of Mark IV M-IS Division dated June 29, 1993, at 8.**

<sup>149</sup> **Ex Parte comments of MFS Network Technologies/Texas Instruments dated August 12, 1994.**

<sup>150</sup> **Ex Parte Comments of Amtech dated August 12, 1994.**

<sup>151</sup> **Notice at para. 25, 8 FCC Rcd. 2502, 2507 (1993).**

<sup>152</sup> Lockheed comments at 4. Mark IV supported a **fixed mileage** separation in its comments but modified its support in reply comments. Mark IV comments at 8-9, reply comments at 8.

<sup>153</sup> **Mark IV reply comments 8-10.**

<sup>154</sup> **NABER comments at 6-7.**

67. The Interagency Group, with the support of Mark IV, proposes that local governments be able to obtain blanket licenses for non-multilateration **systems**.<sup>155</sup> We decline to adopt a blanket licensing scheme for non-multilateration systems. In a shared use environment, it is important that applicants and other co-channel users know exactly where systems are located if they are to avoid interference. If we issue blanket licenses, it will be difficult for the Commission or the public to ascertain the exact location of LMS transmitters.

68. Finally, we proposed that existing non-multilateration systems licensed to operate in spectrum allocated for use by multilateration systems be required to move their operations within three years of the effective date of any new **rules**.<sup>156</sup> SBMS and Location Services support this proposal.<sup>157</sup> Both Teletrac and **Amtech** favor grandfathering existing **non-multilateration** systems, although Teletrac would only do so for systems licensed prior to the initiation of this **proceeding**.<sup>158</sup>

69. As discussed earlier, we have modified our proposal to provide for shared use of the 902.000-904.000 and **909.750-921.750** MHz bands by non-multilateration LMS systems, thus allocating a total of 14 MHz that will be available for non-multilateration operations. Although a non-multilateration licensee could be **required** to share 2 MHz of this **spectrum** (at 919.750-9X.750 MHz) with an MTA multilateration licensee, we believe that the benefit to those non-multilateration systems **requiring** a minimum of 12 MHz of contiguous **spectrum to operate remains substantial and warrants** this overlap.

70. In addition, because we have concluded that sharing between multilateration and non-multilateration systems is generally inadvisable (see paragraph 46, supra), we are **requiring** that licenses for non-multilateration systems in **spectrum** other than the **902.000-904.000** and **909.750-9X.750** MHz bands must be modified by April 1, 1998, to specify operation solely in those bands and to operate consistent with the rules we are adopting by this **Report and Order**. This is consistent with our decision to require multilateration systems to relocate their operations within the same time period. Similarly, authorizations not so **modified** within this period will cancel automatically.

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<sup>155</sup> Comments of Interagency Group at 12; Reply Comments of Mark IV at 6-8.

<sup>156</sup> **Notice** at para. 16, 8 FCC **Rcd.** (1993).

<sup>157</sup> **SBMS comments** at 12; Location Services at 5.

<sup>158</sup> Teletrac comments at 22-23; **Amtech comments** at 3638.

## K. Multilateration System Operations

71. From review of the lengthy record in this proceeding, we have determined that multilateration systems have two distinct methods of operation. One type of multilateration system utilizes a low power, **wideband** location pulse originating from the mobile units and a high powered, narrowband interrogation and control signal emanating from the **fixed/base** stations. These systems also utilize narrowband transmissions, within the band that is used for the location pulse, for two-way voice and data communications between fixed/base stations and mobile units. Another kind of multilateration system operates in a different manner, utilizing **wideband transmissions** for: the location pulse from the mobiles, the interrogation and control signal from the fixed/base stations and the two-way messaging between the fixed/base stations and the mobile units. As we understand these two types of multilateration systems, there are three basic elements used to accomplish location and monitoring functions: forward links, reverse links and communication links. Forward links originate at the **fixed/base** site and are used to control and interrogate mobile units. In contrast, reverse links are signals transmitted from the mobile units or **fixed** station **to fixed/base** stations to determine the location of the mobiles or from fixed stations to other fixed/base stations for system synchronization and testing purposes. Communication links **connect** fixed/base stations and mobile units and are utilized for two-way messaging related to the location or monitoring functions of the system. In addition, multilateration systems use these three basic elements either in what we will refer to as the “narrowband” or the “broadband” portion of the **LMS** band. The narrowband portion we will define as the 250 **kHz** sub-bands (i.e., the sub-bands **927.250-927.500**, **927.500-927.750** and **927.750-928.000** MHz) and we will define the broadband portion as the **sub-bands 904.000-909.750**, **919.750-921.750** and **921.750-927.250** MHz. Each of the three basic elements are discussed below in accordance with their location in the **narrowband** or broadband portion of the LMS band, along with how they are considered in our overall regulation of multilateration systems.

### Narrowband Segment

#### a) Narrowband Forward Links

72. In the **Notice**, we observed that many multilateration systems are designed using forward links to contact **units** to be located.<sup>159</sup> Consistent with existing systems, we proposed that multilateration licensees authorized to operate in the **904-912** MHz sub-band be licensed to operate their forward links in the 250 **kHz** of **spectrum** between 924.890 and 925.140 MHz and that multilateration licensees authorized to operate in the 918-926 MHz **sub-band** be licensed to operate their forward links in the 250 **kHz** of **spectrum** between 904.375 and 904.625 **MHz**.<sup>160</sup>

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<sup>159</sup> Notice at **para. 19**, 8 FCC **Rcd 2502, 2405** (1993).

<sup>160</sup> Notice at **para. 19**, 8 FCC **Rcd 2502.2505** (1993).

73. Teletrac is the only **commenter** that supports the proposed location of the forward links, claiming that it will be adversely affected otherwise because its systems now employ forward links in the manner proposed in the **MobileVision** favors placing the forward links within a licensee's authorized sub-band rather than in the other multilateration **LMS** sub-band as proposed.<sup>162</sup> Location Services proposes keeping the forward links in the opposite sub-band but would move the links to the edges of each **sub-band**.<sup>163</sup> SBMS prefers that the forward links be placed as far from **wideband** frequencies as practical and assigned exclusively.<sup>164</sup> Pinpoint prefers a **wideband** forward link that operates over an entire multilateration system sub-band.<sup>165</sup> **Amtech** recommends placement of the forward links at the edges of the **902-928 MHz** band or make licensees use alternative spectrum for forward links, such as common carrier or private carrier paging **spectrum**.<sup>166</sup> **Symbol**, **ITRON** and **TIA** urge that multilateration **LMS** forward **links** be placed at the upper edge of the **902-928 MHz** band if Part 15 devices are to be **accommodated**.<sup>167</sup> Other Part 15 commenters expressed fear of being "drowned out" by high powered forward links, particularly **wideband** forward **links**.<sup>168</sup>

74. Although there is no identification of forward links in our current rules, we will define a forward link as any signal transmitted to a mobile unit to be located by a multilateration **LMS** system.<sup>169</sup> We will also dedicate a portion of spectrum in the **902-928 MHz** band where narrowband forward links may be used by the multilateration systems that require them for their operations. Thus, in accordance with our band plan for multilateration systems, multilateration licensees will be authorized to use only the following spectrum for narrowband forward **links**:

The 904.000-909.750 MHz band narrowband forward link is **927.750-928.000 MHz**  
The **919.750-921.750 MHz** band **narrowband** forward link is **927.500-927.750 MHz**

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<sup>161</sup> Teletrac Comments at 51, Reply Comments at 33-35.

<sup>162</sup> **MobileVision** Comments at 43-44.

<sup>163</sup> Location Services Comments at 5-6.

<sup>164</sup> **Ex Parte Comments** of **SBMS**, dated August 12, 1994.

<sup>165</sup> **Ex Parte Comments** of Pinpoint dated September 19, 1994, **Ex Parte** comments of Pinpoint dated September 15, 1994.

<sup>166</sup> **Amtech Comments** at 31-32.

<sup>167</sup> **Further Comments** of **ITRON**, **Symbol** and **TIA** dated August 12, 1994.

<sup>168</sup> **See Itron** comments, dated August 12, 1994.

<sup>169</sup> **See** Section 99.7 of our rules.



The **921.750-927.250** MHz band narrowband forward link is **927.250-927.500** MHz

The placement of narrowband forward links at the upper edge of the **902** to 928 MHz band meets the requirements of the **majority** of the multilateration industry and also accommodates the needs of Part 15 **interests**.<sup>170</sup> We have provided the flexibility requested by these various commenters, with two of the **narrowband** forward links placed in spectrum apart from the **licensee's** multilateration sub-band (e.g., the 927.50-927.75 and 927.75-928 **MHz** forward links) and the third forward **link** (927.25X7.50 MHz) placed adjacent to its related multilateration sub-band.

**75.** Based upon comments from entities that employ narrowband forward links, we believe that 250 **kHz** for each multilateration system is a suitable amount of spectrum for narrowband forward **links**.<sup>171</sup> Furthermore, because narrowband forward **link transmissions** will be situated in the uppermost portion of the 902-928 MHz band -- and thus somewhat removed from the operations of other licensed and unlicensed services in the band -- a relatively greater power level for this use should be permitted. We therefore will allow narrowband forward links to operate with a maximum power of 300 watts ERP.

### Broadband Segment

#### a) **Wideband** Forward Links

**76.** Pinpoint and Uniplex have expressed interest in employing a **wideband** forward link, which, like the narrowband forward link, would be used to communicate with mobile **units**. However, unlike the narrowband forward link, a **wideband** forward link could operate over a multilateration system's entire authorized **sub-band**.<sup>172</sup> Part 15 users uniformly oppose this request on the grounds that such **transmissions** are likely to cause interference to Part 15 devices. **Ittron**, for example, points out that the high powered **wideband** forward link could adversely affect the operations of Part 15 devices because it would "present an essentially constant signal at any particular geographic location."<sup>173</sup> Pinpoint, however, asserts that its

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<sup>170</sup> Ex **Parte** Comments of **Teletrac** dated August 12, 1994; Mobilevision Comments at 4344; Location Services Comments at 5-6; Ex **Parte** Comments of Southwestern Bell dated August 12, 1994; **Amtech** Comments at 31-32; **Further Comments** of **ITRON**, Symbol and **TIA** dated August 12, 1994.

<sup>171</sup> Ex **Parte** Comments of SBMS dated August 12, 1994, Ex **Parte** Comments of **Teletrac** dated August 12, 1994, Ex **Parte** Comments of **MobileVision** dated August 12, 1994.

<sup>172</sup> Ex **Parte** Comments of Pinpoint dated September 19, 1994, Ex **Parte** Comments of Uniplex dated September 30, 1994.

<sup>173</sup> See e.g., Ex **Parte** Comments of **ITRON** Inc. at p. 3, dated August 12, 1994 and Symbol Technologies, dated August 12, 1994.

system, which is based on the use of the **wideband** forward link, would pose far less of an interference **threat** to users of the **902-928** MHz band than that caused by a certain, **currently** deployed Part 15 data distribution system.<sup>174</sup> We will permit the authorization of **wideband** forward links, but note that multilateration operations are conditioned on further testing as described in paragraphs 81-82, **infra**.

#### b) Reverse Links

77. As discussed above, a multilateration signal transmitted **to** the fixed/base stations will be referred to as a "reverse link" and is utilized by both types of multilateration systems. These signals are contained within the broadband segment of the multilateration allotment and are primarily location pulses originating from mobile units **and** used for determination of the position of mobile units. Such **transmissions** may also originate from other fixed/base stations for the purpose of system **synchronization** or testing. These **transmissions** are likely to occur less **frequently** and more randomly than the **above-mentioned** forward links and are therefore less likely to cause interference to Part 15 operations. However, as pointed out by one **commenter**, reverse **link transmissions** could present significant problems to Part 15 operations depending on the power levels, duty cycles and density of mobile **units**.<sup>175</sup> Reverse links are an essential part of any multilateration LMS system and therefore must be **accommodated**. However, in order to limit the potential for interference from such **transmissions**, we will limit the **maximum** power level of reverse links to 30 watts ERP. This is a sufficient amount of power to enable mobile units to provide an adequate signal to fixed sites for location, synchronization **and** testing purposes.

#### c) Communication Links

78. As noted by multilateration service **providers**,<sup>176</sup> there is an additional **transmission** that multilateration systems **utilize** for two-way messaging that we will refer to as a "communication link" The communication link emanates from the fixed/base stations and mobile units ancillary to the location and monitoring function of the multilateration system and provides status **and instructional** information relating to the vehicle beii located or the **occupant(s)** of the vehicle. Additionally, these links may be interconnected with the PSN to enable emergency **communications**.<sup>177</sup> Moreover, the method of **transmission** of the communication link differs **between** multilatention systems, the **differences** centeringonthe

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<sup>174</sup> **See comments** filed by Pinpoint Communications, Inc., dated September 19, 1994.

<sup>175</sup> **See letter from** Metricom, Inc., Alarm Industry Communications committee, Electronic Industries Association, Itron, Inc., Part 15 Coalition, Sensormatic Electronics Corporation, Southern California Edison, and Telecommunications Industry Association., dated August 12, 1994.

<sup>176</sup> **See e.g., Ex Parte Comments** of MobileVision dated December 14, 1994, at 1-2.

<sup>177</sup> **See** paragraphs 26 and 27, **supra**.

size of the channel(s) being used.

i) Narrowband Communication Links

79. Narrowband communication links are used in certain multilateration systems to provide voice and data communications within the broadband portion of their allocation of **spectrum**. Additionally, the narrowband communication link differs from a **wideband** communication link in that it uses small (e.g., 25 **kHz**) channels to accomplish its messaging **functions**. These narrowband **transmissions** are a **valuable** asset and may enhance the economic viability and flexibility of these particular multilateration **systems**.<sup>178</sup> However, as we did for reverse links in order to limit their interference potential, we will also limit the **maximum** power of narrowband communication links to 30 watts **ERP**. This limitation encompasses communication links that originate at fixed/base stations as well as mobiles. Due to the fact that these **transmissions** should only occur sporadically or in the event of an emergency, we believe that this power level should serve to limit interference to Part 15 operations. However, we note that multilateration licenses are conditioned on additional testing as discussed in paragraphs 81-82.

ii) **Wideband** Communication Links

80. Certain multilateration systems use **wideband** communication links, integrated with accompanying **wideband** forward links, to provide messaging within the broadband segment. This **wideband** link differs from narrowband communication links because it transmits a direct sequence spread spectrum signal across the entire sub-band (e.g. all of the 904.000-909.750 MHz sub-band) instead of signals on small channels within the sub-band. Although these links are perceived to represent greater interference potential to Part 15 **devices**,<sup>179</sup> we conclude that these **wideband** links should be authorized. As noted earlier, however, multilateration system licenses are **conditioned** on additional testing as discussed in paragraphs 81-82.

**Testing of Multilateration Systems**

81. **In comments, a number of parties to this proceeding have expressed the desire** and need for additional testing to demonstrate the feasibility of multiple services coexisting in the **902-928** MHz band, in particular the multilateration **LMS** users and the operators of Part 15 devices. Our record contains a **significant** amount of information on the issue of mutual **coexistence** between these parties, which was submitted in the form of theoretical analyses, **demonstrations and testing (See Appendix B)**. **This record shows that certain aspects and** elements of these various systems and services create a greater potential for **interference** than

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<sup>178</sup> **See Ex Parte Comments** of Mobilevision dated **December** 14, 1994, at 5.

<sup>179</sup> **See e.g., Ex Parte Comments** of **Cellnet** and **KNOGO** dated August 19, 1994, at 4.

others.<sup>180</sup> The band plan adopted in this item was crafted on the basis of this extensive record. In addition, these submissions were used to establish technical limitations or criteria on the operations of the various systems, to **minimize** the potential for interference and provide a more conducive environment for sharing of the band by the disparate services.

82. The record of this proceed@ contains **substantial** technical analysis supporting the band plan we now adopt. We are persuaded, however, that additional testing could provide users of the band with data that **could** contribute to "fine-tuning" system operations. Therefore, to ensure that the coexistence of the various services in the band is as successful as possible and to identify whether further **refinements** in our rules are necessary, we will condition grant of each MTA multilateration license on the licensee's ability to demonstrate through actual field tests that their systems do not cause unacceptable levels of interference to Part 15 devices. To provide such protection and to facilitate band sharing and **minimize** interference to Part 15 operations, multilateration licensees may employ any one of a number of technical refinements, i.e., limiting duty cycle, pulse duration power, etc. It is our expectation that such testing be accomplished through close cooperation between multilateration systems users and operators of Part 15 systems.

#### L. LMS Below 512 MHz

83. In the Notice, we proposed that the expanded **definition** of **LMS** would apply to below 512 MHz systems, but that licensees of such systems would not be permitted to provide service to individuals or to provide service on a private carrier basis. NABER is the only commenter that addressed LMS operation below 512 MHz. NABER requests clarification of several points **pertaining** to these systems, including coordination **requirements** and co-channel separation **requirements** between LMS systems and **non-LMS** systems used for voice operations.<sup>181</sup> NABER also notes that proposed Section **90.105(b)(3)(i)** discusses loading criteria for systems operating with single frequencies, two-frequency mode, and pairs of frequencies, but that Section **90.105(b)(3)(ii)** only discusses separation criteria for operations using single **frequencies** or two frequencies. NABER suggests that because the loading criteria are the same, we apply the same separation criteria for single frequency operations to operations using pairs of frequencies.

84. Section 90.175 of our Rules provides that applicants for frequencies below 512 MHz must generally obtain a **frequency** recommendation from a frequency coordinator. We

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<sup>180</sup> Many of these submissions have **focused** on **concerns** regarding the use of **wideband** forward links for multilateration systems, the location of such links in the band, and the **appropriate power levels** for both forward and reverse link **transmissions**.

<sup>181</sup> NABER **comments**. NABER also requests clarification as to the effect our "**Refarming**" proceeding (PR Docket 92-235, Notice of Proposed Rule Making, 7 FCC Rcd 8105 (1992)) will have on LMS systems. No final action has yet been taken in the **Refarming proceeding**. **Ultimately**, LMS **systems** below 512 MHz will have to adhere to any decisions reached in that **proceeding**.

conclude that LMS applicants should be subject to these same coordination **requirements** when applying for these frequencies. Accordingly, applicants for **LMS** systems below 512 MHz must meet the coordination requirement of Section 90.175(a) of our Rules, 47 C.F.R. § 90.175(a). Applicants will use the frequency coordinator for the radio service in which they have established their eligibility. We will also require LMS systems authorized below 512 MHz to modify their licenses under the same conditions as other land mobile licensees. This means that a modification application will have to be **filed** for changes in the number of base, **fixed**, control, or mobile transmitters.”

85. Section **90.105(b)(3)(i)** only discusses using pairs of frequencies in the 470-512 MHz band. Because these **frequencies** are only available within 80 km (50 miles) of 13 major urban areas, applying a 120 km (75 miles) separation **between non-LMS** voice systems and LMS systems would severely restrict **LMS** use of this **spectrum**. Pairs of frequencies in the 470-512 MHz band will be assigned in accordance with the allocation plan for the band as described in Subpart L, 47 C.F.R. Part 90, Subpart L, except that the 200 mobile unit loading criteria will apply and an LMS system will not be authorized to share a channel utilized by a **non-LMS** licensee operating a voice system unless an agreement with the **licensee** is reached. Accordingly, the **co-channel** separation between **LMS** systems and **co-channel non-LMS** voice systems in the 470-512 MHz band will be 64 km (40 miles), except on Channel 15 in Chicago, Channel 20 in Philadelphia, and Channel 17 in Wash&ton where the minimum co-channel separation is 32 km (20 miles). See 47 C.F.R. § 90.313.

86. We also adopt our proposal to extend the definition of **LMS** to below-512 MHz systems. We are not, however, expanding uses of LMS systems below 512 MHz to provide service to individuals or to provide service on a wmmmercial basis. Such commercial uses of **LMS** would be inconsistent with the nature of the spectrum below 512 MHz, which is intended primarily for the use of private **land** mobile radio (**PLMR**) wmmunications to enable private land mobile eligibles to provide for their own internal wmmunications needs. **Moreover**, the frequency bands below 512 MHz on which LMS systems are licensed are shared **PLMR** frequencies. Many of these channels are already unacceptably crowded. We are currently wnsidering rule changes to **increase** channel capacity and promote more efficient use of **PLMS frequencies** below 512 MHz.<sup>183</sup> Permitting LMS systems authorized below 512 MHz to provide service on a **commercial** basis, or to provide service to individuals, would only exacerbate this **spectrum congestion**.

## **M. Technical Issues**

**87.** In the Notice, we proposed a number of technical **requirements** for LMS systems to **minimize** the possibility of both **co-channel** and adjacent-charmel interference and we proposed that equipment be type accepted to ensure compliance with these **standards**. The

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<sup>182</sup> See 47 C.F.R. § 90.135(a).

<sup>183</sup> See Notice of Proposed Rule Making, PR Docket No. **92-235**, 7 FCC **Rcd** 8105 (1992).

following technical criteria will be applied to licensees of LMS systems. Our **proposals**, commenters' responses, and our decisions are discussed below.

**88. Type Acceptance.** We proposed that **LMS** equipment be required to be type accepted.<sup>184</sup> This proposal was supported by Teletrac, **MobileVision**, SBMS, Mark IV, and Location **Services**.<sup>185</sup> Teletrac proposes that we require the equipment to be authorized through the notification process one-year from the adoption date of this **Report and Order**, while SBMS suggests type acceptance after **18-months**.<sup>186</sup> Location Services suggests that licensees be permitted to operate new equipment on a **commercial** basis for 18 months before such equipment must be type accepted.<sup>187</sup> We are adopting our proposal to require type acceptance. We decline to adopt Teletrac's proposal that we only require equipment "notification."<sup>188</sup> Considering the mobile nature of most **LMS** transmitters and that new, advanced technologies will be employed in this equipment, we find that the stricter regulatory oversight of having equipment type accepted rather than "notified" is justified. Accordingly, all LMS equipment imported or marketed after April 1, 1996, must be type accepted for use under Part 90 of our Rules, 47 C.F.R. Part 90. This includes the "transmitting tags" used in certain non-multilateration systems. If, however, these units meet the requirements of Part 15 of our Rules, 47 C.F.R. Part 15, they may be authorized under that Part. **By** delaying the **requirement** for type acceptance, we effectively adopt Location Services' proposal for a grace period in which to operate LMS equipment without authorization, albeit for a lesser period than 18 months. As **discussed** in the **Notice**,<sup>189</sup> licensees still in the developmental stages that do not wish to seek type acceptance may be licensed on a developmental basis in accordance with Subpart Q of Part 90.<sup>190</sup>

**89. Emissions.** We proposed that no restriction be placed on the type of emission that may be authorized for LMS operation in the **902-928 MHz band**.<sup>191</sup> **MobileVision** and

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<sup>184</sup> **Notice** at para. 29, 8 FCC **Rcd** 2502.2507 (1993).

<sup>185</sup> Teletrac **comments** at 48; **MobileVision comments** at 50; SBMS **comments** 23; Mark IV **wmmments** at 13; and Location **Services comments** at 3.

<sup>186</sup> Teletrac **comments** at 48; SBMS **comments** at 23.

<sup>187</sup> Location **Services comments** at 3.

<sup>188</sup> Teletrac **comments** at 48.

<sup>189</sup> **Notice** at para. 29, 8 FCC **Rcd**. 2502, 2507 (1993).

<sup>190</sup> 47 C.F.R. Part 90 Subpart Q.

<sup>191</sup> **Notice** at para. 30, 8 FCC **Rcd** 2502, 2507 (1993). **See** Section 2.201 of **the Rules**, 47 C.F.R. § 2.201, for a description of emission designators.

SBMS support this **proposal**.<sup>192</sup> Teletrac supports this proposal only if multilateration systems are required to be physically separated? Teletrac claims that, in the absence of geographic separation, stricter limits on **emissions are required** to prevent interference between multilateration **systems**.<sup>194</sup> We are adopting our proposal to place no limits on the type of emission that can be authorized for **LMS** systems. Allowing any types of emissions will enable any type of location or monitoring technology or **ancillary** service to develop without restrictions. We will limit the likelihood of interference through appropriate power, frequency tolerance and emission mask limitations. Moreover, exclusive licensing of multilateration systems in **MTAs** in each of the three respective **sub-**bands should ameliorate concerns of co-channel multilateration **LMS** interference.

90. **Bandwidth.** We proposed to limit the bandwidth of LMS systems as follows:

for 904-912 and 918-926 MHz -- maximum 8 MHz  
for **902-904 and 926-928 MHz -- maximum 2 MHz**  
for 912-918 MHz -- **maximum 6 MHz**<sup>195</sup>

**MobileVision** supports the maximum bandwidths proposed while **Pinpoint** opposes limiting the maximum permissible bandwidth within the **902-928 MHz band**.<sup>196</sup> In accordance with the band plan we have adopted, we are adopting maximum permissible bandwidths as follows:

For Multilateration systems:

for **904.000-909.750 MHz -- maximum 5.750 MHz**  
for **919.750-921.750 MHz -- maximum 2.000 MHz**  
for **921.750-927.500 MHz -- maximum 5.750 MHz**<sup>197</sup>  
for **919.750-927.750 MHz -- maximum 8.000 MHz**<sup>198</sup>

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<sup>192</sup> **MobileVision** comments at 50; **SBMS** comments at 24.

<sup>193</sup> Teletrac comments at 49.

<sup>194</sup> **Id.**

<sup>195</sup> **Notice** at para. 30, 8 FCC Rcd. 2502, 2507 (1993).

<sup>196</sup> **MobileVision** Comments at 49; **Pinpoint** Comments at 23-26.

<sup>197</sup> This includes 5.5 MHz multilateration bandwidth and adjoining, associated 0.25 MHz forward link.

<sup>198</sup> This bandwidth capability only exists for licensees aggregating the adjacent 2 MHz and 5.5 MHz multilateration bands and includes the adjoining, associated forward link bands.

For Narrow Band Links:

for **927.250-927.500** MHz -- maximum 250 **kHz**  
for 927.500-927.750 MHz -- maximum 250 **kHz**  
for **927.750-928.000** MHz -- maximum 250 **kHz**

For Non-multilateration systems:

for 902.000-904.000 MHz -- maximum 2.000 MHz  
for **909.750-921.750** MHz -- maximum 12.000 MHz

While we establish these maximum permissible bandwidths, applicants for non-multilateration LMS systems should request only the minimum amount of bandwidth necessary to meet their operational needs.

91. **Frequency Tolerance.** We proposed a frequency tolerance for **transmitters** in the **904-912** and 918-926 MHz bands of 0.0005 **percent** and proposed that no minimum **frequency** tolerance be established for transmitters in the **902-904**, 912-918, and **926-928** MHz **bands**.<sup>199</sup> The frequency tolerance for these systems would be specified on the station's authorization. **MobileVision**, SBMS, Mark IV, and Hughes support the proposed frequency tolerance of 0.0005 percent for multilateration systems and support having no specific **frequency** tolerance for non-multilateration systems.<sup>200</sup> Teletrac argues that tighter frequency tolerances are required and recommends a tolerance of 0.00025 percent for both multilateration and non-multilateration **systems**.<sup>201</sup> We agree with Teletrac that tighter frequency tolerances are justified to help reduce the potential for interference to systems operating on adjacent **frequencies** and that this argument **extends** to non-multilateration as well as multilateration systems. Additionally, as Telctrac points out, the **frequency** tolerance **it has proposed is more liberal than that required for other services in the 900 MHz band**. Accordingly, we are adopting a **frequency** tolerance of 0.00025 percent for both multilateration and non-multilateration systems.

92. **Effective Radiated Power.** We proposed a maximum peak effective radiated power (**ERP**) for any LMS systems operating in the **902-928** MHz band of 300 **watts**.<sup>202</sup>

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<sup>199</sup> **Notice** at para. 30, 8 FCC **Rcd.** 2502, 2507 (1993).

<sup>200</sup> **MobileVision** comments at 49; SBMS comments at 24; Mark IV comments at 13; Hughes comments at 13.

<sup>201</sup> Teletrac **comments** at 49.

<sup>202</sup> **Notice** at para. 30, 8 FCC **Rcd** 2502, 2507 (1993). The current **maximum** power for **multilateration** systems is 1 **kW** peak envelope power (PEP) transmitter output **power**. See existing 47 C.F.R. § 90.239(e)(2)(i).



SBMS supports our proposed 300 watt peak ERP.<sup>203</sup> **MobileVision** opposes any reduction in permissible power. AT&T and Hughes support a 30 watt ERP power limit for **non-multilateration** systems with 10 meter and 15 meter antenna height restrictions **respectively**.<sup>204</sup> **Amtech** and Pinpoint support various power limits for different systems based a shared use of the entire **band**.<sup>205</sup> Mark IV supports a field **strength** limit of 1 **mV/m** at 3000 meters with a maximum antenna height of 10 meters for non-multilateration systems rather than a limit on peak **ERP**.<sup>206</sup>

93. **As discussed earlier,**<sup>207</sup> we will limit the maximum ERP of multilateration **LMS** system narrowband forward links, which operate between 927.250-928.000 MHz, to 300 watts. However, we will limit maximum power for **transmissions** of multilateration system base and mobile stations outside the **927.250-928.000 MHz** sub-band to 30 watts maximum ERP. Limiting base and mobile stations' power levels will reduce the potential for interference between co-channel multilateration systems<sup>208</sup> and **will** reduce the likelihood of interference to any other operations in the **902-928 MHz** band. In addition, we are limiting the peak ERP of non-multilateration systems to 30 watts and limiting the antenna height above ground of these systems to 15 meters. Reducing the maximum power and **antenna** height of non-multilateration systems will allow non-multilateration systems to share spectrum more easily with other **non-multilateration** systems **and** with users of Part 15 **devices and will permit greater frequency reuse for these systems**.

94. **Currently**, facilities authorized in the private radio **services** are categorically excluded from our rules **requiring** an environmental assessment to demonstrate that a facility complies with **standards concerning** human exposure to **radiofrequency** radiation. (See Second Report and Order in Gen. Docket No. **79-144, 2 FCC Rcd** 2064 (1987); and Erratum, 21 FCC Rcd 2526 (1987).d for **evaluating** the environmental effects of radiofrequency radiation, however, are **currently** under review in ET Docket No. 93-62 (See Notice of Proposed Rule Making, ET Docket No. **93-62, 8 FCC Rcd**, No. 9362 (1993)). In that **proceeding** we note that some of the current categorical exclusions may be inconsistent with the new guidelines being **considered**. We wish to emphasize here that **LMS** systems will be **required** to **comply** with any **requirements** adopted in ET **Docket** No. 93-62.

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<sup>203</sup> SBMS comments at 24.

<sup>204</sup> AT&T comments at 7-8; Hughes comments at 7-9.

<sup>205</sup> **Amtech** comments at 33-35; Pinpoint comments at 31-34.

<sup>206</sup> **Mark IV** comments at 13.

<sup>207</sup> See discussion of Forward Links, paragraphs 73-76.

<sup>208</sup> We **contemplate** that this issue will have significance in **MTAs** where **exclusive LMS** licensees must co-exist with **grandfathered LMS** licensees.

**95. Interference, Criteria for Co-Channel Multilateration Licensees.**

Exclusive MTA multilateration LMS licensees and co-channel grandfathered multilateration LMS licensees must not interfere with **one** another. Similarly, exclusive MTA multilateration LMS licensees must also ensure that they do not cause interference to exclusive co-channel MTA licensees in adjacent MTAs. To help reduce the likelihood for interference between adjacent MTA licensees, we will impose a 47 dBuV/m field strength limit at the MTA boundary on signals transmitted from the base stations of MTA licensees.<sup>209</sup> If differences arise over whether interference has been caused, we will expect the particular licensees to cooperate with one **another** to resolve these disputes. Should the Commission have to become involved in any disagreements among licensees, we may employ a wide variety of tools to resolve such disputes.<sup>210</sup> These tools could include, but are not limited to, requiring use of a common **controller** or mandating a particular time sharing **arrangement**. If, however, we determine that an LMS licensee has not cooperated in developing a suitable **mechanism to minimize harmful interference**, or that a licensee's system design renders it **extraordinarily sensitive** to interference, we may authorize the other licensee to operate its LMS system regardless of interference caused to the LMS system that failed to cooperate or that has a system design highly susceptible to **interference**.

**96. Emission Mask.** We proposed that emissions anywhere within a licensee's authorized bandwidth not be **required** to be attenuated but that any emissions outside of the authorized bandwidth be attenuated by at least  $55 + 10\log(P)$  dB where P is the highest emission (in watts) of the transmitter inside the authorized **bandwidth**.<sup>211</sup> This **requirement** applies to both multilateration and non-multilateration systems. We also requested comment on whether multilateration systems should be required to distribute power evenly throughout

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<sup>209</sup> We note that in adopting this 47 dBuV/m limit, we are not determining that this field strength will necessarily result in reliable service for all multilateration systems. It is merely a level that may not be exceeded by MTA licensees and is thus established for interference planning purposes only. (see Second Report and Order, Amendment of the Commission's Rules to Establish New Personal Communications Services, GEN Docket No. 90-314, FCC 93451, released October 22, 1993 at paragraph 177).

<sup>210</sup> Disputes over harmful interference (as described in Section 90.173(b) of our Rules) are typically resolved on a case-by-case basis. For these services, while absolute blocking of a licensee's transmissions throughout a large region would constitute the only clear-cut case of harmful interference (see Section 90.7 for definition of harmful interference under 47 C.F.R. Part 90), it is possible that lesser degrees of interference could diminish the accuracy or reliability of certain multilateration systems in a limited portion of a system's area of operation. The degree to which such lesser amounts of interference would be considered harmful cannot be determined in advance, and there can be no guarantee that licensees will be unconditionally protected from interference of this type. Because of these unique characteristics of multilateration systems, we decline to specify what will be considered to constitute harmful interference to such systems.

<sup>211</sup> Notice at para. 30, 8 FCC Rcd. 2507 (1993).

their authorized **band**.<sup>212</sup>

97. Mark IV M-IS was the only **commenter** that supports a requirement that power be evenly distributed across a licensee's authorized bandwidth. **Both Mark IV IVHS and Teletrac** believe that only emissions outside of the **902-928 MHz** band (rather than any emissions outside of a licensee's authorized bandwidth) should be attenuated by  $55 + 10\log(P)$  dB. Mark IV IVHS would require that frequencies outside of the licensee's authorized bandwidth only be attenuated by  $30 + 10\log(P)$  dB, while Teletrac would just require that 99 percent of the power be within the licensee's authorized bandwidth. **MobileVision** would require that spurious spread spectrum emission should not exceed  $100 + 10\log P$  dBW/Hz and the level of any spurious discrete emission could not exceed  $55 + 10\log P$  dBW. SBMS would merely require that the first side-lobe be 20 dB below main lobe and each following side-lobe be progressively reduced by 10 dB out to the third lobe. **Amtech** and Pinpoint provide recommendations for various power, height and emissions limits for different systems and supports establishment of robustness and sharing requirements.

98. We will require licensees to attenuate their emissions by  $55 + 10\log(P)$  dB at the edges of the specified LMS subbands. The licensed **frequency band edges** for multilateration systems for which emissions must be attenuated are 904, 909.75, 919.75, 921.75, 927.50, 927.75 and 928 MHz. If the 919.75-921.75 and **921.75-927.25 MHz subbands** are aggregated by a single licensee, the emission mask limitations at the band edges at 921.75 and 927.50 MHz may be ignored. The licensed frequency band edges for **non-multilateration** systems for which emissions must be attenuated are **902, 904, 909.75 and 921.75 MHz**. These emission limitations will assure that **multilateration and non-multi&ration** systems will not **interfere** with each other and that operations below 902 MHz and above 928 MHz are protected.

#### IV. CONCLUSION

99. Given the plethora of diverse users that share the 902-928 MHz band, this has been an especially difficult proceeding. While we strongly support and wish to encourage the continued development and deployment of an **LMS industry**, we also recognize the **valuable** services being provided by other users of this **spectrum**. We believe that the rules we have adopted herein fairly balance these diverse interests. While we have not been able to **satisfy all of the concerns of all of the parties in this proceeding**, we reviewed extensive **comments and replies to the Notice as well as a very large number of ex parte filings in this docket** and **serious** consideration was given to each position. Given the diverse and often mutually **exclusive interests** of the many parties that participated, our decisions were the best that could be achieved. **The** rules will allow for the continued growth of LMS services and

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<sup>212</sup> IQ.

advance Congress' goal of developing an intelligent transportation system infrastructure. At the same time, we have attempted to ensure that other users of the band, including Amateur operators and users of Part 15 devices, will be able to co-exist with LMS.

100. We have taken the long-term beneficial action of creating the Transportation Infrastructure Radio Service. By creating this new service at this early date in ITS development, we will be able to take an organized approach to regulating spectrum and services related to ITS and transportation infrastructure in general.

## **V. FINAL REGULATORY FLEXIBILITY ANALYSIS**

101. Pursuant to the Regulatory Flexibility Act of 1980, the Commission's final analysis is as follows:

### **Need and Purpose of the Action**

102. The rules adopted herein will enhance use of the **902-928 MHz** band for location and monitoring systems. These rules replace the existing interim rules that govern automatic vehicle monitoring systems. The new rules create a more stable environment for LMS system licensees and provides much needed flexibility for operators of such systems.

### **Issues Raised in Response to the Initial Regulatory Flexibility Analysis**

103. **There were** no comments submitted in response to the Initial Regulatory Flexibility Analysis.

### **Significant Alternatives Considered and Rejected**

104. **All** significant alternatives are **discussed** in this **Report and Order**.

## **VI. PAPERWORK REDUCTION**

105. The proposal contained herein has been analyzed with respect to the Paperwork Reduction Act of 1980 and found to contain no new or modified form, information collection and/or record keeping, labeling, disclosure, or record retention **requirements**; and will not increase or decrease burden hours imposed on the public.

## VI. ORDERING CLAUSES

106. Accordingly, IT IS ORDERED that, **pursuant** to the authority of Sections 4(i), 302, 303(r), and 332(a)(2) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 302, 303(r), and 332(a), Parts 2 and 90 of the Commission's Rules, 47 C.F.R. Parts 2 and 90, ARE AMENDED as set forth in Appendix A below, effective [thirty days after publication in the Federal Register].

**107.** The Petition for Rule Making filed on January 13, 1994 by the American Radio Relay League IS DENIED.

108. For further **information concerning** this **Report and Order**, contact Thomas S. Dombrowsky, Martin D. Liebman or John J. Borkowski of the Wireless Telecommunications Bureau at **(202) 418-0620**.

FEDERAL COMMUNICATIONS COMMISSION

William F. Caton  
**Acting Secretary**

## Appendix A

Parts **2** and 90 of Chapter I of Title 47 of the Code of Federal Regulations are amended as follows:

### **PART 2 - FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS**

1. The authority citation for Part 2 continues to read as follows:

**Authority:** Sec. **4, 302, 303, and 307** of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154, 154(i), 302,303, 303(r), and 307, unless otherwise noted.

2. Section 2.106 is amended by adding "Private Land Mobile (90)" to the FCC use designators in the entry for 902-928 MHz in the table and by revising footnotes US218 and US275 to read as follows:

#### **§ 2.106 Table of Frequency Allocations**

\* \* \* \* \*

International table	United States table	FCC use designators
* * *	Government Non-Government	Special-use Rulepart(s) frequencies
* * * * *		
* * *	902-928 RADIOLOCATION  707 US215 US218 US267 US275 <b>G1 1 G59</b>	<b>902-928</b>   Private Land 915 $\pm$ 13 MHz Mobile (90) Industrial, Amateur (97) scientific, and medical <b>frequency.</b>  707 US215 US218 US267 US275

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US218 The band 902-928 MHz is available for Location and Monitoring Service (**LMS**) systems subject to not causing **harmful** interference to the operation of all Government stations authorized in these bands. These systems must tolerate interference **from** the