

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.

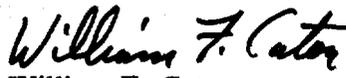
VI. ORDERING CLAUSES

105. 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 the Appendix below, effective [thirty days after publication in the Federal Register].

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

107. 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

A. Part 2 of Chapter 1 of Title 47 of the Code of Federal Regulations is amended to read 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 row 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 frequencies
			Rulepart(s)
* * *	902-928 RADIOLOCATION	902-928	Private Land Mobile (90) Amateur (97)
	707	707	915 ± 13 MHz Industrial, scientific, and medical frequency.
	US215 US218	US215 US218	
	US267 US275	US267 US275	
	G11 G59		

* * * * *

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

operation of industrial, scientific, and medical (ISM) devices and the operation of Government stations authorized in these bands.

US275 The band 902-928 MHz is allocated on a secondary basis to the amateur service subject to not causing harmful interference to the operations of Government stations authorized in this band or to Location and Monitoring Service (LMS) systems. Stations in the Amateur service must tolerate any interference from the operations of industrial, scientific, and medical (ISM) devices, LMS systems, and the operations of Government stations authorized in this band. Further, the Amateur Service is prohibited in those portions of Texas and New Mexico bounded on the south by latitude 31°41' North, on the east by longitude 104°11' West, and on the north by latitude 34°30' North, and on the west by longitude 107°30' West; in addition, outside this area but within 150 miles of these boundaries of White Sands Missile Range the service is restricted to a maximum transmitter peak envelope power output of 50 watts.

* * * * *

B. Part 90 of Chapter 1 of Title 47 of the Code of Federal Regulations is amended to read as follows:

PART 90 - PRIVATE LAND MOBILE RADIO SERVICES

1. The authority citation for Part 90 continues to read as follows:

Authority: Secs. 4, 303, 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 303, and 332, unless otherwise noted.

2. The Table of Contents for Part 90 is revised by amending Subpart M, adding new text and listings in this Subpart to read as follows:

* * * * *

Subpart M -- Transportation Infrastructure Radio Service

§ 90.350 Scope.

§ 90.351 Location and Monitoring Service.

§ 90.353 LMS Operations in the 902 - 928 MHz band.

§ 90.355 LMS Operations below 512 MHz.

§ 90.357 Frequencies for LMS systems in the 902 - 928 MHz band.

§ 90.359 Field Strength Limits for MTA-licensed LMS systems.

§ 90.361 Interference from Part 15 devices.

§ 90.363 Grandfathering provisions for existing AVM Licensees.

* * * * *

3. Section 90.7 is amended by removing the entry for Automatic Vehicle Monitoring and adding a new definition for Basic Trading Areas, Forward Links, Location and Monitoring Service (LMS), Major Trading Areas, Multilateration LMS System, and Non-multilateration LMS System in their proper alphabetical order to read as follows:

§ 90.7 Definitions.

* * * * *

Basic Trading Areas. Service areas that are based on the Rand McNally 1992 Commercial Atlas & Marketing Guide, 123rd Edition, at pages 38-39, with the following additions licensed separately as BTA-like areas: American Samoa; Guam; Northern Mariana Islands; Mayaguez/Aguadilla-Ponce, Puerto Rico; San Juan, Puerto Rico; and the United States Virgin Islands. The Mayaguez/Aguadilla-Ponce BTA-like service area consists of the following municipios: Adjuntas, Aguada, Aguadilla, Anasco, Arroyo, Cabo Rojo, Coamo, Guanica, Guayama, Guayanilla, Hormigueros, Isabela, Jayuya, Juana Diaz, Lajas, Las Marias, Maricao, Maunabo, Mayaguez, Moca, Patillas, Penuelas, Ponce, Quebradillas, Rincon, Sabana Grande, Salinas, San German, Santa Isabel, Villalba, and Yauco. The San Juan BTA-like service area consists of all other municipios in Puerto Rico.

* * * * *

Forward Links. Transmissions in the frequency bands specified in § 90.357(a) and used to control and interrogate the mobile units to be located by multilateration LMS systems.

* * * * *

Location and Monitoring Service (LMS). The use of non-voice signaling methods to locate or monitor mobile radio units. LMS systems may transmit and receive voice and non-voice status and instructional information related to such units.

* * * * *

Major Trading Areas. Service areas based on the Rand McNally 1992 Commercial Atlas & Marketing Guide, 123rd Edition, at pages 38-39, with the following exceptions and additions:

- (1) Alaska is separated from the Seattle MTA and is licensed separately.
- (2) Guam and the Northern Mariana Islands are licensed as a single MTA-like area.
- (3) Puerto Rico and the United States Virgin Islands are licensed as a single MTA-like area.

(4) American Samoa is licensed as a single MTA-like area.

* * * * *

Multilateration LMS System. A system that is 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.

* * * * *

Non-multilateration LMS System. A system that employs any of a number of non-multilateration technologies to transmit information to and/or from vehicular units.

* * * * *

4. Section 90.101 is revised to read as follows:

§ 90.101 Scope.

The Radiolocation Service accommodates the use of radio methods for determination of direction, distance, speed, or position for purposes other than navigation. Rules as to eligibility for licensing, permissible communications, frequency available, and any special requirements are set forth in the following section. Provisions for the Location and Monitoring Service (LMS) are contained in Subpart M of this Part.

5. Section 90.103 is amended by removing paragraph (d) and by redesignating existing paragraph (e) as paragraph (d).

6. Section 90.155 is amended by revising paragraph (a) and adding new paragraph (d) and (e) to read as follows:

(a) All stations authorized under this part, except as provided in paragraphs (b) and (d) of this section and in §§ 90.629 and 90.631(f), must be placed in operation within eight (8) months from the date of grant or the authorization cancels automatically and must be returned to the Commission.

* * * * *

(d) Multilateration LMS systems authorized in accordance with § 90.353 must be constructed and placed in operation within twelve (12) months from the date of grant or the authorization cancels automatically and must be returned to the Commission. MTA-licensed multilateration LMS systems will be considered constructed and placed in operation if such systems construct a sufficient number of base stations that utilize multilateration technology

(see paragraph (e) of this Section) to provide multilateration location service to a substantial portion of at least one BTA in the MTA.

(e) An LMS 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. 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.

7. Section 90.179 is amended by revising paragraph (g) to read as follows:

§ 90.179 Shared use of radio stations.

* * * * *

(g) Above 800 MHz, shared use on a for-profit private carrier basis is permitted only by SMR, Private Carrier Paging, and LMS licensees. See Subparts M, P, and S of this Part.

8. Section 90.203 is amended by adding new paragraph (b)(7) to read as follows:

§ 90.203 Type acceptance required.

* * * * *

(b) * * *

(7) Transmitters imported and marketed prior to April 1, 1996 for use by LMS systems.

* * * * *

9. Section 90.205(b) is amended by adding the 902-927.25 and 927.25-928 MHz bands to the table and by adding footnote (13) to read as follows:

§ 90.205 Power.

* * * * *

(b) * * *

Frequency range (megahertz)	Maximum Output power (watts)	Maximum effective radiated power (watts)
* * * * *		
902-927.25	30 ⁽¹³⁾
927.25-928	300

* * * * *

13 Effective radiated power shall be measured as peak envelope power.

* * * * *

10. Paragraph (g) of Section 90.207 is removed and reserved.

11. Section 90.209 is amended by adding new paragraphs (b)(10) and (m) to read as follows:

§ 90.209 Bandwidth limitations.

* * * * *

(b) * * *

(10) The maximum authorized bandwidth shall be 12 MHz for non-multilateration LMS operations in the band 909.75-921.75 MHz and 2 MHz in the band 902.00-904.00 MHz. The maximum authorized bandwidth for multilateration LMS operations shall be 5.75 MHz in the 904.00-909.75 MHz band; 2 MHz in the 919.75-921.75 MHz band; 5.75 MHz in the 921.75-927.25 MHz band and its associated 927.25-927.50 MHz narrowband forward link; and 8.00 MHz if the 919.75-921.75 MHz and 921.75-927.25 MHz bands and their associated 927.25-927.50 MHz and 927.50-927.75 MHz narrowband forward links are aggregated.

* * * * *

(m) For transmitters authorized under Subpart M that operate in the 902-928 MHz band, the peak power of any emission shall be attenuated below the power of the highest emission contained within the authorized channel bandwidth in accordance with the following schedule:

- (1) On any frequency within the authorized bandwidth: Zero dB.
- (2) On any frequency outside of the authorized bandwidth: $55 + 10\log(P)$ dB where

(P) is the highest emission (watts) of the transmitter inside the authorized bandwidth.

(3) The resolution bandwidth of the instrumentation used to measure the emission power shall be 100 kHz. If a video filter is used, its bandwidth shall not be less than the resolution bandwidth.

(4) Emission power (P) shall be measured in peak values.

12. Section 90.213 is amended by adding the 902-928 MHz band to the table in paragraph (a) to read as follows:

§ 90.213 Frequency tolerance.

(a) * * *

Frequency Tolerance

Frequency range	Fixed and base stations		Mobile stations	
	Over 200W output power	200 w or less output power	Over 2W output power	2W or less output power
902-9280005	.0005	.0005	.0005

* * * * *

* * * * *

13. Section 90.239 is removed and reserved.

14. Subpart M is amended by redesignating it the Transportation Infrastructure Radio Service to read as follows:

Subpart M -- Transportation Infrastructure Radio Service

15. A new Section 90.350 is added to Subpart M to read as follows:

§ 90.350 Scope.

The Transportation Infrastructure Radio Service is for the purpose of integrating radio-based technologies into the nation's transportation infrastructure and to develop and implement the nation's intelligent transportation systems. It includes the Location and Monitoring Service (LMS). Rules as to eligibility for licensing, frequencies available, and any special requirements for services in the Transportation Infrastructure Radio Service are

set forth in this Subpart.

16. A new Section 90.351 is added to Subpart M to read as follows:

§ 90.351 Location and Monitoring Service.

These provisions authorize the licensing of systems in the location and monitoring service (LMS). LMS systems utilize non-voice radio techniques to determine the location and status of mobile radio units. LMS licensees authorized to operate a system in the 902-928 MHz band may serve individuals, federal government agencies, and entities eligible for licensing in Part 90.

(a) Each application to license an LMS system shall include the following supplemental information:

(1) A detailed description of the manner in which the system will operate, including a map or diagram.

(2) The necessary or occupied bandwidth of emission, whichever is greater.

(3) The data transmission characteristics as follows:

(i) The vehicle location update rates;

(ii) Specific transmitter modulation techniques used;

(iii) For codes and timing scheme: A table of bit sequences and their alphanumeric or indicator equivalents, and a statement of bit rise time, bit transmission rates, bit duration, and interval between bits;

(iv) A statement of amplitude-versus-time of the interrogation and reply formats, and an example of a typical message transmission and any synchronizing pulses utilized.

(4) A plan to show the implementation schedule during the initial license term.

(b) LMS stations are exempted from the identification requirements of § 90.425; however, the Commission may impose automatic station identification requirements when determined to be necessary for monitoring and enforcement purposes.

17. A new Section 90.353 is added to Subpart M to read as follows:

§ 90.353 LMS Operations in the 902 - 928 MHz band.

(a) LMS systems may be authorized within the 902-928 MHz band, subject to the following conditions. LMS licensees are required to maintain whatever records are necessary to demonstrate compliance with these provisions and must make these records available to the Commission upon request:

(1) LMS operations will not cause interference to and must tolerate interference from industrial, scientific, and medical (ISM) devices and radiolocation Government stations that operate in the 902 - 928 MHz band.

(2) LMS systems are authorized 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.

(3) LMS systems may interconnect with the public switched network (PSN) only to enable emergency communications. These interconnected communications may only be sent to or received from a system dispatch point or entities eligible in the Public Safety or Special Emergency Radio Services. (See Subparts B and C).

(4) Multilateration LMS systems will be authorized on a primary basis within the bands 904-909.75 MHz and 921.75-927.25 MHz. Additionally, multilateration and non-multilateration systems will share the 919.75-921.75 MHz band on a co-equal basis. Licensing will be on the basis of Major Trading Area (MTA) service areas for multilateration systems, with one exclusive MTA license being issued for each of these three sub-bands. Except as provided in paragraph (a)(3) of this Section, multilateration MTA licensees may be authorized to operate on only one of the three multilateration bands within a given MTA. Additionally, MTA multilateration LMS licenses will be conditioned upon the licensee's ability to demonstrate through actual field tests that their systems do not cause unacceptable levels of interference to Part 15 devices.

(5) Multilateration MTA-licensed systems and grandfathered AVM systems (see Section 90.363) are authorized on a shared basis and must cooperate in the selection and use of frequencies in accordance with Section 90.173(b).

(6) Multilateration MTA licensees may be authorized to operate on both the 919.75-921.75 MHz and 921.75-927.25 MHz bands within a given MTA (see Section 90.209(b)(10)).

(7) Multilateration LMS systems whose primary operations involve the provision of vehicle location services, may provide non-vehicular location services.

(8) Non-multilateration stations are authorized to operate on a shared, non-exclusive basis in the 902-904 MHz and 909.75-921.75 MHz sub-bands. Non-multilateration systems and multilateration systems will share the 919.75-921.75 MHz band on a co-equal basis. Non-multilateration LMS systems may not provide non-vehicular location services. The maximum antenna height above ground for non-multilateration LMS systems is 15 meters.

18. A new section 90.355 is added to Subpart M to read as follows:

§ 90.355 LMS Operations below 512 MHz.

(a) Applicants requiring not more than 25 kHz bandwidth per frequency in the 25-50 MHz, 150-170 MHz, and 450-512 MHz bands may use either base-mobile frequencies currently assigned the applicant, or be assigned base-mobile frequencies available in the service in which eligibility has been established, provided that:

(1) For transmission between vehicles and base stations, each frequency in a single-frequency mode of operation will provide location data for approximately 200 vehicles, or both frequencies in a two-frequency mode of operation will provide location data for approximately 400 vehicles, except that for frequencies in the 450-512 MHz band that are assigned in pairs in accordance with the allocation plan for the band, the requirement is that location data be provided for approximately 200 vehicles for each frequency pair; and a showing is made that 50 percent of the vehicles will be in operation within the system by the end of the second year of the initial license term, and 70 percent will be in operation within the system by the end of the initial license term; except that if these vehicle loading standards will not be met, frequencies will be assigned only on a secondary non-interference basis to any authorized radiotelephony operation.

(2) The minimum separation between a proposed LMS station and the nearest co-channel base station of another licensee operating a voice system is 75 miles (120 km) for a single frequency mode of operation or 35 miles (56 km) for a two-frequency mode of operation. Where the minimum mileage separation cannot be achieved, agreement to the use of F1D, F2D, G1D, G2D or PON emission must be received from all existing co-channel licensees using voice emissions within the applicable mileage limits. If there is interference with voice operations and required agreement was not received, or operation was authorized on a secondary non-interference basis, the licensee of the LMS system is responsible for eliminating the interference.

(3) Frequencies additional to any assigned under paragraph (b)(2)(i) of this section will not be assigned to the same licensee at any stations located within 64 km (40 miles) of any station in which the licensee holds an interest until each of such licensee's frequencies for LMS operation is shown to accommodate not less than 90 percent of the frequency loading requirements specified in paragraph (b)(3)(i) of this section.

19. A new Section 90.357 is added to subpart M to read as follows:

§ 90.357 Frequencies for LMS systems in the 902 - 928 MHz band.

(a) (1) Multilateration LMS systems will be authorized on the following LMS sub-bands:

<u>LMS Sub-band</u>	<u>Forward Link⁽¹⁾</u>
904.000-909.750 MHz	927.750-928.000 MHz
919.750-921.750 MHz ⁽²⁾	927.500-927.750 MHz
921.750-927.250 MHz	927.250-927.500 MHz

1 Forward links for LMS systems may also be contained within the LMS sub-band. However, the maximum allowable power in these sub-bands is 30 watts ERP in accordance with Section 90.205(b).

2 The frequency band 919.750-921.750 MHz is shared co-equally between multilateration and non-multilateration LMS systems.

(b) Non-multilateration LMS systems will be authorized on the following frequency bands:

LMS Sub-band ¹

902.000-904.000 MHz
909.750-921.750 MHz

1 Applicants for non-multilateration LMS systems should request only the minimum amount of bandwidth necessary to meet their operational needs.

20. A new Section 90.359 is added to subpart M to read as follows:

§ 90.359 Field Strength Limits for MTA-licensed LMS systems.

MTA-licensed multilateration systems shall limit the field strength of signals transmitted from their base stations to 47 dBuV/m at their MTA boundary.

21. A new Section 90.361 is added to subpart M to read as follows:

§ 90.361 Interference from Part 15 and Amateur operations.

Part 15 and Amateur operations may not cause harmful interference to LMS systems in the 902-928 MHz band. These operations will not be considered to be causing harmful

interference to a multilateration LMS system operating in one of the three MTA sub-bands (see Section 90.357(a)(1)) if they operate in accordance with the provisions of 47 C.F.R. Parts 15 or 97 and at least one of the following conditions are met:

(a) it is a Part 15 field disturbance sensor operating under Section 15.245 of the rules and it is not operating in the 904-909.750 or 919.750-928.000 MHz sub-bands; 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; and

(2) either

(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.

22. A new Section 90.363 is added to Subpart M to read as follows:

§ 90.363 Grandfathering provisions for existing AVM Licensees.

(a) These provisions authorize grandfathered operation by automatic vehicle monitoring (AVM) systems licensed on or before February 3, 1995. To attain grandfathered status for their stations, existing multilateration AVM licensees must file, within thirty days of the effective date of the rules adopted in PR Docket No. 93-61, applications to modify their station licenses to comply with the band plan shown in Section 90.357. These applications to modify must identify the multilateration sub-band or sub-bands in which they intend to operate their LMS system stations, once their applications to modify have been authorized. The application to modify a license to comply with the band plan shown in Section 90.357 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. When

existing AVM licensees file these applications to modify, they must certify that either 1) the stations that compose their AVM system have been constructed and are operational as of February 3, 1995 or 2) that the stations are not constructed in accordance with Section 90.155(e) as of February 3, 1995. Multilateration AVM systems that are constructed and operational on February 3, 1995 will be given until April 1, 1998 to convert to the spectrum identified in their LMS system license. Such licensees may continue to operate their systems during this period. Licensees of multilateration AVM constructed and operational 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. Multilateration AVM licensees for stations not constructed as of February 3, 1995 must construct and operate their LMS systems on the spectrum identified in their LMS system license by April 1, 1996. These licenses will terminate 30 days after the effective date of the rules contained in PR Docket 93-61 unless timely modification applications are filed.

(b) Non-multilateration systems licensed prior to February 3, 1995 in spectrum other than the 902.00-904.00 and 909.75-921.75 MHz bands must modify their licenses by April 1, 1998 to specify operation solely in the bands provided in Section 90.357 for non-multilateration systems and to operate their systems consistently with the provisions of Section 90.353.

Appendix B

List of Technical Studies, Tests and Analyses (included in the record in PR Docket 93-61)

- June 25, 1993 Theoretical and Field Performance of Radiolocation Systems
Pactel Teletrac filed on June 29, 1993
- June 28, 1993 Engineering Analysis of Cochannel Pulse-Ranging LMS Systems
Professor Raymond Pickholtz, filed by Teletrac on June 29, 1993
- June 29, 1993 The relationship between Position-fixing rate & Occupied Bandwidth in
AVL Systems
Louis H. M. Jandrell, Pinpoint
- July 29, 1993 Response to Comments filed in PR Docket 93-61
Louis H. M. Jandrell, Pinpoint
- January 14, 1994 Capacity and Interference Resistance of Spread-Spectrum Automatic
Vehicle Monitoring Systems in the 902 - 928 MHz ISM Band Interim
Report Mobile Portable Radio Research Group of the Bradley Dept of
Electrical Engineering at Virginia Tech, filed by Southwestern Bell
Feb. 1, 1994
- January 20, 1994 Review and Discussion of the Pinpoint ARRAY™ Network and Its
Performance
Hatfield Associates, Inc., filed by Pinpoint
- March 15, 1994 Time Division Considerations for Wideband LMS Systems
- Technical Review of the Virginia Tech Interim Report "Capacity and
Interference Resistance of Spread Spectrum Automatic Vehicle
Monitoring Systems in the 902 - 928 MHz Band"
- Technical Review of Hatfield Associates' "Review and Discussion of
the Pinpoint ARRAY Network and Its Performance"
Graham Smith, MobileVision
- May 10, 1994 Report on the Viability of Location Monitoring Services Technology
Within the IVHS Industry
MobileVision
- June 21, 1994 Experience with Part 15 Interference
AirTouch Teletrac

- June 22, 1994 Further Analysis of Interference of Part 15 Devices and LMS Wideband Systems
Probability of Interference
Graham Smith, MobileVision filed on June 22, 1994
- June 23, 1994 LMS Consensus Position on Part 15 Interference
Filed by Teletrac, MobileVision, Pinpoint and Uniplex on June 23, 1994
- August 2, 1994 Comments on MobileVision's "Further Analysis of Interference of Part 15 Devices and LMS Wideband Systems Probability of Interference"
Dr. Jay E. Padgett, Chairman, TIA Consumer Radio Section, filed by Part 15 Coalition on August 12, 1994
- August 8, 1994 Wide Area Pulse-Ranging AVM/LMS: Messaging/Locating System Design Tradeoffs and Part 15 Interference
Dr. Jay E. Padgett, Chairman, TIA Consumer Radio Section, filed by Part 15 Coalition on August 12, 1994
- September 15, 1994 Letter to William F. Caton concerning "Wide Area Pulse-Ranging AVM/LMS: Messaging/Locating System Design Tradeoffs and Part 15 Interference" by Louis H. M. Jandrell, Pinpoint
- October 14, 1994 Capacity and Interference Resistance of Spread-Spectrum Automatic Vehicle Monitoring Systems in the 902 - 928 MHz ISM Band Final Report, Mobile and Portable Radio Research Group of the Bradley Department of Electrical Engineering, Virginia Tech
Filed by Southwestern Bell on October 19, 1994
- November 30, 1994 Response to Pinpoint's Comments on "Wide Area Pulse-Ranging AVM/LMS: Messaging/Locating System Design Tradeoffs and Part 15 Interference"
Dr. Jay E. Padgett, Chairman, TIA Consumer Radio Section
- December 7, 1994 On the Effect of Bandwidth on the Performance of AVM Systems Operating in the 902 - 928 MHz ISM Band
Costas N. Georghiades
Electrical Engineering Dept, Texas A&M University
Filed by Pinpoint
- December 13, 1994 Desensitization Calculations for Part 15 Devices and Wideband LMS
Graham Smith, MobileVision

**CONCURRING STATEMENT
OF
COMMISSIONER JAMES H. QUELLO**

RE: Automatic Vehicle Monitoring

I am concurring in the issuance of this Report and Order only because it appears to constitute the best of three not very good alternatives.

In practical terms, the Commission must do one of the following: acknowledge that AVM systems have been designed and built in reliance on operating in the 902-928 MHz band and do the best we can to accommodate them; acknowledge that AVM systems' operating in this band is liable to cause a variety of interference problems, and thus move at least some of them out of the band; or force the mutually-interfering AVM and Part 15 users into some type of negotiated rulemaking and conduct some systematized field testing during the pendency of the negotiation process. The Report and Order does the first.

I would not vote for this Report and Order if either of the other two alternatives appeared likely to produce a better result. But in my judgment neither one does. While moving the most interference-prone AVM systems to another frequency band would perhaps be the best result if the Commission were writing on a clean slate, unfortunately, we are not. During the pendency of these proceedings AVM systems have been engineered in reliance on interim rules predicated on continued operation in the 902-928 MHz band. I would feel less compelled by this element of detrimental reliance had it not lasted as long as it has, and had a number of AVM licenses not been conferred in the interim. But it has, and under these circumstances to completely disrupt existing and planned AVM operations by reassigning them to different frequency bands strikes me as inequitable at best.

Nor does further testing and a forced negotiated rulemaking look promising to me. Although I would not characterize the testing that has been done to date as anything more than fragmentary and inconclusive, I am not certain that a more rigorous system of testing would tell us more than we already know: that interference to and from Part 15 devices and AVM systems is likely to be sporadic, unpredictable and, beyond a certain point, intractable. And the Report and Order's attempt to prescribe that AVM systems "adequately protect" the six to eight million Part 15 devices already operating in this band is not very reassuring. The sheer number and diversity of the Part 15 devices that already operate in this band virtually guarantees that this standard, however laudable, will be well-nigh impossible to interpret and enforce. For example, is your new 900 MHz cordless phone "adequately protected" if it doesn't work only once in, say, five tries? or once in twenty-five? What would you consider "acceptable interference" to an infant monitor, or to a security system? And I defy anyone to tell me what would

constitute "adequate protection" to the Part 15 device that controls traffic during emergencies in Orlando, Florida. Nor do I think that forcing the parties to negotiate with one another is likely to be productive at this point. If the record in this long-pending proceeding demonstrates anything beyond a shadow of a doubt, it demonstrates that the various users in this band are unlikely to reach consensus on much of anything.

And so back to my original point: in this case the only real choice the Commission has is to make the best of a less-than-optimal situation, and so we have tried. This may gratify some of the AVM interests who have desperately pleaded that, after such a lapse of time, ANY decision is better than NO decision. But it in no way gratifies me. Regulatory philosophies have come and gone over the years this proceeding has been pending, but the Commission's principal regulatory responsibility, regardless of the prevailing regulatory philosophy, is to prevent interference. And that is precisely what we may not have done here. In this light, perhaps the most important lesson we can learn from this experience is that the Commission must pay close attention to the details of how the new spectrum being transferred from government to non-government use is allocated and assigned so that we are never put in this type of position again.

Rarely do I sound so negative in discussing an item that I am, after all, not dissenting from. But in my judgment this Report and Order will be but our first step into a potential bog of interference problems. I sincerely hope I am wrong, but I fear I am right.

**DISSENTING STATEMENT
OF
COMMISSIONER ANDREW C. BARRETT**

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

In this Report and Order, the Commission adopts rules for the future licensing and continued development of a number of services using the 902-928 MHz band, including Automatic Vehicle Monitoring (AVM) systems and unlicensed Part 15 devices. As a result of the proliferation of these valued services, the rules seek to accommodate operational needs for a range of technologies, such as licensed vehicle location and automatic toll collection systems, as well as unlicensed devices used for utility meter reading and inventory control, in order that both AVM systems and Part 15 devices are able to attain their respective service objectives without interference. This Report and Order adopts a new spectrum allocation plan, which will replace the interim rules that have allowed for sharing in this spectrum band, with: (1) separate sub-bands for licensed Location and Monitoring Services (LMS), which encompass the general AVM service as well as other advanced transportation-related services, and (2) a provision for three separate sub-bands for exclusive licensing of wideband multilateration LMS systems. Any mutually exclusive applications for use of the three sub-bands will be resolved through competitive bidding and multilateration licensees will not bar competitive secondary users under specified technical parameters.

After reviewing this decision, I cannot find substantial cause to disagree with this specific allocation for the 902-928 MHz band, especially to the extent this plan seeks to address many aspects of the record. I dissent to this decision, however, because of the lack of controlled testing prior to adopting the new band plan. As a consequence, I believe that the decision fails to balance the policy considerations in determining permanent rules for use of the shared spectrum in the 902-928 MHz band. Furthermore, I am concerned that this decision suddenly has been affected by a perceived time sensitivity for determining permanent rules, which has weighed against taking a step to provide for controlled testing. As a result, despite the many complexities of establishing rules for uses of this band and the significant time passed during the pendency of this proceeding, I am convinced that we have not determined a balanced and certain policy result for diverse AVM systems and Part 15 uses of the band. I would have preferred to wait the relatively brief period of time necessary to conduct controlled forms of testing of the proposed band plan. We also should have considered the policy consequences caused by the Commission's decision to allocate this spectrum rather than allowing the relative strengths and interests of the various companies to determine the technical parameters and an acceptable plan for sharing in the band.

The Commission's decision regarding the development of AVM systems and the use of the 902-928 MHz band should have considered the extent to which some form of

controlled testing would provide greater assurance regarding potential interference and to determine the implications of AVM operation under any new band plan. In order to reach a balanced public policy result for AVM systems and Part 15 devices in this band, I believe that the necessity of gathering more certain empirical information through controlled testing should have guided us in resolving the issues of potential interference in this proceeding. In the absence of such testing, I believe that any certainty that companies developing AVM systems may gain from a decision to replace the interim rules is undermined by the uncertainty for the public regarding the implications of the new band plan.

Without the opportunity for controlled testing prior to adopting permanent rules for AVM systems, I question the empirical basis for this decision. I observe that the nature of empirical evidence in record, which was intended for more narrow purposes of supporting or opposing the claims of parties regarding the impact of using a specific AVM technology, includes various technical studies that begin with different hypothetical conditions, and lead to divergent conclusions.¹ Although these studies might be considered "testing" as a basis for this decision, it is necessary to distinguish between these technical studies, which are subject to limitations and biases according to the interests of their sponsoring parties, as opposed to controlled testing for the purpose of demonstrating interference. I especially am concerned that the record's technical studies do not allow for similar assumptions or conditions. By comparison, controlled testing would use this new allocation of the 902-928 MHz band as a condition and then determine the potential for interference among AVM systems and Part 15 devices. Consequently, I believe that the record in this proceeding offers little indication regarding the potential implications for all interested parties, including the consumers and manufacturers of many Part 15 devices, such as cordless phones, baby monitors, and garage door openers. Additionally, while this decision may allow for yet another form of "testing" after determining permanent rules for AVM systems and allocating the band, I question the value of testing for interference after establishing a permanent band plan when the Commission will have limited recourse to prevent AVM systems and Part 15 devices from interfering with one another to ensure that uses of the band by all valued services will serve the public interest.

It is my opinion that the apparent time sensitivity of this proceeding, after many iterations of alternative band plans, amounts to a question of whether sufficient time has passed such that the need to move forward and provide final rules for use of the 902-928 MHz band should have outweighed the necessity of providing for controlled testing or a negotiated result. I especially am concerned by suggestions that in retrospect a negotiated process, with sufficient direction from the Commission, may now appear to have been worthwhile, or at a minimum, that controlled testing may have been useful at some point in the past. Similarly, I question whether a decision to provide for controlled testing eventually will not be viewed, at some point in the future, as the better result. Therefore, I believe that controlled testing should have been completed.

¹ See Appendix B to Report and Order for summary of technical studies submitted in this proceeding.

SEPARATE STATEMENT
OF
COMMISSIONER SUSAN NESS

RE: Automatic Vehicle Monitoring (AVM) Systems (PR Docket No. 93-61)

In this Report and Order we balance the competing spectrum needs of the authorized users of the 902-928 MHz band. This is a difficult task because of the wide range of services and equipment that share this band. The rules we adopt today do not fully satisfy all requests; however, I believe they represent a reasonable compromise. Moreover, they further the public interest by facilitating the growth of new and innovative services.

Entrepreneurial companies have made substantial investments to develop and market services and products that use this band. These companies understandably have been reluctant to make additional investments to upgrade or expand their service or products until we adopt final rules. Adoption of these rules promotes the public interest by removing this cloud of regulatory uncertainty and allowing these service providers to move ahead.

For example, these rules make permanent spectrum available for electronic tag readers, which are devices that can eliminate the need to stop for toll collection on highways and bridges, and thereby measurably facilitate the flow of traffic. These rules also accord new protections to many types of innovative unlicensed devices, such as wireless local area networks, cordless telephones and PBXs, remote utility meter reading devices, and wireless security alarm systems. Finally, these rules permit different types of radio location services to track and locate vehicles, an important asset to fleet managers and of potential use to locate emergency 9-1-1 callers using cellular or PCS telephones.

Over a period of years different services were authorized to operate in this band because it was underutilized and could support multiple applications without causing interference. That now is changing, with several million unlicensed devices already operating in this band and automatic vehicle monitoring (AVM) systems poised for substantial growth.

It is my expectation and hope that our adoption of these rules will spur providers to work together to engineer innovative solutions for spectrum sharing in areas where congestion occurs. Multilateration AVM licensees are required to locate and build their systems to avoid interference, and will receive only conditional licenses until they have tested and demonstrated that each system can co-exist with other users in their specific locality. These provisions are intended to ensure efficient use of the spectrum under real-world conditions, and users are expected to cooperate with each other to achieve the maximum use from this scarce resource.

I strongly support the continued availability of spectrum bands where new and innovative services can be implemented by sharing spectrum. But I also appreciate that sharing spectrum has practical limits. If demand for multiple services within the same band substantially increases and effective operation no longer is possible, new spectrum may be sought for the successful service. With this in mind, I will carefully consider requests for different spectrum from parties that now use the 902-928 MHz band but at some point no longer are able to operate efficiently in that band due to congestion.

In the meantime, the rules we adopt today ensure mutual coexistence by requiring new multilateration AVM systems to be tested in their actual locations and interference problems resolved before a final license will be granted. Our new rules also protect the continued operation of many unlicensed devices. The rules we adopt will, I believe, foster new technological growth in this band and result in new services being made available to the American public.

SEPARATE STATEMENT OF
COMMISSIONER RACHELLE B. CHONG

*Re: Amendment of Part 90 of the Commission's Rules to Adopt Regulations
for Automatic Vehicle Monitoring Systems*

In this decision, the Commission adopts permanent rules for the operation of Automatic Vehicle Monitoring (AVM) systems in the 902-928 MHz band. I support the spectrum allocation plan we adopt in this order.

As a policymaker, it is my preference to strive for consensus among the parties, but when that is impossible to achieve, as it is here, it is the Commission's job to bite the bullet and make the tough choices with the public interest as our guide. I recognize that this AVM decision does not accommodate every party's stated needs, but I believe this decision is the best we can do at this time.

At the heart of the conundrum is the fact that many classes of licensees and operations make use of the 902-928 MHz band for different purposes pursuant to an established hierarchy of use. The band is allocated on a primary basis for use by Government radiolocation systems and Industrial, Scientific and Medical (ISM) equipment. AVM systems operate in the band on a secondary basis to these primary users. Amateur Radio Service licensees also operate in this band, but on a secondary basis to the ISM, Government and AVM users. Finally, Commission rules allow enhanced operation of spread spectrum devices in the 902-928 MHz band on an unlicensed basis, pursuant to Part 15 of our rules. Under our current rules, unlicensed Part 15 users must not cause interference to and must accept interference from all other users of the band.

The myriad uses of this band added a measure of complexity to the decision-making process in this proceeding and, in some cases, limited our flexibility. Virtually every choice we considered had impacts on multiple groups of users – and often impacted them in very different ways. At times, the record in this proceeding was supplemented by almost daily ex parte filings as the parties came forth to explain how various regulatory scenarios might impact their businesses and what they considered "not negotiable." This "point-counterpoint" activity, while intended to clarify the record, at times had the opposite effect. While not all parties will be content with this decision, be assured that I and my colleagues spent an extraordinary amount of time listening to all points of view, and reviewing the comments and the many ex parte supplements filed in this proceeding, in an attempt to ensure that we understood each party's position and weighed it carefully.

Some have suggested further delay. I note that the Commission adopted a Notice of Proposed Rulemaking in this proceeding in March 1993. For almost two years, the changes we proposed to our rules in that Notice have created great uncertainty for the users of the 902-928 MHz band. In my opinion, further regulatory uncertainty would be bad for our licensees' businesses and for continued development of AVM services. Our licensees deserve to have this issue finally decided. Thus, I believe the Commission must make the difficult decisions necessary to give the parties the certainty they need to go forward.