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

In the Matter of	)	
	)	
Amendment of Parts 2 and 90 of the	)	ET Docket No. 98-95
Commission's Rules to Allocate the	)	RM-9096
5.850-5.925 GHz Band to the	)	
Mobile Service for Dedicated Short	)	
Range Communications of Intelligent	)	
Transportation Services	)	

REPORT AND ORDER

Adopted: October 21, 1999 **Released:** October 22, 1999

By the Commission:

INTRODUCTION

1. By this action, we allocate 75 megahertz of spectrum at 5.850-5.925 GHz to the mobile service for use by Dedicated Short Range Communications ("DSRC") systems operating in the Intelligent Transportation System ("ITS") radio service. ITS services are expected to improve traveler safety, decrease traffic congestion, facilitate the reduction of air pollution, and help to conserve vital fossil fuels. DSRC systems are being designed that require a short range wireless link to transfer information between vehicles and roadside systems. We are also adopting basic technical rules establishing power limits, unwanted emission and frequency stability limits for DSRC operations. We defer consideration of licensing and service rules and spectrum channelization plans to a later proceeding because standards addressing such matters are still under development by the Department of Transportation. Once such standards are developed, the Commission could take whatever action is necessary to implement the standards related to DSRC use. Our decisions here will further the goals of the United States ("U.S.") Congress and the Department of Transportation to improve the efficiency of the Nation's transportation infrastructure and will facilitate the growth and development of the ITS industry.

BACKGROUND

2. On June 11, 1998, the Commission voted to approve and released the ***Notice of Proposed Rule Making*** (*"NPRM"*)[1] in ET Docket No. 98-95 which proposed to allocate the 5.85-5.925 GHz band on a primary basis to the mobile service for use by DSRC-based[2] ITS operations.[3] As discussed in the ***NPRM,*** ITS applications rely upon the integration of advanced communications systems and highway infrastructure systems. Communications are an essential component of the backbone of all ITS applications, which rely on the swift and accurate flow of information. While many ITS communications requirements are being met within the framework of existing telecommunications systems, the ***NPRM*** stated that there is a need for spectrum for reliable short-range wireless communications links between vehicles traveling at highway speeds and roadside systems, *ie.*, DSRC.[4] Accordingly, the Commission proposed an allocation of 75 megahertz of spectrum near 5.9 GHz for DSRC operations and requested comment on various related matters.

3. Two days before the release of the ***NPRM,*** on June 9, 1998, the President signed the ***Transportation Equity Act for the 21st Century.***[5] Section 5206(f) of this Act states that "[t]he Federal Communications Commission shall consider, in consultation with the Secretary, spectrum needs for the operation of intelligent transportation systems, including spectrum for the dedicated short-range vehicle-to-wayside wireless standard. Not later than January 1, 2000, the Federal

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[1] ***See Amendment of Parts 2 and 90 of the Commission's Rules to Allocate the 5.850-5.925 GHz Band to the Mobile Service for Dedicated Short Range Communications of Intelligent Transportation Services, Notice of Proposed Rule Making,*** ET Docket No. 98-95, 13 FCC Rcd 14321 (1998).

[2] Appendix B provides examples of DSRC applications that were described in ITS America's Petition for Rule Making, Appendix C at 4.

[3] The Intermodal Surface Transportation Efficiency Act of 1991 ("ISTEA") established a national program within the U.S. Department of Transportation ("DOT") *to* develop "Intelligent Transportation Systems" or "ITS" within the United States. Section 6059 of ISTEA defines ITS as: The development or application of electronics, communications, or information processing (including advanced traffic management systems, commercial vehicle operations, advanced traveler information systems, commercial and advanced vehicle control systems, advanced public transportation systems, satellite vehicle tracking systems, and advanced vehicle communications systems) used singly or in combination to improve the efficiency and safety of surface transportation systems. ***See*** Pub. L. No. 102-240, 105 Stat. 1914 (1991).

[4] See NPRM at ¶7,14. An example of an emerging DSRC application is Automated Roadside Safety Inspection, which would enable the transmission of vehicle safety and other data between roadside inspection stations and large commercial trucks moving at highway speeds. The trucks would thus not need to stop unless signalled to do so by authorities at the inspection station. Another application, Incident Management operations, would use roadway sensors and DSRC-equipped vehicles to more quickly detect traffic congestion (accidents, traffic from sporting events, ***etc.)*** and dispatch any necessary emergency personnel or take other needed action.

[5] ***See Transportation Equity Act for the 21st Century,*** Pub. L.105-178, signed June 9, 1998.

Communications Commission shall have completed a rule making considering the allocation of spectrum for intelligent transportation systems."

4. In response to the *NPRM,* the Commission received 13 comments and *6* reply comments. ITS proponents support the allocation of *75* megahertz of spectrum at *5.85-5.925* GHz for use by DSRC-based ITS services. Amateur radio entities argue that other spectrum bands above 40 GHz would be more appropriate and that the DSRC allocation would substantially reduce the value of the *5.9* GHz band to the Amateur radio service. Additionally, Resound Corporation ("Resound") opposes DSRC operations in the *5.850-5.875* GHz segment because it plans to use this spectrum on an unlicensed basis for hearing assistance devices and ear-piece communications for devices such as cellular phones and land mobile radios.

DISCUSSION

5. We are cognizant of the substantial efforts by both Government and non-Government entities to develop, in response to Congress' transportation legislation, a National ITS Plan and Architecture[6] addressing ways of using communications technologies to increase the efficiency of the nation's transportation infrastructure. The record in this proceeding overwhelmingly supports the allocation of spectrum for DSRC-based ITS applications to increase traveler safety, reduce fuel consumption and pollution, and continue to advance the nation's economy. As discussed below, while some parties argue that other spectrum may be more appropriate for DSRC operations, we find that the *5.85-5.925* GHz band can accommodate a wide variety of reliable DSRC applications without significantly hindering other users of this spectrum.

A. Spectrum Allocation.

6. The *5.850-5.925* GHz band is allocated internationally on a primary basis for Fixed Services, Fixed Satellite Service ("FSS") Earth-to-space links ("uplinks"), and Mobile Services. Additionally, in Region 2[7] this band is allocated on a secondary basis to the Amateur radio service and the Radiolocation service. Further, the *5.850-5.875* GHz segment is designated

[6] The DOT, in cooperation with public and private partners throughout the United States, has sought to foster the development of ITS through the creation of a "National ITS Program Plan" and "National ITS Architecture." The National ITS Program Plan and Architecture identify 30 "user services" or applications that comprise the collaborative public/private vision of ITS, as well as the technological framework for implementing these services. See NPRM at ¶2.

[7] The International Telecommunications Union ("ITU") Radio Regulations divide the world into three regions for the purposes of its rules and North America is within Region 2. For a precise description of these regions, see 47 C.F.R. §2.104(b).

internationally for industrial, scientific and medical ("ISM") applications.* Domestically, the entire 5.850-5.925 GHz band is currently allocated on a co-primary basis for the Government's Radiolocation Service (*i.e.,* for use by high-powered military radar systems) and for non-Government **FSS** uplink operations. ISM devices and unlicensed **Part** 15 devices are also permitted to operate in the 5.850-5.875 GHz segment. Finally, the Amateur radio service has a secondary domestic allocation in the entire band.'

7. In the ***NPRM,*** we stated that the 5.9 GHz range **was** appropriate for DSRC applications due to its potential compatibility with European and Asian DSRC developments, the availability of radio technology, signal propagation characteristics, and the available spectral capacity in this spectrum range." After carefully reviewing the record, we conclude that an allocation of spectrum in the 5.9 GHz region is the best available choice for DSRC applications. The comments confirm that DSRC-based ITS applications are being developed internationally in this frequency range. Therefore, an allocation for DSRC operations in the 5.9 GHz region should produce economies of scale that will reduce costs and promote international compatibility. The record also demonstrates that the propagation characteristics of this region of the spectrum are well suited to the short range communications of up to a mile that will typify DSRC operations." The ITS community has done research showing that the 5.85-5.925 GHz frequency band provides adequate range for DSRC communications and reasonable frequency reuse distances.[12]

8. The American Radio Relay League ("ARRL") argues that the Commission **has** not adequately considered alternative spectrum above **40** GHz that is relatively available and could **be** used for short range communications." We find that the propagation characteristics of millimeter wave spectrum would not accommodate any DSRC applications. Specifically, signals in the millimeter wave spectrum tend to be sharply attenuated by the atmosphere, foliage and

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[8] International Footnote **S5.150** incorporates the older provisions of Footnote 806 designating the **5.725-5.875** GHz band for ISM applications and states that radiocommunication services operating within this band must accept harmful interference which may be caused by these applications.

[9] ***See*** **47** C.F.R. § **2.106,** Table of Frequency Allocations.

[10] ***See NPRM*** at ¶ 13.

[11] We are primarily concerned with DSRC applications such **as** Automated Roadside Safety Inspection and Automated Highway Systems where the roadside infrastructure would need to communicate with vehicles up to a mile away and may have to go around or through obstacles such **as** trees and buildings along a highway.

[12] ***See Spectrum Requirements for Dedicated Short Range Communications (DSRC) Public Safety and Commercial Applications,*** prepared by ARINC at Appendix D (1996). ***See also European Pre-standard Road Traffic and Transport Telematics (RTTT),*** Attachment *3* to Appendix L of the ITS America Petition at 23.

[13] ***See ARRL*** Comments at *5.*

other objects.[14] While these characteristics may be favorable for some applications, this spectrum is generally used for line of sight communications and is rarely used in a mobile environment where signals can easily be blocked. DSRC applications will be mobile and not all DSRC communications will be line of sight. Further, many DSRC-based ITS services will need a high degree of reliability which could not be achieved using spectrum above 40 GHz due to the potential for signal blockage. Therefore, we find that millimeter wave spectrum would not be appropriate for DSRC-based ITS communications. Further, DSRC applications at millimeter wave frequencies would not benefit from the global research and development being performed for the 5.9 GHz range.

9. Amateur radio interests and Resound argue that the proposed allocation of 75 megahertz of spectrum for DSRC operations is excessive and that neither the comments nor the *NPRM* justified such a large allocation.[15] The Department of Transportation ("DOT") asserts that an allocation of 75 megahertz is needed to provide for future growth and development of a wide array of DSRC applications and to promote investment in ITS technology. Based on the record, we conclude that an allocation of 75 megahertz of spectrum for DSRC is warranted. First, we note that DSRC applications are a key element in meeting the nation's transportation needs into the next century and in improving the safety of our nation's highways. With this goal in mind, we agree with the DOT that it is important to provide sufficient spectrum to facilitate the development and growth of DSRC applications. For example, this allocation will ensure that adequate spectrum will be available for advanced DSRC applications that are anticipated in the future, such as Automated Highway systems,[16] which could require several dedicated wideband channels to ensure service reliability. We also find that an allocation of 75 megahertz will provide the flexibility needed to share spectrum with incumbent operations.

10. ARRL argues that an allocation of 75 megahertz is unjustified compared to the 10 megahertz being made available in Europe for similar DSRC applications.[17] The European Road Transport and Traffic Telematics ("RTTT") pre-standard consists of 10 megahertz at 5.795-5.805 GHz with an additional 10 megahertz available on a national basis at 5.805-5.815 GHz, and recommends that this spectrum be made available on an exclusive basis to avoid interference.[18] However, the European pre-standard allows for 5 megahertz channel pairs and is intended to

[14] ***See Millimeter Wave Propagation: Spectrum Management Implications,*** Federal Communications Commission, Office of Engineering and Technology, Bulletin Number 70 (1997).

[15] ***See*** ARRL Comments at 5 and Resound Comments at 10.

[16] Automated Highway Systems ("AHS") would transfer full control of equipped vehicles to an automated system operating on designated AHS lanes.

[17] ***See*** ARRL Comments at 7.

[18] See ITS America Comments Appendix B at *6.*

provide far fewer applications than planned for in the National ITS Architecture for the U.S.[19] Further, the European pre-standard states that future applications may require expansion of the available spectrum at 5.8 GHz. The Japanese pre-standard for DSRC applications plans to make 60 megahertz of spectrum available in the 5.8 GHz range on an exclusive basis.[20] Further, the Japanese standard uses 10 megahertz channels in order to convey large amounts of data to fast moving vehicles as they pass through small communication areas. We note that the record submitted for DSRC deployment in the U.S. indicates a need for up to 32 different DSRC transactions, many of which will require two-way capabilities, wideband channels, and the need for multiple channels in a single location.[21] We also note that not all channels will be available for DSRC deployment in all areas due to incumbent radar, ISM and FSS operations. Therefore, we find that 75 megahertz of DSRC spectrum within the United States is warranted due to the scope of the National ITS Architecture,[22] the incumbent operations in this band in the U.S. and consideration DSRC developments domestically and internationally.

11. Because vehicles, especially commercial trucks, often travel beyond the boundaries of the United States, we consulted with both Canada and Mexico to determine their plans for deploying ITS technologies. Canada has advised that it has a significant number of fixed service operations in the 5.875-5.883 GHz and 5.908-5.925 GHz bands which could be incompatible with DSRC-based ITS operations in Canada. Nevertheless, we believe North American interoperability can be achieved. An allocation of 75 megahertz for DSRC applications will allow ITS licensees flexibility in the implementation of ITS. ITS services that require cross-border interoperability can be placed in the 50 megahertz of spectrum where Canada does not have significant fixed service deployment (5.850-5.875 MHz and 5.883-5.908 MHz). Further, we believe that DSRC mobile devices could easily be designed to respond to road-side beacons across the entire 5.825-5.925 GHz range which would promote interoperability with Canadian ITS operations should they decide to use the 5.825-5.850 GHz portion. We do not believe low power DSRC operations in the United States would cause interference to Canadian fixed operations in the 5.875-5.883 GHz and 5.908-5.925 GHz bands. While discussions with Mexico are on-going, we do not anticipate spectrum sharing problems with operations in Mexico. As service rules are developed and operations in these bands are more clearly defined, we will consider the need to develop coordination requirements in border areas. Nevertheless, we encourage any entities addressing standards for ITS operations in the 5.9 GHz range to plan DSRC applications with the least potential for interference with Canadian operations for the 5.875-5.883 GHz and 5.908-5.925 GHz bands.

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19 *See i.e.,* ITS America Petition at 9-30 and Attachment 3 to Appendix L.

20 *See* ITS America Comments Appendix C at 3.

21 *See e.g.*, Ex *parte* filing of ITS America on May 17, 1999; and *Spectrum Requirements for Dedicated Short Range Communications (DSRC) Public Safety and Commercial Applications,* prepared by ARINC (1996).

22 *See NPRM at* ¶2 and ISTEA, *supra* n. 3.

12. For the reasons discussed above, we conclude that the 5.85-5.925 GHz band is appropriate for DSRC-based ITS applications due to the variety of operations to be accommodated, the propagation characteristics of the band, the significant efforts of the Federal and state governments paired with industry to research ITS use in this band, and ITS developments internationally. Accordingly, we allocate the 5.850-5.925 GHz band on a primary basis to the mobile service for use by DSRC-based ITS operations. In order to insure that mobile operations in this range are ITS related, we are adopting footnote NG160 to our Table of Frequency Allocations to read as follows:[23]

> NG160 In the 5850-5925 MHz band, the use of the non-Federal government mobile service is limited to Dedicated Short Range Communications operating in the Intelligent Transportation System radio service.

B. Spectrum Sharing.

13. The *NPRM* noted that DSRC operations could not cause interference to incumbent Industrial Scientific and Medical ("ISM") operations in the 5.9 GHz band because these devices generate electromagnetic energy for non-communications related purposes (*e.g.*, microwave ovens) and do not have receivers. Additionally, high powered Government radar operations would typically cause interference to low power mobile operations rather than receive interference. The *NPRM* also tentatively concluded that sharing with incumbent FSS and amateur operations in the band should be possible.[24] Commenters indicate that spectrum sharing with incumbent Government operations and FSS operations can be accomplished, but secondary amateur radio interests and unlicensed interests argue that a DSRC allocation could lead to spectrum incompatibilities.

14. Government Radar *Operations.* The National Telecommunications and Information Administration ("NTIA") urges the Commission to require DSRC operations within 75 kilometers of 65 possible radar locations to coordinate their operations through the Frequency Assignment Subcommittee of the Interdepartment Radio Advisory Committee ("IRAC").[25] DOT provides a study that indicates that DSRC operations could operate in close proximity to most high powered

[23] As a ministerial matter, we are amending the Table of Frequency Allocations, Section 2.106 of our rules, to indicate that ISM equipment is permitted in the 5800 MHz band +/- 75 MHz. This provision exists in Section 18.301 of our rules and should also be reflected in the Table of Frequency Allocations. *See* 47 C.F.R. $18.301.

[24] See *NPRM* at ¶¶19-23

[25] See October 13, 1998 Letter from William T. Hatch, Deputy Associate Administrator for Spectrum Management of NTIA, to Mr. Fred Thomas, FCC Liaison Representative to IRAC. The 65 radar locations are displayed in Appendix A.

Government radar operations.[26] We agree that sharing between DSRC and Government operations is possible if proper coordination is performed, and thus we adopt the NTIA recommendation. We find that this coordination requirement will enable DSRC deployment across the U.S. Further, we agree with NTIA that DSRC applications within these coordination areas cannot claim protection from existing radar operations, but new radar installations that may be deployed subsequent to DSRC implementation would have to coordinate with incumbent DSRC operations.

15. *FSS Operations.* Panamsat states that as long as DSRC-based ITS applications operate according to the technical parameters described in the *NPRM,* interference to FSS operations should not result, and Panamsat does not oppose the allocation.[27] As discussed below, we are adopting the power limits proposed in the *NPRM.* The aggregate increase in noise in this band from DSRC devices would be small compared to that caused by ISM devices and Government radar operations.[28] We also note that no commenters question the spectrum sharing feasibility of FSS operations and DSRC operations.[29] We thus conclude that DSRC applications would be compatible with FSS uplinks because FSS earth stations typically use highly directional antennas pointed towards the geostationary orbital arc, and DSRC applications would typically be pointed towards a highway and operate at relatively low power. It may be necessary in some cases for DSRC systems to avoid an area near an incumbent FSS earth station in order to avoid the high powered earth station transmission. Nonetheless, because of the limited number of FSS earth stations and their use of highly directional antennas, we find that spectrum sharing is feasible. At this time, we do not anticipate that prior coordination is necessary between DSRC and FSS operations, but we will consider this matter in a later proceeding.

16. Amateur Service Operations. Amateur service licensees and organizations representing amateur service interests raise the majority of DSRC spectrum sharing concerns. We are sympathetic with ARRL's concerns that an ITS allocation at *5.9* GHz, together with the U-NII allocation in the *5.725-5.825* GHz band, could impact amateur service use in the *5.650-5.925* GHz band. We note, however, that the amateur service is afforded secondary status in these bands and that, as the *NPRM* pointed out, this secondary amateur service allocation covers *275* megahertz of spectrum in the *5.650-5.925* GHz band. We also note that the amateurs historically have been able to design and modify their systems to avoid or minimize interference given the

[26] *See Electromagnetic Compatibility Testing of a Dedicated Short-range Communication System,* performed by the National Telecommunications and Information Administration ("NTIA"), NTIA Report 98-352. *See* DOT Comments at Attachment 2.

[27] *See* Panamsat Comments at 1.

[28] For example, ISM devices have no power limit and NTIA indicates that high power government radar systems in the 5 GHz range typically have peak effective isotropic radiated power in the range of 113-133 dBm (199.5 megawatts - 19.95 gigawatts). *See* DOT Comments at Attachment 1, section 3.4.

[29] *See NPRM* at ¶20.

flexibility in selecting transmitting channels that Part 97 affords amateur service stations.[30] The record indicates that amateur service use of the 5.85-5.925 GHz band is primarily for point-to-point networks.[31] We believe that spectrum sharing between the amateur service point-to-point links and DSRC operations is viable. The DSRC applications will generally operate over relatively short distances and will use directional antennas. While DSRC operations along the path of a higher power amateur service point-to-point link may experience interference, we conclude that these occurrences would be infrequent and interference could be mitigated by using alternative frequencies, shielding, informal coordination or by other means. Therefore, we find that DSRC operations in the 5.85-5.925 GHz band are unlikely to receive significant interference from or cause interference to amateur operations.

17. *ARRL* suggests that coordination between the Amateur radio service and DSRC operations would promote spectrum sharing in the 5.85-5.925 GHz band.[32] Given that amateur operations are secondary in this spectrum range, are not extensively deployed, and considering the availability of remedies if interference should occur; we do not anticipate that a formal coordination procedure will be necessary. However, the Commission may revisit this matter in the future as DSRC operations develop and more experience is gained with sharing this spectrum. We encourage any ITS entities wishing to use the 5.85-5.925 GHz band to informally notify the ARRL or the local amateur service community of its intended operation. In this regard, we note that in many areas of the country, amateur radio operators have established clubs which can disseminate information locally, that bulletin boards devoted to specialized interests in amateur radio are available on the Internet, and that databases of amateur radio operators and their locations also are readily available on the Internet.

18. *Unlicensed Hearing Assistance Devices.* Resound filed comments stating that it is contemplating development of unlicensed low power hearing assistance devices in the 5.85-5.875 GHz band under our Part 15 rules.[33] The planned device would offer significant performance in the presence of audio background noise (i.e., the listener would be better able to hear a particular person in a crowded room). Resound objected to the proposed allocation of this spectrum for DSRC operations because it could cause interference to its planned hearing assistance devices.[34] We note that other high powered incumbent operations, such as Government

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30 See NPRM at ¶22.

31 ARRL claims it makes extensive use of this band on the west coast for a microwave network used in emergency communications. See ARRL Comments at 9.

32 See ARRL Comments at 8.

33 We note that Motorola had worked with Resound to develop its hearing assistance technology for the 5.85-5.875 GHz band and filed comments similar to Resound's opposing a DSRC allocation in this spectrum range. However, on October 5, 1999, Motorola filed a letter in this docket withdrawing its filings from ET Docket No. 98-95.

34 See 47 C.F.R. §15.249.

radar systems, ISM operations and amateur systems, already occupy this spectrum. Even if we were to preclude DSRC operations in the 5.85-5.875 GHz segment, the incumbent operations in this band already pose a significant interference environment for hearing assistance devices. We are unaware of whether Resound has made a final determination as to whether to pursue use of this spectrum for hearing assistance devices. We recognize that Resound's hearing assistance devices could be beneficial and encourage them to identify other spectrum that may be more appropriate for these devices.

C. Technical Requirements.

19. The *NPRM* proposed basic technical requirements such as power limits, unwanted emission limits, radio frequency exposure guidelines and frequency stability requirements, in order to promote spectrum sharing and ensure the safety of DSRC users. Additionally, the *NPRM* discussed the importance of technical standards and a spectrum channel plan to promote nationwide interoperability among DSRC operations and future developments of this service. The *NPRM* also discussed our existing Part 15 unlicensed rules and the potential for certain DSRC applications to be deployed on an unlicensed basis.[35]

20. The comments in response to the *NPRM* support basic technical rules necessary to prevent harmful interference in the 5.9 GHz band and urge the Commission to maintain a flexible regulatory environment to accommodate the evolution and development of DSRC applications and standards.[36] ITS America notes that ITS standards have already been developed in Europe, and that Japan is close to deployment of ITS. Additionally, the **TEA-21** legislation requires the necessary federal agencies to develop, implement, and maintain a national architecture to guide nationwide deployment of ITS and to set standards and protocols to promote the widespread use of these technologies and to ensure interoperability.[37] We note that the Secretary of Transportation submitted, in satisfaction of the June 1, 1999 statutory requirement, a report to Congress identifying which standards are critical to national interoperability or standards development and specifying the status of the development of each standard identified.[38] We find that it would be beneficial at this time to adopt basic technical requirements to promote spectrum sharing and create a basic framework for the development of DSRC operational standards by industry. We recognize that the rules we adopt here may need to be reviewed at such time as we develop licensing and service rules for DSRC systems.

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[35] *See NPRM* at ¶42.

[36] *See* Mark IV Industries, Limited, I.V.H.S. Division at 5, DOT Comments at Attachment 3, and ITS America Comments at 10.

[37] *See* ITS Comments at 8.

[38] *See Intelligent Transportation Systems: Critical Standards,* U.S. Department of Transportation, June 1999.

1. Spectrum Channelization

21. The *NPRM* sought comment on whether and how spectrum allocated for DSRC use could be divided into channels, allowing for different types of DSRC applications to operate on discrete portions of the allocated band.[39] The NPRM noted that a spectrum channelization plan could facilitate spectrum efficiency and interoperability of DSRC applications. The *NPRM* stated that any DSRC channelization plan would need to accommodate the deployment of affordable equipment, allow both narrowband and broadband data transmissions, and should handle a variety of communications, including one-way low-speed data links, two-way high-speed data links and so forth. The *NPRM* stated that, although decisions on channelization issues could be deferred to a later proceeding addressing service rules and licensing of DSRC services, a record here would assist standards setting organizations that are currently studying and evaluating channelization concerns.

22. Comments to the *NPRM* support DSRC spectrum channelization to promote interoperability and suggest that any plan should include flexible options to allow for various technologies, application specific deployment, and the evolution of DSRC services.[40] We find that a spectrum channelization plan would facilitate the efficient use of this spectrum and interoperability among various DSRC services. However, the record here is insufficient to devise a specific channel plan that would adequately address the spectrum requirements, both narrowband and broadband, of the various potential DSRC applications. We invite the ITS industry and the DOT to consider the spectrum requirements of various DSRC applications and recommend a spectrum channel plan. We will address this matter further in a future proceeding proposing licensing and service rules.

2. Power.

23. In the *NPRM*, we proposed to permit DSRC-type devices to operate at a maximum transmitter output power of 750 milliwatts ("mw") with up to 16 dBi gain antennas, with a 30 W effective isotropic radiated power ("EIRP"), to encourage the use of directional antennas to meet DSRC range requirements and a high level of frequency reuse.[41] However, the record in response to the *NPRM* indicates that this proposed power limit may be overly restrictive for some DSRC applications. Specifically, the proposed rules did not account for losses in the transmission line from roadside transmitters to the transmitting antennas that may be located over the travel

[39] *See NPRM* at ¶38-41.

[40] *See* DOT Comments Attachment 3 at 3, Mark IV Comments at 5, and ITS America Comments at 14.

[41] *See NPRM* at ¶31.

lanes.[42] Additionally, specifying power in terms of maximum transmitter output power with a permitted antenna gain could preclude some DSRC applications which need to use antennas that are not highly directional. For example, a freight tracking system within a freight yard could benefit from sending a signal in all directions but such operations would be precluded by our proposed power requirement. DOT states that although wide area applications are unlikely at 5.9 GHz, such alternatives should not be precluded. Further, both DOT and ITS America assert that some DSRC applications may require more than 30 W EIRP to achieve their desired communications.[43]

24. We conclude that it is important to establish some power limits for DSRC operations so that they can achieve widespread deployment, and typically power requirements need to be flexible enough to allow various DSRC applications to be developed. We find that most DSRC operations will use highly directional antennas to focus communications in an intended direction (*e.g.*, along the lane of a highway) and to promote frequency reuse. We agree with comments that indicate that some flexibility in our peak transmit output power should be permitted to account for line losses between the transmitter and the antenna. Therefore, we adopt the following power requirements for DSRC operations in the 5.85-5.925 GHz band:

> The peak transmit output power over the frequency band of operations shall not exceed 750 mW or 28.8 dBm with up to 16 dBi in antenna gain. If transmitting antennas of directional gain greater than 16 dBi are used, the peak transmit output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 16 dBi, *i.e.*, the device's maximum EIRP shall not exceed 30 W EIRP. However, the peak transmitter output power may be increased to account for any line losses due to long transmission cables between the transmitter and the DSRC device's antenna, provided the EIRP does not exceed 30 W.

We conclude that this power limit is sufficient to satisfy many DSRC applications, compensate for transmission line losses, promote the deployment of various types of applications, and provide a high degree of frequency reuse. Nonetheless, our rules will require ITS licensees to use the minimal power necessary to achieve reliable communications in order to promote frequency reuse. We recognize that when operating standards for various DSRC applications are devised, we may need to revisit the specific requirements needed for each type of application and how those applications will best be deployed within a corresponding spectrum channelization plan. For example, DSRC applications requiring more than 750 mW of transmitter output power could be designated to specific channels, whereas other channels could be reserved for those applications using lower power to allow widespread deployment of such operations. Any requests for

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[42] *See* Mark IV Comments at 5, citing *In the Matter of Amendment of Parts 2 and 15 of the Commission's Rules regarding Spread Spectrum Transmitters, Report and Order,* ET Docket No. 96-8, 12 FCC Rcd 7488, 7497 (1997).

[43] *See* DOT Comments at Attachment 3 and ITS America Comments at 15.

additional power should be accompanied by sufficient analysis to demonstrate spectrum sharing with other operations in this frequency range.

3. Unwanted Emission Limits.

25. The NPRM tentatively concluded that the emission mask requirements for Location and Monitoring Service ("LMS") operations in the 902-928 MHz band would be appropriate for DSRC applications in the 5.9 GHz band.[44] No commenter made specific recommendations regarding the proposed unwanted emission limits, but DOT expressed concern that the wholesale application of the proposed limits may be too restrictive for DSRC applications in the 5.9 GHz range.[45] We conclude that it is necessary to limit the amount of unwanted emissions, both those occurring outside of the DSRC spectrum band and those emanating from one channel to the next within the DSRC band. We thus find that the unwanted emission limits proposed in the *NPRM* are appropriate and necessary to promote spectrum sharing between DSRC applications in the 5.85-5.925 GHz band.[46] Accordingly, we adopt the emission mask requirements of Section 90.210(k) for DSRC operations in the 5.9 GHz band. We recognize that depending on the developing DSRC applications, the licensing scheme adopted and the corresponding spectrum channelization plan, we may need to revisit the emission limits between specific channels or applications, *e.g.*, more sensitive applications on specific channels may require additional protection or a licensee with access to multiple consecutive channels in a geographic area could benefit from additional flexibility regarding unwanted emissions without affecting other operations.

4. Frequency Stability.

26. The NPRM proposed to apply to DSRC operations in the 5.9 GHz band the frequency stability requirement specified in Section 2.995 (now Section 2.1055) of our rules[47] in order to prevent DSRC operations from causing interference to DSRC operations on other channels or to other services in nearby spectrum. We note that Part 90 also has more specific frequency stability requirements in Section 90.213 which vary according to the channel bandwidth

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[44] *See* NPRM at ¶ 32.

[45] See DOT Comments Attachment 3 at 2.

[46] We note that the unwanted emission limits adopted here are the existing emission mask requirements for LMS operations in the 902-928 MHz band and are comparable with the maximum spurious emission limits in the ITU Radio Regulations. See 47 C.F.R. § 90.210(k) and *Table of Maximum Permitted Spurious Emission Power Levels, Final Acts of* WRC-97, Appendix S3 (Geneva 1997).

[47] *See 47* C.F.R. § 2.1055. (Frequency stability to be measured with ambient temperature variation of -30° to +50° Centigrade and with variation of primary supply voltage of 85-115% of nominal value.) This rule was renumbered in *Amendment of Parts 2, 15, 18 and Other Parts of the Commission's Rules to Simplify and Streamline the Equipment Authorization Process for Radio Frequency Equipment, Report and Order, ET* Docket No. 97-94, 13 FCC Rcd 11415 (1998).

of the operation.[48] Since we are not yet able to establish a channelization plan for DSRC operations, we will defer any decision on frequency stability requirements to a future proceeding.

*5. RF **Guidelines.***

27. No party opposed the NPRM's proposal to use our existing RF guidelines to protect the traveling public from excessive RF energy.[49] We note that the low power nature of DSRC devices makes it very unlikely that excessive levels of RF energy could result from DSRC operations. Nevertheless, the Commission requires compliance with these guidelines for all applications to ensure the public's safety. Therefore, DSRC operations must comply with the RF safety guidelines contained in the ***Second Memorandum Opinion and Order ("SecondMO&O")*** in ET Docket No. 93-62.[50] We believe this level of protection is appropriate and will not result in exposure to the public of unsafe levels of RF energy.

*6. **Unlicensed DSRC Operations.***

28. The NPRM acknowledged that some non-safety DSRC applications would benefit from unlicensed status because of the ease of implementing and the technical flexibility typically permitted such operations. The *NPRM* pointed out that our rules already permit a variety of unlicensed operations in the 5.725-5.875 GHz range," but asked if the existing Part 15 rules for unlicensed operations were sufficient to accommodate DSRC applications.[52] Specifically, Section 15.245 of our Rules permits unlicensed field disturbance sensors to operate in the 5.785-5.815 GHz band. While these field disturbance sensors are not available for two-way information communications, our rules would permit backscatter" type toll-tag operations in this band with a permitted average field strength of 500 millivolts/meter at a distance of 3 meters (75 mW EIRP). Additionally, Section 15.247 of our Rules permits unlicensed spread spectrum communications devices to operate in the 5.725-5.850 GHz band with a maximum peak

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[48] ***See47*** C.F.R. § 90.213.

[49] ***See*** NPRM at ¶ 35.

[50] ***See Report and Order,*** ET Docket No. 93-62, 11 FCC Rcd 15123 (1997), ***Second Memorandum Opinion and Order and Notice of Proposed Rule making*** at para. 31, ET Docket No. 93-62, 12 FCC Rcd 13494 (1997). ***See also,*** 47 C.F.R. § 1.1307(b).

[51] ***See*** 47 C.F.R. §§ 15.245(b), 15.247 and 15.249.

[52] ***See*** *NPRM* at ¶42.

[53] Amtech explains that backscatter tags contain circuitry that modulates a signal striking the tag so that the reflected (backscatter) signal can be received by a reader and then decoded. Backscatter tags do not contain a transmitter and may operate without a battery, relying on the incident signal as a source of electric power. By contrast, active DSRC tags (transceivers) contain transmitters and receivers for communicating with beacons and must be connected to batteries or some other source of electric power. ***See*** Amtech Reply at 7.

transmitter output power of 1 watt with antenna gain of up to 6 dBi. Finally, Section 15.249 permits unlicensed communications devices to operate in the 5.725-5.875 GHz band with a maximum average field strength of 50 millivolts/meter at a distance of 3 meters (0.8 mW EIRP). Amtech Systems Division of Intermec Technologies Corporation ("Amtech") states that unlicensed use should be part of the DSRC scheme whether or not it is part of the 5.85-5.925 GHz allocation. Amtech also requests that the Commission change its interpretation of frequency hopping spread spectrum systems[54] to allow backscatter DSRC systems in the 5.725-5.825 GHz band under Section 15.247.

29. A backscatter system that transmits an unmodulated carrier signal to a mobile transponder which, in turn, reflects a modulated signal, does not qualify as a conventional spread spectrum system under our rules. Our rules define a spread spectrum system as a system that conveys information by modulation of a carrier by some conventional means and then deliberately widens the bandwidth by means of a spreading function over that which would be needed to transmit the information alone.[55] Because backscatter beacon stations do not modulate their carriers, they do not qualify as spread spectrum devices. We thus decline to modify our rules to allow backscatter systems to qualify for use as spread spectrum systems under Section 15.247. Nevertheless, the spread spectrum requirements of Section 15.247 can likely accommodate a wide range of alternative unlicensed DSRC communication systems.

30. We believe that low power unlicensed DSRC could benefit some applications, such as fee collection at parking garages and commercial establishments. We note that unlicensed applications under our Part 15 rules may not be appropriate for all DSRC applications because they must accept any interference and must not cause interference to other operations, particularly any services with allocated status such as the Part 90 DSRC operations addressed here.[56] Nevertheless, we believe that these types of applications could be useful for DSRC deployments in the 5.85-5.925 GHz band and we will explore in a future proceeding whether we should provide for such applications under either unlicensed or licensed-by-rule status. For example, while short range low power DSRC backscatter systems could probably satisfy the maximum average field strength requirements under Section 15.249 for the 5.725-5.875 GHz band, it is problematic to allow such systems to operate at the same higher power as unlicensed spread spectrum devices under Section 15.247. Therefore, although we find that our existing Part 15

[54] A frequency hopping system is a spread spectrum system in which the carrier is modulated with the coded information in a conventional manner causing a conventional spreading of the RF energy about the frequency carrier. The frequency of the carrier is not fixed but changes at fixed intervals under the direction of a coded sequence. The wide RF bandwidth needed by such a system is not needed to spread the RF energy about the carrier but rather to accommodate the range of frequencies to which the carrier frequency can hop. The test of a frequency hopping system is that the near term distribution of hops appears random, the long term distribution appears evenly distributed over the hop set, and sequential hops are randomly distributed in both direction and magnitude of change in the hop set. See 47 C.F.R. §2.1.

[55] See 47 C.F.R. §2.1.

[56] See47 C.F.R. §15.5.

rules for unlicensed operations should not be changed for the 5.725-5.875 GHz band at this time, we will explore further possible unlicensed or licensed-by-rule requirements for the 5.85-5.925 GHz band once DSRC standards are developed and we have a better idea of what technical requirements would be necessary.

*E. **Other Issues.***

31. Commenters generally support the following definition of DSRC services which we proposed in the NPRM:

> The use of non-voice radio techniques to transfer data over short distances between roadside and mobile radio units, between mobile units, and between portable and mobile units to perform operations related to the improvement of traffic flow, traffic safety and other intelligent transportation service applications in a variety of public and commercial environments. DSRC systems may also transmit status and instructional messages related to the units involved.[57]

As commenters point out, this definition is not as limiting as the definition for LMS operations in the 902-928 MHz band and should allow for a broad range of commercial, private, and safety-related services anticipated for DSRC operations without permitting unintended use.[58] For example, we find that stipulating DSRC as a data service, not intended for two-way voice communications, is in accordance with the ITS National Architecture and would prevent a proliferation of voice applications which could hinder the use of the spectrum by DSRC data applications. Further, any ITS applications that would benefit from real time two-way voice communications could use a variety of other existing land mobile services. Accordingly, we adopt the proposed DSRC definition for *this* mobile allocation in the 5.9 GHz range.

PROCEDURAL INFORMATION

32. ***Final Regulatory Flexibility Analysis.*** The Final Regulatory Flexibility Analysis for this Report and Order, pursuant to the Regulatory Flexibility Act, 5 U.S.C. §604, is contained in Appendix C.

33. For further information concerning this proceeding, contact Tom Derenge at (202) 418-2451, internet: tderenge@fcc.gov, Office of Engineering and Technology, Federal Communications Commission, Washington, DC 20554.

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[57] See NPRM at ¶¶ 43-45.

[58] See DOT Comments at 7 and Mark IV Comments at 6.

ORDERING CLAUSES

34. IT IS ORDERED that, pursuant to Sections 4(i), 7, 302, 303(c), 303(e), 303(f) and 303(r) of the Communications Act of 1934, as amended, 47 **U.S.C.** Section 154(i), 157, 302, 303(c), 303(e), 303(f) and 303(r), this Report and Order IS ADOPTED and that Parts 2 and **90** of the Commission's Rules ARE AMENDED, as specified in Appendix **A,** effective 30 days after publication in the Federal Register.

35. IT IS FURTHER ORDERED THAT the Regulatory Flexibility Analysis, **as** required by Section **604** of the Regulatory Flexibility Act and **as** set **forth** in Appendix C, IS ADOPTED.

36. IT IS FURTHER ORDERED that the Commission's Office of Public Affairs, Reference Operations Division, SHALL SEND a copy of this Report and Order, including the Final Regulatory Flexibility Certification, to the Chief Counsel **for** Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas

Magalie Roman Salas
Secretary

Appendix A: Final Rules

Parts 2 and 90 of title 47 of the Code of Federal Regulations are to be 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: 47 U.S.C. 154, 302, 303, 307 and 336, unless otherwise noted.

2. Section 2.106, the Table of Frequency Allocations, is amended as follows:

a. Revise the entry for the 5850-5925 MHz band to read as follows.

b. **Add** footnote NG160.

§ 2.106 Table of Frequency Allocations

* * * * *

Region 1 -- allocation MHz	Region 2 -- allocation MHz	Region 3 -- allocation MHz	Government	Non-Government	Rule part(s)	Special-use frequencies
			Allocation MHz	Allocation MHz		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
*	*	*	*		*	*
5850 - 5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE **S5.150**	**5850 - 5925** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation **S5.150**	**5850 - 5925** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Radiolocation **S5.150**	**5850 - 5925** RADIOLOCATION **G2** **55.150 US245**	**5850 - 5925** FIXED-SATELLITE (Earth-to-space) **US245** MOBILE NG160 Amateur **S5.150**	ISM Equipment **(18)** Private Land Mobile (90) Amateur **(97)**	
*		*	*	*	*	*

NON-GOVERNMENT (NG) FOOTNOTES

* * * * *

NG160 In the 5850-5925 MHz band, the use of the non-Federal government mobile service is limited to Dedicated Short Range Communications operating in the Intelligent Transportation System radio service.

* * * * *

PART 90 - PRIVATE LAND MOBILE RADIO SERVICES

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

Authority: Sections 4, 251-2, 303, 309, and 332, 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 251-2, 303, 309, and 332, unless otherwise noted.

2. Section 90.7 is amended by adding a new definition for Dedicated Short Range Communications Service to read as follows:

§ 90.7 Definitions.

* * *

Dedicated Short Range Communications Services *(DSRCS)* The use of non-voice radio techniques to transfer data over short distances between roadside and mobile radio units, between mobile units, and between portable and mobile units to **perform** operations related to the improvement of traffic flow, traffic safety and other intelligent transportation service applications in a variety of public and commercial environments. DSRC systems may also transmit status and instructional messages related to the units involved.

* * *

3. Section 90.205 is amended by renumbering Subsections 90.205(m) and (90.205(n) to 90.205(n) and 90.205(o), respectively; and by adding a new Subsection 90.205(m) to read as follows:

§ 90.205 Power and antenna height limits.

* * *

(m) ***5850-5925*** *MHz.* The peak transmit output power over the frequency band of operations shall not exceed 750 mW or 28.8 dBm with up to 16 dBi in antenna gain. If transmitting antennas of directional gain greater than 16 dBi are used, the peak transmit output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 16 dBi, *i.e.,* the device's maximum EIRP shall not exceed **30** W EIRP. However, the peak transmitter output power may be increased to account for any line losses due to long transmission cables between the transmitter and the DSRCS device's antenna, provided the EIRP does not exceed **30** W.

(n) *All other frequency bands.* Requested transmitter power will be considered and authorized on a case by case basis.

(o) The output power shall not exceed by more than 20 percent either the output power shown in the Radio Equipment List [available in accordance with §90.203(a)(1)] for transmitters included in this list or when not or when not so listed, the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

4. Section 90.210 is amended by amending the "APPLICABLE EMISSION MASKS" Table to read as follows and by amending Subsection 90.210(k)(3) to read as follows:

§ 90.210 Emission masks.

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power modulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating in the frequency bands governed under this part.

Applicable Emission Masks		
Frequency band	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25 [1]	A or B	A or C
25-50	B	C
72-76	B	C
150-174 [2]	B, D, or E	C, D, or E
150 Paging-only	B	C
220-222	F	F
421-512 [2]	B, D, or E	C, D, or E
450 Paging-only	B	fi
806-821/851-866 [3]	B	G
821-824/866-869	B	H
896-901/935-940	I	J
902-928	K	K
929-930	B	G
5850-5925	K	K
All other bands	B	C

[1] Equipment using single sideband J3E emission must the requirements of Emission Mask A. Equipment using other emissions must meet the requirements of Emission Mask B or C, as applicable.

[2] Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D, and equipment designed to operate with a 6.25 kHz channel bandwidth must meet the requirements of Emission Mask E.

[3] Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of §90.691.

* * *

(k) * * *

*(3) **Other transmitters.*** For all other transmitters authorized under subpart **M** that operate in the *902-928* MHz band and for Dedicated **Short** Range Communication Services in the *5.850-5.925* GHz band, the peak power of any emission shall be attenuated below the power of the highest emission contained within the licensee's sub-band in accordance with the following schedule:

(i) On any frequency within the authorized bandwidth: **Zero dB.**

(ii) On any frequency outside the licensee's sub-band edges: **55 + 10 log(P) dB**, where (P) is the highest emission (watts) of the transmitter inside the licensee's sub-band.

* * *

5. Section 90.350 is amended to read **as** follows:

§ 90.350 Scope.

The Intelligent Transportation Systems 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) and Dedicated Short Range Communications Service (DSRCS). Rules **as** to eligibility for licensing, frequencies available, and any special requirements for services in the Intelligent Transportation Systems radio service are set forth in **this** subpart.

6. **A** new Section 90.371 is added to subpart M to read **as** follows:

§ 90.371 Dedicated Short Range Communications Service

These provisions pertain to systems in the dedicated short range communications services (DSRCS). DSRCS systems utilize non-voice radio techniques to transfer data over short distances between roadside and mobile radio units, between mobile units, and between portable and mobile units to perform operations related to the improvement of **traffic** flow, traffic safety and other intelligent transportation service applications in a variety **of** public and commercial environments. When authorized, DSRCS licensees operating systems in the *5850-5925* MHz band may serve individuals, federal government agencies and entities eligible for licensing in this **Part,** and must comply with the following requirements.

(a) DSRCS stations operating in the band *5850-5925* MHz shall not receive protection from Government Radiolocation services in operation prior to the establishment of the DSRCS station. Operation of DSRCS stations within 75 kilometers of the locations listed in the table below **must** be coordinated through the National Telecommunications and Information Administration.

Location	Latitude	Longitude
Ft. Lewis, WA	470525N	122351OW
Yakima Firing Center, WA	464018N	1202135W
Ft. Carson, CO	383810N	1044750W
Ft. Riley, KS	385813N	0965139W
Ft. Shafter, HI	211800N	1574900W
Hunter Army Airfield, GA	320100N	0810800W
Ft. Gillem, GA	333600N	0841900W
Ft. Benning, GA	322130N	0845815W
Ft. Stewart, GA	315145N	0813655W
Ft. Rucker, AL	311947N	0854255W
Yuma Proving Grounds, AZ	330114N	1141855W
Ft. Hood, TX	310830N	0974550W
Ft. Knox, KY	375350N	0855655W
Ft. Bragg, NC	350805N	0790035W
Ft. Campbell, Ky	363950N	0872820W
Ft. Polk, LA	310343N	0931226W
Ft. Leonard Wood, MO	374430N	0920737W
Ft. Irwin, CA	351536N	1164102W
Ft. Sill, OK	344024N	0982352W
Ft. Bliss, TX	314850N	1062533W
Ft. Leavenworth, KS	392115N	0945500W
Ft. Drum, NY	440115N	0754844W
Ft. Gordon, GA	332510N	0820910W
Ft. McCoy, WI	440636N	0904127W
Ft. Dix, NJ	400025N	0743713W

Parks Reserve Forces **Training** Area, CA	374254N	1214218W
Ft. Hunter Ligget, CA	355756N	1211404W
Pacific Missile Test Center, CA	340914N	1190524W
Naval Air Development Center, PA	401200N	0750500W
Mid-Atlantic Area Frequency Coordinator, MD	381710N	0762500W
Naval Research Laboratory, MD	383927N	0763143W
Naval Ocean Systems Center, CA	324500N	1171000W
Naval Research Laboratory, DC	385500N	0770000W
Naval Surface Weapons Center, MD	390205N	0765900W
Naval Electronic Systems Engineering Activity, MD	381000N	0762300W
Midway Research Center,	382640N	0772650W
Aberdeen Proving Ground, MD	392825N	0760655W
Ft. Huachuca, AZ	313500N	1102000w
Ft. Monmouth. NJ	401900N	0740215W
Picatinny Arsenal, NJ	405600N	0743400W
Redstone Arsenal, AL	343630N	0863610W
White Sands Missile Range, NM	322246N	1062813W
Army Research Laboratory, MD	390000N	0765800W

Space and Missile Systems Center, CA	335500N	1182200W
Edwards AFB, CA	345400N	1175200W
Patrick AFB, FL	281331N	0803607W
Eglin AFB, FL	302900N	0863200W
Holloman AFB, NM	322510N	1060601W
Kirtland AFB, NM	350230N	1063624W
Griffiss AFB, NY	431315N	0752431W
Wright-Patterson AFB, OH	394656N	0840539W
Hanscom AFB, MA	422816N	0711725W
Nellis AFB, NV	361410N	1150245W
Vandenberg AFB, CA	344348N	1203436W
U.S. Air Force Academy, CO	385800N	1044900W
Brooks AFB, TX	292000N	0982600W
Arnold AFB, TN	352250N	0860202W
Tyndall AFB, FL	300412N	0853436W
Charles E. Kelly Support Facility--Oakdale, PA	402357N	0800925W

Appendix B: DSRC Applications

o Current DSRC applications include:

- Electronic payment services - Allows cars to pay tolls automatically without stopping. Could be expanded in the future to be used at parking garages, drive through restaurants and other business applications.
- Commercial Vehicle Electronic Clearance - Installed by highway departments to allow commercial vehicle operators pass over weigh-in-motion sensors at inspection stations without stopping while the vehicle transmits relevant information such as: credentials, size, weight, cargo, and safety information.

o Emerging DSRC-based services include:

- Traffic Control - This service gathers traffic data from stationary traffic surveillance monitors and DSRC-equipped vehicles and uses the data tu assign rights-of-way to certain vehicle types. Rights-of-way are assigned through control of traffic signals, freeway ramps, reversible lanes, and information signs.
- Transit Vehicle Signal Priority - A DSRC-equipped transit vehicle (city bus), when identified by a DSRC-equipped intersection, can give priority to proceed ahead of other traffic at a traffic signal.
- Emergency Vehicle Signal Preemption - Emergency vehicles are given priority at traffic signals.
- Incident Management - (Incidents include accidents, sporting events, parades, construction, etc.) Roadway sensors and DSRC-equipped vehicles will allow incident management users to reduce congestion by accelerating incident detection and response time. The system can track cars as they travel to their destination and use the information to estimate traffic flow and detect incidents.
- En-route Driver Information - Provides drivers with real-time advisories about traffic conditions, accidents, construction and transit schedules.

*In-vehicle Signing - Displays information from roadside transmitters on video monitors or "heads-up" displays within the vehicle to provide the driver information pertinent to their specific circumstances based on their destination, surroundings and current activities. Information could include roadway conditions, alert drivers to railroad crossings, construction zones, fallen rocks, chemical spills, winding curves and other hazards. In-vehicle signing also serves as the driver interface for many other DSRC-based applications.

*Driver Advisory - Allows traffic managers to control the content of real-time and location-specific traffic advisory information.

- Automated Roadside Safety Inspection - DSRC would download information from a commercial vehicle's transponder memory about the driver, the vehicle (braking system

and load distribution), the carrier and previous safety inspection, and upload inspection results to the transponder's memory. This function *can* increase the number of inspections while not increasing the number **of** inspectors or delaying commercial vehicle travel.

- Public Transportation Management - DSRC-equipped transit vehicles can realize increased use and efficiency by improving service reliability, on-time performance, schedule information accuracy and reduced costs **of** public transit.
- Freight Mobility - Allows dispatchers to locate and track commercial fleet vehicles, transit vehicles and there cargo, and re-route vehicles based on real-time traffic information. Allows fleet operators to optimize performance by enabling just-in-time pick-up and delivery, reducing driver hours sitting in congestion and waiting to deliver or receive goods, and automating cargo inventory and tracking systems.

  *Automatic Equipment Monitoring - Transponders on vehicles, trailers, rail cars, cargo containers may be tracked, information such **as** type and temperature of cargo, delivery schedule, hazardous materials, etc. can be checked.

  *Fleet Management -

  -Access control - regulate and restrict access to freight yards, maintenance bays, and other restricted areas

  -**Trip** log - downloads all DSRC events made during a **trip** into a log while the vehicle is stopped at a freight yard enabling fleet managers to determine the vehicle's route, time on the route and safety information.(27)
- Highway-Rail Intersection - DSRC equipment used to trigger warning systems at railroad intersections when a train is approaching.

o Future DSRC-based services:

- Intersection Collision Warning Systems - Roadside speed and location sensing equipment, DSRC equipment, in-vehicle signing and trajectory computing and control electronics will be used to help drivers avoid intersection collisions.
- Automated Highway System - System that will transfer full control **of** equipped vehicles to automated system operating on designated AHS lanes.

APPENDIX C

Final Regulatory Flexibility Analysis

As required by the Regulatory Flexibility Act ("RFA"),[59] an Initial Regulatory Flexibility Analysis ("IRFA") was incorporated into the *Notice of Proposed Rule Making ("NPRM")* in this docket, ET Docket No. 98-95.[60] The Commission sought written comment on the proposals in the NPRM, including the IRFA. The Final Regulatory Flexibility Analysis ("FRFA") in this Report and Order conforms to the RFA.[61]

A. Need for and Objective of this Report and Order (R&O). This R&O allocates the 5.850-5.925 GHz band to the Private Land Mobile Service ("PLMS") for use by Dedicated Short Range Communications Services ("DSRCS") in the provision of Intelligent Transportation Services ("ITS"). DSRCS communications are used for non-voice wireless transfer of data over short distances between roadside and mobile radio units, between mobile units, and between portable and mobile units to perform operations related to the improvement of traffic flow, traffic safety and other intelligent transportation service applications in a variety of public and commercial environments. The objective of this action is to provide sufficient spectrum to permit the development of DSRCS technologies to improve the Nation's transportation infrastructure and bolster the involvement of United States companies in this emerging industry. While this R&O does adopt an allocation and some basic technical parameters, the issues of licensing, channelization, and other complex technical matters are being deferred to a later proceeding. Therefore, because this present action will not result in the provision of these operations, the IRFA certified that the *NPRM* would not have a significant economic impact on a substantial number of small entities. Nevertheless, a full voluntary IRFA was performed. No comments directly addressed the IRFA.

B. Summary of Significant Issues raised by the Comments in Response to the IRFA. No comments were filed in response to the IRFA.

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[59] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 *et. seq.*, has been amended by the Contract With America Advancement Act of 1996, Pub. L. No. 104-121, 110 Stat. 847 (1996) (CWAAA). Title II of the CWAAA is the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).

[60] *See In the Matter of Amendment of Parts 2 and 90 of the Commission's Rules to Allocate the 5.850-5.925 GHz Band to the Mobile Service for Dedicated Short Range Communications of Intelligent Transportation Services, Notice of Proposed Rule Making,* ET Docket No. 98-95, 13 FCC Rcd 14321, (1998).

[61] *See* 5 U.S.C. § 604.

C. Description and Estimate of the Number of Small Entities to which the Rules Will Apply. Under the RFA, small entities may include small organizations, small businesses, and small governmental jurisdictions.[62] The RFA, 5 U.S.C. § 601(3), generally defines the term "small business" as having the same meaning as the term "small business concern" under the Small Business Act, 15 U.S.C. § 632. A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration ("SBA"). This standard also applies in determining whether an entity is a small business for purposes of the RFA.

The 5.85-5.925 GHz band is currently available to the U.S. Federal Government for Radiolocation purposes, Fixed Satellite Service licensees for international intercontinental links, amateur radio operators and by various entities using Part 18 Industrial, Scientific and Medical ("ISM') equipment and Part 15 unlicensed device equipment. We note that there are only 45 Fixed Satellite Service ("FSS") licenses issued for operation in 5.85-5.925 GHz band and most if not all are held by large corporations. Further, amateur radio operators and the Federal Government do not qualify as small entities. We also note that Part 18 ISM devices are protected in this band, which only generate electromagnetic energy, are not used for communication purposes and therefore cannot receive interference or be impacted by this action. Finally, while Part 15 unlicensed devices are permitted to operate in the 5.85-5.875 GHz portion, they do so on an unlicensed, unprotected basis. Further, the Commission has no means to determine the number of small entities that might use unlicensed Part 15 equipment that operates in the band at issue. SBA guidelines to the Small Business Regulatory Enforcement Fairness Act ("SBREFA") state that about 99.7% of all firms are small and have fewer than 500 employees and less than $25 million in sales and assets.[63] There are approximately 6.3 million establishments in the SBA database.[64] The R&O discusses means by which the potential DSRCS would be able to share the spectrum with incumbent operations and concludes that harmful interference can be avoided through coordination. Accordingly, we do not believe this action would have a negative impact on small entities that operate in the 5.85-5.925 GHz band.

Regarding the Fixed Satellite Service licensees for international intercontinental links, the Commission has not developed a definition of small entities applicable to licensees in the international services. Therefore, the applicable definition of small entity is generally the definition under the SBA rules applicable to Communications Services, Not Elsewhere

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62 *See* 5 U.S.C. § 601(6).

63 *See A Guide to the Regulatory Flexability Act,* U.S. Small Business Administration, Washington, DC, May, 1996, at page 14.

64 *Id.* at 15.

Classified (NEC).[65] This definition provides that a small entity is expressed as one with $11.0 million or less in annual receipts.[66] According to the Census Bureau, there were a total of 848 communications services providers, NEC, in operation in 1992, and a total of 775 had annual receipts of less than $9,999 million.[67] The Census report does not provide more precise data.

Regarding the future use of the 5.85-5.925 GHz band by DSRCS equipment, we believe it is too early to make an determination on such operations. A future rule making proceeding will propose further technical standards, licensing and service rules and a separate regulatory flexibility analysis will address all issues relevant to that proceeding.

D. Description of Projected Reporting, Record Keeping and Other Compliance Requirements. In this proceeding, we are allocating this spectrum for a new service. The licensing and technical regulations governing these operations will be addressed in a separate proceeding. Therefore, this action does not create any reporting or compliance requirements.

E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered. The IRFA in this proceeding requested comment on ways to minimize economic impact on small entities, but no comments were filed. Nevertheless, the attached R&O discusses whether operational standards should be adopted to facilitate nation-wide interoperability of DSRCS, but deferred this issue to a later proceeding that will develop service rules for these operations. The development of DSRCS operational standards could delay the initial deployment of such equipment, but could ultimately result in equal footing for all manufacturers, including small entities, in producing equipment that meets uniform standards.

F. Report to Congress. This Commission will send a copy of the R&O, including this FRFA, in a report to be sent to Congress pursuant to the Small Business Regulatory Enforcement Fairness Act of 1996, see U.S.C. § 801(a)(1)(A). In addition, the Commission will send a copy of the R&O, including FRFA, to the Chief Counsel for Advocacy of the Small Business Administration. A copy of the R&O and FRFA (or summaries thereof) will also be published in the Federal Register. See 5 U.S.C. § 604(b).

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[65] An exception is the Direct Broadcast Satellite (DBS) Service, infra.

[66] 13 C.F.R. § 120.121, SIC code 4899.

[67] 1992 Economic Census Industry and Enterprise Receipts Size Report, Table 2D, SIC code 4899 (U.S. Bureau of the Census data under contract to the Office of Advocacy of the U.S. Small Business Administration).