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Public Comment to FCC 02-302

The Notice of Proposed Rule Making (NPRM) Regarding WT Docket No. 01-90 and ET Docket

No. 02-302 "Regarding Dedicated Short-Range Communication Services in the 5.850-5.925 GHz Band (5.9 GHz Band)"

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Public Comment to FCC 02-302

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1.0 SCOPE

The Johns Hopkins University Applied Physics Laboratory (JHU/APL), under contract to the Federal Highway Administration (FHWA), is a noted member[1] of the joint American Society for Test and Measurement (ASTM) E17.51 Subcommittee and the Institute of Electrical and Electronic Engineers (IEEE) SCC32 committee that comprise the Dedicated Short Range Communications (DSRC) Standards Writing Group. The Laboratory endorses the ITS America submittal to the FCC, regarding DSRC use of the 5.850 to 5.925 GHz band. Technical information is provided to demonstrate that this plan represents a flexible design that supports interoperable deployment of public safety applications. This plan implements the recommendations of the FCC Spectrum Policy Task Force, as stated in Report ET Docket No. 02-135, dated November 2002[2]

This document discusses how the proposed Channeling Plan conforms to the mandates of ET Docket. No. 02-135. The interaction between public safety applications and private services is described. Recommendations are made to govern licensing of DSRC. These recommendations include: “license by rule” for On Board Units (OBUs), Site licensing for Road Side Units (RSUs) instead of licensing by geographic area, and the prohibition of Part 15 devices. Answers to specific questions raised by The Commission in FCC 02-302 are also provided.

[1] Section C, Paragraph 28 entitled, “ITS America and the Standards Writing Group” of FCC 02-0302
[2] Federal Communications Commission Spectrum Policy Task Force Report ET Docket No. 02-135, November, 2002.

2.0 902-928 MHZ LOCATION AND MONITORING SERVICE BAND

2.1 Background

Paragraphs 24 through 29 in Section C of FCC 02-302, entitled “Interoperability,” highlight the problems associated with the allocation of a frequency band for public applications, without mandating a national communications standard. The proliferation of multiple equipment protocols has led to isolated, non-interoperable service areas throughout the U. S. Users enrolled in more than one program and long-distance travelers have been forced to purchase multiple transponders (onboard units), in order to receive service. Particularly hard hit has been the commercial vehicle operator, providing interstate transport or nationwide services. Not only are equipment costs multiplied, but performance and reliability degrades as the potential for interference increases. In some cases, two or more transponders of identical manufacture are required onboard the vehicle, because systems are not interoperable, despite deploying identical roadside communications equipment. Imagine the public outcry, if multiple car stereo systems were required, in order to receive AM/FM broadcast service, in different cities.

Lack of interoperability, through a common communications standard, also increases deployment and operating costs to state agencies and private sector operators. Programs are forced to build and maintain redundant transponder distribution and service capabilities. New service startup costs are higher, as new programs must account for these transponder-related costs, without being able to leverage a large, existing national customer base. Many potential new services, and their value-added benefits to the nation, are not realized because of this increased entry cost.

The success, to date, of electronic toll collection (ETC), electronic screening (E-Screening) and other DSRC-based applications illustrate the value and utility of the technology. Of particular note is the overwhelming success of the E-ZPass^{sm} system in the Northeast region. The E-ZPass^{sm} program allows customers to pay tolls electronically in multiple states using a single transponder. The widespread acceptance of E-ZPass^{sm} demonstrates the importance of interoperability.

Because of the tremendous amounts of sunken capital investment in DSRC hardware and related infrastructure, the possibility of remedying the current situation without a national standard is virtually impossible. If the proposed 5.9 GHz DSRC standard was adopted, then systems could migrate to the new interoperable devices, during the course of the normal equipment replacement cycle. Without an accepted national standard, the variety of non-interoperable devices will remain, and the situation will not improve.

2.2 Collocation of Existing DSRC Systems

JHU/APL has conducted numerous tests and technical studies into the possibility of collocating existing 902-928 MHz DSRC devices with different communications protocols. The results confirmed the obvious. It is physically impossible for two products, operating at or near the same frequency, with no timing coordination or other compensation mechanism, to effectively operate, without interfering with each other. The passive/backscatter DSRC systems utilize beacons that continuously provide a signal, even when the transponder is responding. Active protocol DSRC systems have powered transponders that initiate transmissions. Thus, backscatter systems interfere with active transponders by increasing the noise floor. Conversely, active transponder transmissions create interference to the backscatter beacons. The problem is even worse when considering the case of two different active protocol systems, where the transmissions are sufficiently similar to result in a jamming effect.

Another problem in co-deploying DSRC equipment, both operating in the 902-928 MHz frequency band, occurs for lane-based applications, such as at ETC plazas. The effective radiated power (ERP) of the beacon transmissions results in RF spillage into adjacent lanes. The existing antennas are not physically large enough to support the necessary directivity, so, a combination of methods, including controlled power levels, timing, and transaction zone sizing, are used to keep the system from interfering with itself. Add a second DSRC system, operating in the same frequency band, and the problem becomes virtually impossible.

2.3 Migration of Existing DSRC Systems from 902-928 MHz to 5.9 GHz

FHWA has taken a first step toward national interoperability of DSRC systems, by proposing a standard for Commercial Vehicle Operations (CVO) deployments[3]. This proposal would require CVO projects receiving federal highway funds to adhere to a new 902-928 MHz DSRC standard, commonly referred to as the "Sandwich Specification." The 902-928 MHz DSRC Sandwich Specification is based on existing active-protocol product design, but also incorporates a new application layer standard, IEEE 1455-1999.

IEEE 1455-1999 describes how communications are conducted between the Roadside Unit (RSU) and the Onboard Unit (OBU). Data access is controlled using various service tables. Message types and formats are also specified in IEEE 1455-1999.

The IEEE 1455-1999 standard also defines the application layer for the proposed 5.9 GHz DSRC standards. This commonality between the 902-928 MHz DSRC Sandwich Specification and the proposed 5.9 GHz DSRC standards would ease the migration from deployed to new equipment. Since message types and formats would be

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[3] Department of Transportation, Federal Highway Administration, 23 CFR Part 945, FHWA Docket No. FHWA 99-5844, RIN 2125-AE63, "Dedicated Short Range Communications in Intelligent Transportation Systems (ITS) Commercial Vehicle Operations.

unchanged, interfaces to the roadside equipment would remain the same and back-office systems unchanged.

Discussion presented in Paragraph 83, "Location and Monitoring Service," expresses concern about premature adoption and migration to the 5.9 GHz band (see Section K, Other Matters). Presentations at the DSRC Standards Writing Group meetings show that these concerns may be overstated. Several states, including Florida, Texas and New York, are already planning and making preparations for early transition to 5.9 GHz.

The International Bridge, Tunnel and Thruway Association (IBTTA), a member of the DSRC Standards Writing Group representing the major ETC systems, also supports the proposed 5.9 GHz DSRC Standard effort. IBTTA has also been studying migration strategies to 5.9 GHz DSRC.

3.0 5.850 TO 5.925 GHZ DSRC BAND

3.1 Design Considerations

The Executive Summary of the Task Force Major Findings and the Recommendations sections of ET Docket No. 02-135, assert that:

- "The Commission should pursue a balanced spectrum policy that includes both the granting of exclusive spectrum usage rights through market-based mechanisms and creating open access to spectrum 'commons', with command-and-control regulation used in limited circumstances."[4]
- Public safety is identified as an interest objective.
- "Common Elements of Spectrum Policy" include "(p)olicies that encourage grouping of spectrum neighbors" with technically compatible characteristics.[5]
- Interference management in a dense mobile arena is tantamount.
- "Command-and-control regulation should be reserved only for situations where prescribing spectrum use by regulation is necessary to accomplish important public interest objectives or to conform to treaty obligations."[6]
- "Public safety users should have the ability to lease excess capacity for other uses through time sharing of spectrum or other mechanisms."[7]

All of these objectives are recognized and agreed to by the DSRC Standards Writing Group. The proposed 5.9 GHz standards and the Channeling Plan developed by the DSRC Standards writing Group satisfies these objectives.

In order to select the modulation type that fully supports the public safety requirement, the DSRC Standards Writing Group 9 GHz used the following guidelines:

- Maximum data rate should support existing and future requirements
- Robust modulation scheme to reduce multi-path and fading
- Use proven or promising emerging technology
- No limitations on supported public safety applications (exclude capability of two-way, real-time voice communications link)
- Minimal implementation cost
- Minimum implementation risk
- Maximum flexibility of features (i.e. channeling, interfacing, message lengths, etc.)
- Open architecture to be freely available to multiple suppliers
- Diagnostic outputs to assist in performance evaluation
- Provide for growth to support future applications

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[4]Reference 2, Page 3.
[5] Ibid, Page 4.
[6] Ibid, Page 5.
[7] Ibid, Page 17.

- Detailed specifications and acceptance tests will be defined
- Licensing procedure will be developed to ensure standard, interchangeable and interoperable products.

The DSRC Standards Writing Group performed extensive research and analysis in order to develop the best solution and optimize use of the frequency band. These activities included:

- Examination of the Japanese and European DSRC standards in order to adopt the best features of each, and learn from their shortcomings
- Extensive testing of competing technologies under realistic conditions.
- Multi-path testing was conducted in a parking garage, between buildings and at a toll plaza.
- Two-way data link testing was conducted on highways and at a test track at speeds up to 120 mph to determine if sufficient time was available to meet transaction requirements.
- Simulations were developed to characterize the propagation channel for DSRC environments[8] and to model the effects of delay spread, antenna height, Doppler and path loss.

Data link simulations were the basis for the DSRC band requirements to use 10 MHz channels, half the 802.11a data rates, and system clock requirements with twice the stability of the 802.11a clock. These requirements reduce the potential for performance degradation due to multi-path and fading. Also, transmit mask, transmission power level control and the Received Signal Strength Indication (RSSI) levels are increased in the DSRC standard, in order to reduce the potential for interference. This design does not allow for Part 15 devices to cohabitate in this band with licensed DSRC equipment.[9]

3.2 DSRC Relationship to Adjacent Frequency Bands

As noted in Paragraph 29 of FCC 02-302, the DSRC Standards Writing Group, on August 24, 2001, cast a nearly unanimous decision to select Orthogonal Frequency Division Multiplexing (OFDM) and IEEE 802.11a technology as the basis for the new 5.9 GHz DSRC standard. This selection allowed DSRC to leverage the technology adopted for its neighbor, the Unlicensed National Information Infrastructure (U-NII) band. Thus, DSRC now fulfills the Spectrum Policy Task Force Requirement to "encourage grouping of spectrum 'neighbors' with technically compatible characteristics."[10] Selection of the 802.11a technology opens the market to the large

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[8] "DSRC Physical Channel Characterization", Final Report, prepared for CALTRANS TCFI by TechnoCom Corporation, June 30, 2000.
[9] Response to question posed by The Commission in Paragraph 50 of Reference 1 regarding shared usage of DSRC and Part 15 equipment in the DSRC band.
[10] Reference 2, Page 16.

number of chip vendors producing 802.11a products, and ultimately, significantly reducing development and manufacturing costs.

Much of the upper layer architecture development effort is designed to be consistent with relevant International Standards Organization (ISO) and other IEEE standards. ISO Working Group 16 is developing the Communication Air Interface Long and Short Media (CALM) architecture. CALM covers the frequency spectrum from 4.9 to 5.9 GHz, and mandates total system interoperability at all levels.

To meet the CALM requirements, the DSRC architecture adopted IPV6 as the method of handling upper layer applications. This design allows DSRC to use standard internet protocols to handle message traffic in all channels except the DSRC Control Channel. DSRC is therefore consistent with the Spectrum Policy Task Force recommendation to develop a "…balanced spectrum policy that includes both the granting of exclusive spectrum usage rights through market-based mechanisms and creating open access to spectrum 'commons', with command-and-control regulation used in limited circumstances."[11]

FCC has ruled that the 4.5 GHz band will be provided to emergency services for communications. Specifically, the 4.5 GHz band will be restricted to voice and data communications between police, fire, and other emergency services. DSRC at 5.9 GHz complements this function by providing for public safety notification and broadcasts. In fact, the DSRC proposed channeling plan augments the 4.5 GHz capability, by allowing emergency services to also operate at 5.9 GHz, albeit under the same rules of usage as the general public[12].

[11] Reference 2, Page 3.
[12] With the exception of being allowed higher effective radiated power for applications on Channel 184.

4.0 DSRC CHANNELING PLAN

The channeling plan developed by the DSRC Standards Writing Group fully exploits all IEEE 802.11a, IEEE 802.11 and U-NII band technologies. The Command Channel concept is based on existing 902-928 MHz DSRC products, and fully supports the requirement for public safety to be the primary, but not the only user of the 5.9 GHz band. Section D of FCC 02-0302, provides a description of this concept. Additional detail is provided below.

The Control Channel is designated to provide "command-and-control regulation used in limited circumstances."[13] It is the "(e)fficient and reliable enforcement mechanism(s) to ensure regulatory compliance by all spectrum users."[14] As stated in Paragraph 37 of FCC 02-302, this channel ***must*** be accessed on a periodic basis by ***every*** unit operating in the DSRC band. This channel is used by both RSUs and OBUs to transmit public safety information and also to advertise the availability of other licensed services. In order to maintain the integrity of the Control Channel and ensure the performance necessary to support public safety functions, it is imperative that only approved DSRC hardware should operate in this 5.9 GHz frequency band. Other non-conforming equipment would generate interference since timing on channels could not be coordinated[15].

The Spectrum Policy Task Force recommended that, "…command-and-control regulation should be reserved only for spectrum uses that provide clear, non-market public interest benefits or that require regulatory prescription to avoid market failure."[16] The proposed DSRC Channeling plan implements this recommendation by supporting the public safety functions using the Control Channel while also permitting other private sector services to operate.

The ability to fully support, and grant priority to all public safety messages is required for all RSUs. Otherwise, the RSUs may be operated to provide services without interference to other users. Licensing of RSUs is critical because this design could be exploited to provide priority to non-critical transmissions, and therefore, interfere with public safety and other legitimate services.

OBUs are required to listen to the Control Channel every few hundred milliseconds[17], in order to check for public safety messages. The messages on the Control Channel are of variable length, but are generally kept short, to permit maximum access to the channel. Licensing of both RSUs and OBUs is necessary to prevent excessive use of the Control Channel. OBUs should be licensed by rule, since these

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[13] Reference 2, Page 3.
[14] Ibid, Page 4.
[15] See footnote 16.
[16] Ibid, Page 41.
[17] The exact access time will be determined via simulations

devices are mobile and can operate across the nation communicating with any other DSRC devices within range[18].

Control Channel access will be performed via a standard 802.11a feature, Carrier Sense Multiple Access with Collision Detection (CSMA/CD). All devices when tuned to the Control Channel, by default listen for a transmission. If a DSRC device desires to transmit, but detects another message being broadcast on the Control Channel, it must wait before attempting to transmit. A request to send (RTS) is initiated and time is granted first to high priority (public safety) broadcasts, then to lower priority transmissions. If a device leaves the Control Channel, to communicate on another channel, a timer is activated to indicate when to return to the Control Channel.

The same Control Channel is used for roadside-to-vehicle, vehicle-to-roadside and vehicle-to-vehicle communications. This design exploits the fact that DSRC has limited range. Simulations indicate that even in high density areas, reliable service can be provided. Additional simulations are being developed to refine the detailed specification of the Control Channel.

Since the Control Channel will be fixed throughout the nation, all DSRC devices will be designed to access those services. ASTM Standard E2213-02 now requires that every DSRC device to power-up in a default state[19] to listen on the Control Channel. Note that only Control Channel services are required for all devices. Therefore, a wide range of DSRC products can be developed, with low-cost devices only providing access to the services residing on the Control Channel, which includes public safety. High-end, more expensive devices will be able to support additional DSRC and U-NII channels and deliver the full capability of DSRC.

[18] OBU-to-OBU communications would be an enhancement function over the low cost, baseline OBU product

[19] ASTM E2213-02, Standard Specification for Telecommunications and information exchange between roadside and vehicle systems, Specific requirements – 5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) specifications, Section 6.4.1.

5.0 LICENSING ISSUES

5.1 Onboard Units (OBUs)

By definition, an OBU is any mobile device that participates in the DSRC band and conforms to the DSRC rules while in motion. As the Commission points out in Paragraph 51 of Section 2.0 of FCC 02-302 entitled "On Board Units," there are basically two types of OBUs. The Public Safety OBUs are equipped with enhanced capabilities to support public safety and emergency services[20]. The second classification, entitled "OBUs associated with a specific system," is contrary to the proposed DSRC concept and not in the best interest of the nation. Since OBUs are general purpose devices, supporting a wide range of both private and public services, throughout the nation, it is impossible to associate these OBUs with a single specific system. Instead the DSRC proposal defines "private OBUs," which are "licensed by rule" devices, intended for use by the general public. These devices freely operate with multiple systems, across the nation.

DSRC is designed to capitalize upon the significant advantages offered by current spectrum-based radio smart technologies. Smart technologies sense the spectrum environment to dynamically adapt and adjust operations. "…Increasing access to the spectrum for smart technologies, such as software-controlled radios, can improve utilization, through more efficient access, of the radio spectrum without detriment to existing spectrum users."[21] DSRC devices are software-controlled and incorporate these smart technologies. Extensive power control features used in both transmission and RSSI reporting conforms to both the "commons" model and the "command-and-control" model of the Spectrum Policy Task Force. They also allow DSRC devices to afford the maximum amount of interference protection[22] and permits "power levels to be adjusted to match the environment of the transmitter and the intended service area."[23]

Private OBUs will be limited to 23 dBm maximum effective radiated output power. Power levels for transmission will be adjusted automatically, as part of the communications. When a receiving device detects point-to-point transmissions, its RSSI determines the appropriate output power adjustment for the transmitting device. The required output power information is sent back to the transmitting device, via a reply message. And, likewise, the appropriate output power adjustment for the return link is also communicated in the opposite direction. In this manner, transmission power levels can be optimized and the number of DSRC devices sharing the spectrum can be maximized. This design affords the "Maximum Flexibility of Spectrum Use"[24] in a

[20] Ibid, Sections 8.9.1.6 and 8.9.1.7.
[21] Reference 2, Page 15.
[22] Ibid, page 18.
[23] Ibid, page 19.
[24] Ibid, Page 16.

frequency band "…in which regulating spectrum use on a command-and-control basis may continue to be necessary to achieve certain public interest objectives."[25]

Conformance with these highly-advanced DSRC design requirements can not be ensured by Part 15 regulation. Part 15 does not mandate adequate power, power control, clock stability or channel control to satisfy the proposed DSRC architecture. If Part 15 devices were permitted to operate without coordination, it would have the effect of increasing the noise floor and otherwise interfering with DSRC devices. Allowing limited-capability Part 15 devices to operate in the 5.9 GHz band, without requiring the additional DSRC requirements would reduce the overall performance and reliability of the frequency band.

DSRC OBUs should be licensed by rule and mandated to participate on the Control Channel while moving. License by rule satisfies the requirement of the Spectral Policy Task Force for "(e)fficient and reliable enforcement mechanisms to ensure regulatory compliance by all spectrum users."[26] Requiring all devices in the 5.9 GHz band to operate in accordance with the DSRC standards is necessary, to reliably support public safety functions and other services.

Public Safety OBUs are permitted higher output power levels on specific channels to ensure that safety transmissions reach their intended audience[27]. Additional features are also included to allow emergency vehicles to perform safety functions such as traffic signal control and emergency message broadcast. In order to prevent this privileged capability from being abused or counterfeited, special security measures are necessary. Licensing and regulation of these Public Safety OBUs is absolutely required.

Finally, in regard to the issue The Commission raises in Paragraph 53 of FCC 02-302, "we seek comment on whether OBUs not associated with an RSU should be permitted to operate under Part 15." All OBUs associate with RSUs for Control Channel information. All RSUs are required to transmit public safety information to all OBUs in range. Therefore, OBUs are always associated with any RSU within range. As discussed earlier, Part 15 operations, whether by dedicated devices, or as a feature of OBUs, should not be permitted due to degradation in the overall performance and reliability of the frequency band.

5.2 Roadside Units (RSUs)

An RSU is a device that operates in the DSRC band from a stationary position. The same rules of Control Channel utilization used for OBUs also apply to RSUs.

There are two types of RSUs, fixed and portable. Fixed RSUs are affixed to a structure or otherwise installed at a stationary location. Portable RSUs are public safety

[25] Ibid, Pages 16 and 41.
[26] Reference 2, Page 4.
[27] For example, traffic signals, cars, etc. within their intended, extended communication zone.

devices that can be temporarily placed near a danger zone, and operated in a stationary manner. These Portable RSUs can perform functions similar to the variable message signs currently used by highway authorities. Only authorized agencies will be allowed to own Portable RSUs, and their operations restricted to public safety functions.

RSU installations are similar to cellular towers in that it has a communication zone dictated by the RF environment. The RSU controls communications/transactions between OBUs within its zone. It may have hardwired connections to external resources, permitting data transfer and coordination of message traffic with other RSUs and back office applications. Unlike cellular towers, large/tall structures are not required as DSRC communication ranges are very limited. RSUs should be non-interference devices without overlapping communication zones in the 5.9 GHz DSRC band.

While geographic licensing works best for cellular service, it is not the correct solution for DSRC. Cellular service is best operated in large continuous coverage areas served by a few providers. In contrast, DSRC is envisioned to encompass a multitude of services, provided by a number of enterprises, each with localized communications zones. In many cases, DSRC operations, and the associated communications zones may be restricted to the property boundaries of the private enterprise (i.e. restaurants, gas stations, parking facilities, banks, etc…).

Although geographic licensing may be initially successful at getting some DSRC services rapidly deployed, as noted by The Commission in Paragraph 48 of FCC 02-302, it would not serve the long term interests of the nation. Geographic licensing would inhibit the multitude of services that could be provided. It would be a windfall for the luck few that get in first, and an economic barrier or burden for all that follow. The overall success of the 5.9 GHz DSRC frequency band may be jeopardized because of the minimal value added by only a limited number of services. Site licensing is the best way to act on the recommendation of the Spectrum Policy Task Force found in "The Case for Spectrum Reform," whereby "(t)he Commission should also strive, wherever possible, to eliminate regulatory barriers to increased spectrum access."[28]

High-technology "smart antennas"[29] further support deployment through site licensing. Use of high frequency/short wavelength combined with new higher dielectric microwave materials permits tiny, inexpensive antenna arrays, and patches to be customized to service any communication zone requirement[30]. Coverage initially granted to an RSU to serve a broad area could later be adjusted when new RSUs enter the area. Also additional RSUs may be able to target specific communications zones, in the

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[28] Reference 2, Page 4.

[29] See, for example, "Smart Antennas: The Freedom to Choose", Wireless Design and Development Magazine, November 2002, Pages 20-22.

[30] For the technology competition, JHU/APL was required to produce antennas for RSU and OBU operations. For the RSU, a helix antenna was constructed, measuring approximately 6 inches in length by 2.5 inches at the base. This antenna had as good a pattern as the 36 inch by 36 inch antennas currently used for ETC beacons and could be manufactured for a fraction of the cost.

vicinity of, but otherwise uncovered by existing RSUs. Time Division Multiple Access (TDMA) with CSMA-CD and channel limits methods could also be used to prevent interference of operations in close proximity.

Public safety services would have priority for site licenses. Other services, including private sector providers would require site licensing, to guarantee a level of service and to ensure that they do not interfere with other users. Note that all licensees would be required to be licensed for the control channel in addition to specific service channels."[31]

Private users could lease underutilized capacity from public safety installations or other facilities to assure maximum, efficient utilization of spectrum. Leased services and other users could be preempted whenever public safety broadcast is required. That is one scenario, but not the only, where public safety capabilities would propagate, fueled by private sector resources.

[31] Reference 1, Paragraph 46, Pages 29-30.

6.0 SPECIFIC ISSUES

This section provides discussion on the specific issues raised by the FCC. These items are addressed in the order in which they were presented in the NPRM.

6.1 Paragraph 14: The Definition of DSRC

In response to The Commission's question regarding the definition of DSRC, information is already provided throughout the NPRM, and specifically in the questions and discussions presented by The Commission through Paragraph 23. Although many applications have been identified, the DSRC Standards Writing Group is unable to list all of the potential applications for DSRC, because such a compilation would incomplete. Since the channel plan and DSRC hardware are being designed to support a twenty plus year life cycle, it would be short-sighted to generate a list from the current perspective.

Specifically, The Commission asks whether or not DSRC should handle the audio component of the "Emergency Vehicle Video Relay." The 4.940-4.990 GHz band, under the plan proposed by ETA[32], is a more appropriate place for this application to reside. It should not be explicitly excluded from DSRC, and could reside there if so desired. In general, the definition of "data transfer" should remain as flexible as possible and not exclude specific applications where possible.

As pointed out in Paragraph 15, DSRC is not designed to be a real-time, two-way communication system to compete with the cellular system, or for mobile video applications. Under stationary conditions, the throughput rates would support real-time data transfer.

The best answer to the question regarding a definition of DSRC, is that DSRC has been purposely designed to be integrated into the CALM architecture. CALM seeks to utilize the best resource for an application, subject to the guidelines and restrictions for the devices. If DSRC best satisfies the requirements of an application, then it should be used.

6.2 Paragraph 16: Changing the Service Definition from "Including Commercial Environments" to "A Variety of Environments":

Instead of either of these two options, we support the ITS America application to change the definition to "private environments." The term "variety" could be interpreted to permit the use of unlicensed equipment. The ITS America recommendation that the 5.9 GHz band 'be designated for shared public safety and private services"[33] is correct and precise.

[32] "Wireless Communications Systems for Public Safety 4.9 GHz – Leveraging 5.9 GHz DSRC to 4.9 GHz PS by Engineering Technology of America, Inc., December 2002.
[33] Reference 2, Paragraph 17, page 13.

6.3 Paragraph 19: Public Safety Radio Services

The 4.940-4.990 GHz band, with no interference from private and commercial users, is the appropriate location for these services. The DSRC Standards Writing Group has purposely excluded point-to-point direct emergency service communications and has listed it under "exemptions."

6.4 Paragraphs 22 and 23: Non-public Safety Uses

In these paragraphs The Commission asks if private users should be permitted to use the public safety DSRC band. The Commission also asks if non-public safety applications should be permitted in the band.

The DSRC proposal would allow private users to provide services though the 5.9 GHz band without compromising support of public safety services. The Control Channel and licensing requirements guarantee that the DSRC band will "preserve and protect the ability of public safety entities to do their important jobs in light of the increasing spectrum demands."[34]

6.5 Paragraph 31: Interoperability

The DSRC Standards Writing Group shares the Commission's concerns and is taking a number of steps to ensure interoperability.

A test plan to verify compliance with ASTM E2213-02 is being developed. This document, "Standard Test Method for Telecommunications and Information Exchange Between Roadside and Vehicle Systems Specific Requirements – 5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Standard Test Method," verifies that products conform to ASTM E2213-02. Specifically, interoperability at the lower layers of the communications stack, is being checked.

Interoperability requirements extend beyond the lower layers. The DSRC Standards Writing Group expects that all DSRC operations should conform to the IEEE standards documents governing the upper layers of communication stack. A letter has been drafted by the DSRC Standards Writing Group to the FHWA and ITS America informing them of this additional requirement.

To ensure interoperability, all DSRC hardware devices must be certified to operate in the band. The DSRC Standards Writing Group also recommends "(p)eriodic review and revision of spectrum rules to account for technological advances and other

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[34] Ibid, Page 3.

changes."[35] This action is necessary to accommodate changing requirements throughout the life cycle.

6.6 Paragraphs 35 to 39: Band Plan

Detail discussion regarding the design of the band and channeling plans are provided in Sections 3 and 4 of this document. The channel size was developed to support DSRC in a mobile, high multi-path environment while taking full advantage of the 802.11a U-NII Band with technically compatible characteristics."[36] Channels smaller than 10 MHz would not have met the performance requirements for DSRC.

In Paragraph 39, The Commission requests inputs regarding the structure of the channeling plan and the possibility of subdividing it. The DSRC Control Channel is a single channel, accessible throughout the country. All DSRC devices must be able to operate on the Control Channel. Restricting operations on selected other channels to specific types of operations could accomplish the same effect as subdivision while retaining interoperability among DSRC devices.

6.7 Licensing Plan, Road Side Units and On Board Units

RSUs should be regulated using site licensing. OBUs should be governed using license by rule. Part 15 devices should not be allowed. Detailed discussions on each of these recommendations can be found in Section 5 of this document

6.8 Treatment of Incumbent Services

There exists a potential problem for DSRC to interfere with the Fixed Satellite Service. The noise floor could increase for satellite receiving antennas as a result of DSRC operations at the same or adjacent frequencies. If such a problem is identified, then using the flexible channeling plan, operations at or near those frequencies could be avoided. The satellite stations are treated as primary users to be protected in the band. Site licensing protects the satellite services as well as other radar users.

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[35] Reference 2, Page 4.
[36]Ibid, Page 4.

7.0 SUMMARY

The Johns Hopkins University Applied Physics Laboratory, under contract to the Federal Highway Administration endorses the ITS America submittal to the FCC, regarding DSRC use of the 5.850 to 5.925 GHz band. Technical information is provided to demonstrate that this plan implements the recommendations of the FCC Spectrum Policy Task Force, as stated in Report ET Docket No. 02-135, dated November 2002[37]

The ASTM E2213-02 lower layer standard and its associated test plan, represent an integrated package for 5.9 GHz DSRC hardware development, integration and interoperability in North America. Combined with the IEEE upper layer standards, the DSRC products should be interoperable and interchangeable.

DSRC licensing should be handled as follows:

- OBUs should be licensed by rule devices.
- RSUs should be required to obtain site licenses.
- Part 15 devices should be prohibited.

As proposed, DSRC would satisfy the recommendations of the Spectrum Policy Task Force. Specifically, DSRC:

- ensures effective public safety operations,
- supports efficient band utilization,
- minimizes interference through controlled management of resources,
- matches up with neighbors with technically compatible characteristics,
- provides a clear definition of spectrum user's rights and responsibilities,
- supports leasing of spectrum capacity during low-use periods, and
- conforms to the Spectrum Rights "Command-and-Control" model.38

The DSRC proposal should be adopted as it reliably, efficiently and effectively supports both public safety and private sector services.

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[37] Federal Communications Commission Spectrum Policy Task Force Report ET Docket No. 02-135, November, 2002.
[38] Reference 2, Page 5.