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June 29, 2016

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW
Washington, D.C. 20554

VIA ELECTRONIC DELIVERY

Re: ET Docket No. 13-49

Revision of Part 15 of the Commissioner's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band

Ms. Dortch,

By this submission, The Oakland County Connected Vehicle Task Force[1] and the supporting entities that have co-signed this letter respectfully respond to your Public Notice FCC 16-68 of June 1, 2016, inviting interested parties to update and refresh the record on the status of potential spectrum sharing solutions between proposed Unlicensed National Information Infrastructure (U-NII) devices and Dedicated Short Range Communications (DSRC) operations in the 5.850-5.925 GHz (U-NII-4) band.

Beginning in the middle of p. 7 of FCC 16-68, a number of important questions are raised. We believe that these questions can be satisfactorily answered on the basis of a methodology that does not rely on spectrum sharing but rather on a technological *ecosystem* that preserves the integrity of the DSRC spectrum and leverages the existing protocol architecture (IEEE 802.11p, IEEE 1609) so as to enable applications that can generate the revenues needed to fund the deployment of roadside infrastructure (RSUs). We offer a detailed response to these questions further below in this submission, but first we present an overview of the background, rationale and policy goals of our proposed methodology, an outline of which is provided in the Attachment.

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[1] Oakland County, Michigan is home to 75 of the top 100 global automotive suppliers and more than 50% of the R&D centers bringing connected/autonomous technology to market. The Task Force, convened by the County Executive, is a collaboration of more than 15 public and private entities striving to build a sustainable business case for CAV VtoI deployment. Its membership includes RCOC and MDOT representation and chief technology officers from entities such as Lear, HNTB, IHS, and Mobile Comply.

Overview

We are acutely aware of the imperative that the rising value of spectrum imposes on our industry. We understand that the allocation of the DSRC spectrum comes with an obligation to ensure that the full benefits of its use, both in terms of safety and mobility on our roadways, are realized as quickly as possible. We believe that this obligation is shared by both the automotive industry and the public sector entities with jurisdiction over the building and maintenance of our roadways.

The Oakland County Connected Vehicle Task Force was established with the express purpose of formulating a business model and a technological ecosystem, based entirely on the DNA of DSRC and the WAVE (IEEE 1609 and 802.11p) standards, whereby the different constraints under which the private and public sectors must operate are reconciled. As the jurisdiction with the highest concentration of automotive industry corporate presence in the United States, our public officials are particularly well-placed to appreciate the needs of both sectors. There is an urgent desire to harness the full power of DSRC technology without imposing a burden on taxpayers, while simultaneously creating conditions that motivate the private sector to continue to invest in innovation built on the DSRC platform. The extraordinary level of response to the USDOT Smart Cities Challenge issued last December by Secretary Foxx clearly demonstrates that our goals reflect those of many other jurisdictions throughout the country.

From the outset, our view has been that the DSRC spectrum is essentially a public good which, if exploited in a way that maximizes its market value, provides the means to bridge the funding gap for deployment of roadside infrastructure that has been recognized by most DSRC stakeholders as the most important question needing resolution in order to move forward. We also believe that the tools required to accomplish this can be developed based on the inherent capabilities designed into the WAVE standards. Our formula for reaching these goals is straightforward:

- Propose the establishment of a regional public sector authority to oversee the deployment and maintenance of DSRC infrastructure
- Encourage the private sector to create tools to leverage the non-safety-critical DSRC channels (Service Channels), particularly aimed at exploiting the insatiable consumer demand for mobile wireless Internet services.
- Require all the access points (RSU) and clients (OBU) to adhere strictly to the existing 5.9 GHz DSRC communications protocol. This ensures that both non-safety of life and imminent crash avoidance applications are simultaneously supported as originally envisioned in the band plan and avoids compromising the substantial investment in development and testing incurred by both the federal government and the automotive industry during the last decade.
- Seek to establish policies placing a priority on the need for re-investment in DSRC infrastructure of revenues associated with provision of Internet connectivity services, while enabling the private sector to profit from development of the tools and their application in providing market-driven services.

- Create an ecosystem favorable to the rapid introduction of aftermarket on-board units (OBUs) which (we believe) is essential for accelerating the timetable by which the full benefits of DSRC V2V and V2I can be realized.

- Establish a foundation on which an infrastructure Authority and/or Network Operator can grow to encompass the region of southeast Michigan and hopefully demonstrate a functional model for other regions to follow.

- Demonstrate that this method can become a template for both inter-governmental cooperation, as well as public-private partnership that can be used throughout the United States.

FCC 16-68 Q&A

We are proposing an approach to use of the DSRC spectrum that would preserve the existing FCC licensing rules. With this approach, devices not licensed for DSRC are never allowed access to DSRC spectrum. If a Smartphone or Tablet runs an application that can be routed by a neighboring OBU through an available Service Channel, we can monitor the resulting consumption of bandwidth, which become the basis of our ability to leverage part of the spectrum and therefore aim for financial self-sustainability.

Our proposal calls for Internet traffic from a 3rd party device to be redirected to the IPv6 interface defined in WAVE, but since it is the OBU that actually transmits and receives at the PHY level of the protocol stack, there is absolutely no interference with time critical applications. Prioritization of this traffic and channel selection for its transmission is carried out by the WME (WAVE Management Entity), in accordance with the policies governed by IEEE 1609.4. In other words, all Internet traffic carried either for applications running in the OBU itself, or on behalf of 3rd party devices, is subject to the policies governing the infrastructure operation, which will ensure that whenever and wherever Service Channels are needed for safety-of-life, collision avoidance or any other time-critical traffic management applications, lower priority traffic will be superseded by the more important traffic.

Under our proposed scheme, many of the questions put forward in FCC 16-68 become moot. Nevertheless we have chosen to offer commentary on all of the questions which are excerpted from FCC 16-68 and reproduced below in italics and then followed by our response.

As described above, each proposed sharing approach relies on a different mechanism to avoid co-channel operations when DSRC channels are in use at a given location. We now seek comment on the merits of these two approaches. What are the benefits and drawbacks of each approach?

Neither of the currently proposed spectrum sharing approaches offer financial benefits to "roadway management" jurisdictions for funding the all-important roadside infrastructure. We do not believe that there are any benefits, with either of these proposals, which would outweigh the benefits of our approach in terms of providing revenue tools to local roadway management authorities and/or Network Operators for deployment and operation of DSRC infrastructure.

Would one approach be better than the other (e.g., minimize the risks of interference to DSRC more effectively while providing a comparable degree of meaningful access to spectrum for unlicensed devices)?

For reasons explained further below, we are skeptical that the "detect and vacate" method will perform adequately when tested with a realistic number of DSRC and UNII devices. So whereas we oppose both schemes, when compared to each other, "re-channelization" is better than "detect-and-vacate" but presents other challenges to the transportation industry already working to deploy hardware.

For either approach, is it necessary for the Commission to specify all the details of the interference avoidance mechanism in the FCC rules or can this be addressed by relying primarily on industry standards bodies to develop the specific sharing methods?

The failure of the IEEE 802.11p "Tiger Team" to reach a consensus on the question of spectrum sharing does not augur well for the idea of deferring to standards bodies to establish an interference avoidance mechanism.

If the former, what specific technical details need to be specified in the FCC rules (e.g., out of bound emissions, noise tolerance, detection threshold, channel vacate time, etc.)?

Since we advocate against spectrum sharing at the PHY level, establishing a new set of rules is unnecessary. However, we wish to point out that the "detect and vacate" method specifies that "detection" applies only to the preamble of an IEEE 802.11p packet transmission. During the remainder of the time required for its transmission, the IEEE 802.11p packet could be exposed to co-channel interference from U-NII devices. In order to avoid this exposure, U-NII devices would have to remain silent for the period of time (measured relative to the last detected 802.11p preamble) required for transmitting the maximum possible size of an 802.11p packet. But it is not clear whether the Cisco solution takes this into account. Furthermore, it would appear that the "vacate" part of the operation is delayed until after the end of any current U-NII transmission. It is therefore reasonable to speculate that, for a large number of U-NII devices within range of DSRC devices, this behavior may result in some significant loss of throughput for DSRC.

Has industry agreed upon performance indicators for DSRC, and if so, what are these metrics and is there a process to hold products to these performance levels?

We believe this was all established within the framework of Collision-Avoidance Metrics Partnership (CAMP) – but would be better answered by OEM's and Tier 1 Suppliers.

We also seek comment on how the choice of avoidance protocol affects the deployment and performance of DSRC. Would "re-channelization" require any change in the design of the DSRC electronic components contained in DSRC prototypes or just require a change in the processing of the data?

In principle, it should be possible to accommodate, in software, the different widths for safety and non-safety channels within a single DSRC PHY. We should point out however that this would appear to be of little consequence to the originator of the re-channelization scheme. Qualcomm introduced a new chipset early this year that supports 5 GHz WiFi, LTE and DSRC, a platform aimed at enabling Internet connectivity from the car through cellular communications while confining DSRC capability to safety applications. In this context, there is no need for the DSRC Service Channels, so the result is a de facto dedication of the spectrum to WiFi. Meanwhile vehicles enabled for DSRC but without the dual mode capability offered by Qualcomm, would have to contend for the two 20 MHz Service Channels, thereby reducing the capacity to provide mobile Internet services through the DSRC infrastructure and limiting the capacity to pay for infrastructure through leveraging of the Service Channels. We also have serious concerns that the integration of unlicensed WiFi and DSRC Medium Access Control (MAC) layers in the same platform creates a new cyber-attack surface that could undermine the extensive security provisions designed into WAVE.

We seek comment on whether changing the channel plan would require re-testing of DSRC and, if so, precisely what would need to be done, why, and in what timeframe? Commenters responding to this question should provide specific information about why the completed tests are not applicable to re-channelization, how any new tests will differ from those already performed, and the relevant timeframes for completing these specific tasks.

We believe that this question would be better answered by OEM's, Tier One Suppliers and others working diligently in the pursuit of deploying vehicle hardware and infrastructure test beds. *Further, any testing, studies or analyses that have been performed regarding DSRC capabilities,*

Wi-Fi performance, interference studies or the potential benefits or drawbacks of sharing, which are relied upon by stakeholders in this proceeding, either in the past or going forward, need to be filed in the record to be considered. Additionally, has any testing been done regarding DSRC self-interference or potential harmful interference with satellite and government co-channel or adjacent users? [Any such information filed should include the test plans, results, and underlying data needed to fully evaluate the submission. If there are data or reports that are not public, parties should describe the data and reports and explain why it is necessary to submit this information confidentially].

We believe this that testing was also carried out within CAMP but also feel that this question would be better answered by OEM's, Tier One Suppliers and others working diligently in the pursuit of deploying vehicle hardware and infrastructure test beds.

We also seek comment on what DSRC-related use cases should be expected and permitted in this band. Commenters should provide specific information regarding what DSRC applications are anticipated, what are the projected spectrum needs for each application, and how would the commenter classify each (i.e., safety, non-safety, time critical or not)?

We believe that the most significant use case is now the provision of mobile Internet services offered to non-DSRC devices which have attached themselves to a DSRC OBU. This establishes a foundation for providing Internet Connectivity over Service Channels when applications use the IPv6 interface to the WAVE stack, whether they are running locally or routed through the OBU from a neighboring device in the vehicle.. The Internet Connectivity services are announced by RSUs using WAVE Service Advertisements (WSAs). Furthermore, individual infrastructure authorities would have the discretion to offer service from specific RSUs at specific times, giving them the freedom to implement their own policy options. When policy dictates that these services be suspended to make way, on the supporting Service Channels, for higher priority applications, the OBU can detect that the Provider Service Identifier (PSID) has been removed from the WSAs it receives from the RSU and then change the ``transmitter profile`` it registers with its MAC Layer Management Entity (MLME) so that the WME no longer allows IPv6 traffic on the Service Channel in question.

Obviously these mobile Internet services are not time critical nor are they safety-related (except in the most general possible sense when supporting such purposes as real-time navigation). However, they are critical to enabling infrastructure authorities to finance their own roadside deployments.

Should the DSRC offerings provided on a priority or exclusive basis be restricted to safety-of-life or crash avoidance purposes?

The WAVE standards already allow for prioritization of different services based on the Provider Service Identifier (PSID) identified in the WSA. IEEE 1609.12 provides a standardized framework for allocation of a PSID. In other words, the flexibility to establish whether a specific service should have priority or exclusivity is already built into the system specifications. We believe that there is no need for a "one size fits all" set of rules.

What are the technical or policy reasons for differentiating between safety-of-life and non-safety-of-life applications?

The technical reasons are clear. Non-safety-of-life applications should never have a deleterious impact on the latency of safety-of-life applications. The policy reason is that we believe that the use of non-safety-of-life spectrum should be managed in a way that leads to funding of infrastructure.

Are there meaningful distinctions between DSRC applications that are safety-related and those that are not, such as applications that are time critical?

Possibly; e.g. the benefit of time-critical Signal Phase and Timing (SPaT) messages from signalized intersections applies as much to optimizing mobility (reduced travel time, greenhouse gas emissions, etc.) as to improving safety.

For parties that advocate for re-channelization, is there a natural bifurcation point if we decide to separate safety-related and non-safety-related DSRC? For instance, while entertainment, social media, maps, and parking applications are not safety-related, what is a good definition for a feature or service to be considered truly a safety-of-life use?

We do not believe that there is a natural bifurcation point. We strongly believe that the establishment of any "bifurcation point" would irreversibly eliminate the option to re-allocate non-safety related channels to accommodate the future potential needs of time-critical applications. For instance, there may be a future requirement to remove the SPaT messaging load from the V2V channel (172) and re-allocate it to a Service Channel. The potential to develop safe and reliable vehicle autonomy is likely to be enhanced with the availability of low latency signalling from roadside infrastructure, not only intersection controllers but also movable infrastructure such as lane closure signals. We must maintain the flexibility, as the needs of urban traffic congestion and autonomous vehicle engineering arise, to meet these needs by assigning a Service Channel that currently only carries traffic that is not time-critical. This will not be possible if unlicensed devices are allowed to operate in these channels.

How does our current band plan and these sharing approaches match up with international efforts for safety-related DSRC systems?

We believe that this question would be better answered by OEM's, Tier One Suppliers and others working diligently in the pursuit of deploying vehicle hardware and infrastructure test beds.

To help us fully evaluate the potential effects of re-channelization, please provide the projected timeframe for introduction of DSRC deployments under the current channel plan. What market penetration (e.g., percentage of cars on the road) is needed for DSRC to reliably provide safety-of-life functions or prevent vehicle-to-vehicle collisions?

The conventional wisdom is that concrete benefits are realizable with less than 25% penetration. However it is important to realize that aftermarket devices can accelerate the rate of penetration and the potential exists to introduce these in the very short term. Given the need for a new iteration of testing, we believe that re-channelization would introduce unwarranted delay in the development of the V2V market and push the realization of safety benefits further into the future.

What are the projected timeframes for achieving the penetration levels needed for each safety-of-life or crash avoidance function to be effective?

The time horizon for achieving "critical mass" needed for safety benefits is inter-dependent with the deployment of roadside infrastructure. We believe that these are linked in a "virtuous circle".

Will these penetration levels be met by equipment that is native to the automobile or through standalone or retrofit devices? Would these timeframes change if re-channelization occurs and by how much?

As previously indicated, aftermarket devices are necessary to achieve the required penetration levels sooner rather than later. But whereas the near-term availability of aftermarket equipment may be nullified by the adoption of the re-channelization scheme and the testing required for it, we cannot gauge the impact on timeframes.

In the meantime, what other spectrum bands, driver-assist technologies, and commercial offerings are providing similar services to those envisioned using DSRC?

The relationship of ADAS (advanced driver assist systems) to DSRC is discussed throughout the so-called "V2V Readiness Report" published by NHTSA in August of 2014. The general view expressed in this report, and which is echoed in the automotive industry, is that ADAS and DSRC are complementary, and not necessarily substitutes for one another. However, in the case of ATIS (advanced traveller information services) envisioned using DSRC, particularly with respect to real-time navigation, it is widely accepted that LTE-based commercial services (e.g. WAZE) have made significant progress in providing equivalent functionality. Nevertheless, we believe that in this area, LTE and DSRC can be complementary rather than competitive, where the common ground is found in the standardized messaging formats established by SAE J-2735. The complementarity of LTE and DSRC is a basic tenet of the USDOT Connected Vehicle Reference Information Architecture (CVRIA), to which we intend to adhere to in our infrastructure deployment and operations plan.

Is it possible that autonomous car and other technologies could bypass DSRC safety-of-life capabilities prior to reaching a sufficient technology penetration to make this service effective?

We prefer to view this question from the perspective of the complementarity of DSRC and vehicle autonomy. The development of reliable vehicle autonomy is linked to the availability of DSRC infrastructure. Whereas fully autonomous vehicles (Level 5) must be independent of DSRC infrastructure, the intermediate levels on the path to full autonomy can all benefit from both DSRC infrastructure and a growing fleet of DSRC-enabled vehicles.

Does the 5.850-5.895 MHz portion of the band potentially offer the most value for unlicensed operations?

No. As previously stated, we believe that "unlicensed operations" should be enabled at the Internet layer, not by allowing actual spectrum sharing but by granting access to mobile Internet services (advertised by RSUs) for non-DSRC devices attached to OBUs .

What are the advantages and disadvantages of combining the non-safety-related channels into larger channels?

Larger channels provide for greater throughput but at shorter distances. The re-channelization scheme therefore appears well-suited to a technology platform that enables an in-vehicle WiFi access point (AP) with an LTE connection to the Internet. But where the connectivity to the Internet is established through DSRC, a narrower channel width is more effective at the longer distances typically separating the vehicle from the RSUs that are equivalent to WiFi APs. So there are disadvantages to the re-channelization scheme on several levels. The larger channels are less effective in providing Internet connectivity through DSRC infrastructure and, as we have already indicated above, the unlicensed use of non-safety-related spectrum reduces the effective bandwidth available to pay for DSRC infrastructure.

How should portions of the band not required for safety-of-life applications be shared among DSRC and unlicensed operations?

As previously indicated, we believe that "sharing" should be enabled at the Internet layer and that actual sharing of spectrum at the PHY layer should be avoided.

For instance, should non-safety of life DSRC applications share the lower re-channelized band on an equal basis with unlicensed operators or have some priority?

If we define an "unlicensed operator" as simply a device with connectivity to the IoT through a licensed device, re-channelization is unnecessary. Non-safety DSRC and non-DSRC applications can effectively share the Service Channels of the DSRC spectrum. Also, the IEEE 1609 suite of specifications (particularly IEEE 1609.4) already provide mechanisms for prioritization of applications based on the Provider Service Identifier (PSID).

If commercial or other non-safety DSRC applications have priority access to the band, is a detect-and-vacate protocol necessary or does the IEEE 802.11 standard or other protocols allow for prioritization of DSRC traffic without the need to vacate non-safety channels for a pre-determined time period?

It is the “detect-and-vacate” obligation imposed on unlicensed devices (assuming that it will work effectively) that is supposed to be the guarantor that DSRC applications (regardless of criticality) have “priority access to the band”. Without “detect-and-vacate”, ensuring access to the band would be analogous to trying to ensure safety at a blind intersection where the traffic lights are not working.

In addition, we invite interested parties to suggest other approaches that would facilitate unlicensed use of the 5.850-5.925 GHz band without causing harmful interference to DSRC operations. Would a hybrid approach taking elements from both the "detect and avoid" and the "re-channelization" proposals create benefits for both DSRC and U-NII users?

For example, are there advantages to an approach where unlicensed users and DSRC non-safety of life applications would share access to the lower 45 megahertz of DSRC spectrum, while unlicensed devices would use a "detect and avoid" approach to avoid, and thus protect, co-channel safety-of-life DSRC operations in the upper 30 megahertz of spectrum?

We do not believe that this would be beneficial for several reasons. First, there is a fundamental “opportunity cost” to allowing unlicensed devices to operate on spectrum that could otherwise be leveraged by infrastructure authorities. The alternative we propose is superior to this concept, for the financial reasons already cited. But even if the opportunity cost was not a factor, one of the benefits of re-channelization is that it obviates the need for “detect and vacate” hardware in U-NII devices. Allowing co-channel operations in the upper 30 MHz would simply re-introduce that need, thus nullifying the benefit sought by re-channelization.

Is it feasible to develop a "hybrid chip" that would implement a DSRC standard receiver for detection purposes to allow unlicensed use, if the spectrum is clear?

As indicated previously, Qualcomm announced this kind of product at CES in January 2016, supporting both 5 GHz WiFi and DSRC.

Would it be viable to employ an approach based on use of a database to control access to the spectrum similar to that used for the Citizens Broadband Band Radio Service at 3.5 GHz or for White Space devices in the TV and 600 MHz Service bands?

Not only would it be viable, it would be necessary so that the infrastructure authority would have the option to apply billing charges for bandwidth.

The undersigned do hereby support and ask that the comments and responses set forth herein be made part of the record and given due consideration by the Commission.

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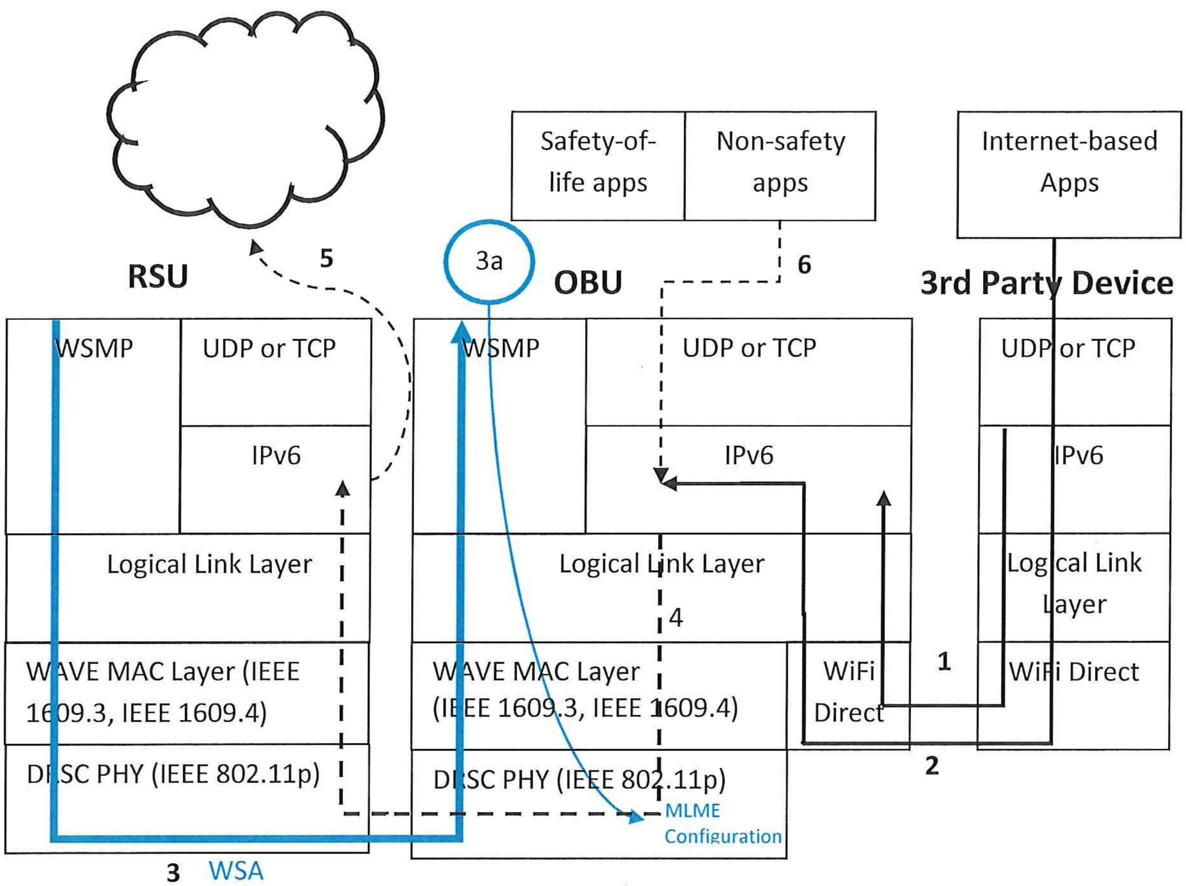
Attachment: **Proposed scheme for extending Internet Connectivity to non-DSRC Devices**
Controlled by Infrastructure Authority: policy reflected in WAVE Service Announcements (WSAs) from RSU



The figure above provides a very high level view of the functional and process architecture of the OCCV proposal.

In step 1, a third party device attaches itself to an OBU through a WiFi PeertoPeer (WiFi Direct) interface, using the "discovery" and "address configuration" methods specified in IPv6 . The WiFi Direct interface may operate in 5 GHz but not overlapping the DSRC spectrum.

In step 2, the third party device wants to send IPv6 traffic to a remote Internet host, so it routes it through the OBU.

Step 3 shows a periodic WAVE Service Advertisement (WSA) from the RSU, identifying which services are locally available. Infrastructure authority/operator may make a policy-based decision to enable/disable Internet Connectivity. The process 3a running in the OBU implements this policy by reconfiguring the channels available for selection in the MAC Layer Management Entity (MLME).

In step 4, if the most recent WSA indicates that the service is available, the OBU routes the IPv6 traffic to the RSU, using the Service Channel specified for this.

In step 5, if the RSU is currently configured to support Internet Connectivity, it routes the IPv6 traffic to the Internet towards the remote host.

The reverse communications path, from the cloud to the RSU to the OBU and then back to the external 3rd party, can be illustrated simply by reversing the direction of the arrows and the numbering of the steps.

Step 6 illustrates the instance of a non-safety-of-life application, resident in the OBU, generating IPv6 traffic. This path of communications is identical to the path for IPv6 traffic from the external (3rd party) device, demonstrating that all IPv6 traffic is governed by the same MAC and PHY protocols.