# Austroads' Submission to the '2014 Review of the *Motor Vehicle Standards Act 1989*'

October 2014

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# 1 INTRODUCTION

## *1.1 Submission Overview*

Austroads welcomes the Australian Government's review of the *Motor Vehicle Standards Act 1989* (MVSA) and its focus on reducing road trauma while considering opportunities for achieving efficiency gains with relevant regulations and processes.

This Austroads submission provides input that is specific to emerging Cooperative Intelligent Transport Systems (C-ITS), commonly referred to as connected vehicle technologies.

The three main transport challenges facing Australian and international jurisdictions are to reduce road trauma caused by vehicle crashes, to improve transport efficiency, and to reduce the environmental impacts of transport. The use of Intelligent Transport Systems (ITS), which refers to the use of information and communications technologies (ICT) within the transport network, are progressively delivering improvements in each of these three areas.

C-ITS refers to the use of wireless communications to dynamically share information from vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V). This will enable vehicle and transport systems that cooperatively work together to deliver safety and mobility outcomes that build upon those achievable with standalone systems.

International developments of C-ITS are well progressed, and some elements of C-ITS are already deployed in vehicles in some regions. However, despite efforts to achieve global harmonisation, there are regional differences with C-ITS deployments that Australia will need to give consideration to when importing C-ITS equipped vehicles. For example, there are differences in the allocation of radiofrequency bands between Europe, USA and Japan. The implications of this are that vehicles transmitting on different frequencies will not be able to communicate with each other, making their C-ITS safety systems ineffectual. Also, some vehicles may include radiocommunications equipment that is not licensed for use in Australia, and could cause interference to other existing licensed users. Further, it is likely that some emerging safety applications will require satellite positioning and mapping services that are not currently supported in Australia.

Compliance with agreed international standards will be critical to ensuring that C-ITS from different manufacturers are interoperable and safety is optimised, not compromised. Many C-ITS standards are unlikely to become or be referenced by UNECE vehicle regulations. This does not mean that they will not be critical to achieving road safety outcomes.

The key recommendations that Austroads submits for consideration are:

1. The MVSA and the various vehicle import schemes should give consideration to determining compliance with agreed international safety-related standards for C-ITS, and not just those that are referenced by a UNECE regulation or an ADR.

2. The MVSA and the various vehicle import schemes should have linkages to Australian communications regulations, to ensure that any radiocommunications equipment fitted to imported vehicles complies with local licensing conditions.

3. Vehicle import schemes should give appropriate consideration to safety systems that rely on satellite positioning and mapping data, to ensure that no safety systems are compromised by positioning or mapping systems that do not meet local requirements.

Austroads looks forward to the next steps in this review, and stands ready to provide any further input or assistance that is necessary to help progress this important activity.

## *1.2 Austroads Profile*

Austroads purpose is to contribute to improved Australian and New Zealand transport outcomes by:

- providing expert advice to TISOC and TIC on road and road transport issues
- facilitating collaboration between road agencies
- promoting harmonisation, consistency and uniformity in road and related operations
- undertaking strategic research on behalf of road agencies and communicating outcomes
- promoting improved and consistent practice by road agencies.

Austroads membership comprises the Australian state (six) and territory (two) road transport and traffic authorities, the Commonwealth Department of Infrastructure and Regional Development, the Australian Local Government Association, and the NZ Transport Agency. It is governed by a board consisting of the chief executive officer (or an alternative senior executive officer) of each of its 11 member organisations:

- Roads and Maritime Services, New South Wales
- Roads Corporation, Victoria (VicRoads)
- Department of Transport and Main Roads, Queensland
- Main Roads Western Australia
- Department of Planning, Transport and Infrastructure, South Australia
- Department of State Growth, Tasmania
- Department of Lands and Planning, Northern Territory
- ACT Department of Territory and Municipal Services
- Department of Infrastructure and Regional Development
- Australian Local Government Association
- NZ Transport Agency

The success of Austroads is derived from the collaboration of member organisations and others in the road industry. It aims to be the Australasian leader in providing high quality information, advice and fostering research in the road sector.

# 2 OVERVIEW OF COOPERATIVE ITS

## *2.1 Cooperative ITS*

Growth in population, rising standards of living, growing economies and the increasing numbers of motor vehicles and kilometres travelled have brought about challenges for road transport agencies regarding the safety of road users, the efficiency and productivity of transport networks and the impact on the environment.

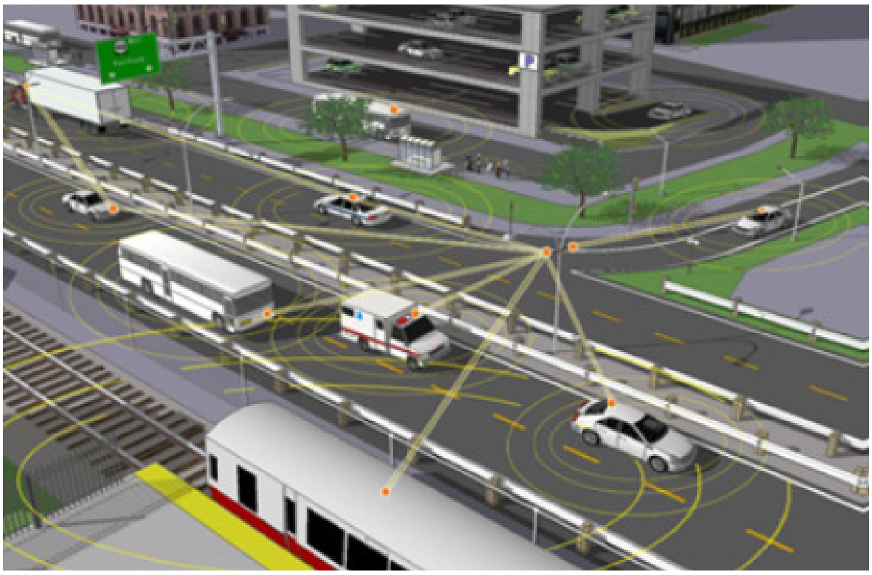
These challenges are being faced globally. Australia has and should take advantage of solutions being developed internationally, to ensure it can address these challenges effectively and at a minimal cost.

Intelligent Transport Systems (ITS), which refers to the use of information and communications technologies (ICT) within the transport network, are increasingly being used to address these safety, efficiency and environmental challenges.

Cooperative ITS (C-ITS) refers to the use of wireless communications to share information in near real-time from vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V). This will enable the next generation of vehicle and transport systems that cooperatively work together to deliver safety and mobility outcomes that build upon those achievable with standalone systems.

The C-ITS ecosystem that is evolving internationally uses wireless connections between vehicles, roadside infrastructure, mobile devices and back-end transport systems. As illustrated in Figure 2.1, this also includes connections between different modes of transport.

**Figure 2.1 – Illustration of C-ITS communication links in a traffic environment**



Source: US DOT

The data transmitted and received by C-ITS equipped vehicles will enable a wide range of safety, efficiency and environmental applications. As the C-ITS ecosystem evolves, it is anticipated that the number and effectiveness of C-ITS applications will increase. Examples of C-ITS applications that are currently under development internationally include the following:

Safety applications:

- Forward collision warning and collision avoidance
- Intersection movement assistance
- Right turn assist
- Electronic emergency brake light
- Overtake warning and lane change warning
- Speed zone warning
- Red light violation warning
- Rail crossing warning
- Adaptive cruise control
- Height restriction warning
- Emergency vehicle prioritisation
- Road condition warning

Mobility & environmental applications:

- Traffic information services
- Enhanced route guidance
- Road access management
- In-vehicle signage
- Green wave and vehicle prioritisation
- Eco-driving systems
- Probe vehicle data to enable optimised traffic management

## *2.2 Benefits of C-ITS*

Developments with C-ITS are showing significant potential to improve safety, efficiency and environmental outcomes with road transport. The key benefits that are being targeted both internationally and locally are as follows:

- Reduce the number of fatalities and serious injuries caused by road crashes
- Reduce the costs associated with road trauma
- Reduce traffic congestion, including reduced delay times and vehicle operating costs
- Improve travel efficiency and the productivity of road infrastructure use
- Reduce the environmental impacts of road transport, through less emissions and fuel use

Road safety is the primary driver for C-ITS. Road crashes cause approximately 1,200 deaths and over 30,000 serious injuries in Australia every year. The social impacts of road trauma are devastating, and according to the National Road Safety Strategy 2011-2020 the annual cost to the Australian economy has been estimated to be $27 billion (ATC 2011).

As highlighted in the previous section, C-ITS will enable a range of emerging vehicle safety applications, including collision warning and avoidance applications. A study by the US Department of Transportation (US DOT) has estimated that C-ITS could positively address 81% of all crash types involving a non-impaired driver (US DOT 2010). Further to this, Austroads engaged MUARC to do a study into the possible benefits of collision avoidance technologies using C-ITS, in which it was estimated that the total number of fatal and serious casualty crashes in Australia could be reduced by 25-35% (Austroads 2011). However, achieving reductions approaching this order of magnitude across the road transport system would require a significant proportion of vehicles to be C-ITS enabled.

## 2.3 Wireless Communications Technologies

The emergence of C-ITS will see vehicles become increasingly connected using wireless communications equipment. Multiple communications technologies will be used by C-ITS for data exchange, including:

- Dedicated Short Range Communications (DSRC)
- Cellular networks (eg. 3G, 4G LTE)
- Wireless Local Area Networks (eg. WiFi)
- Radio broadcast (including analogue and digital)
- Global Navigation Satellite Systems (GNSS)

DSRC is emerging as an important technology for C-ITS safety applications due to its very low latency and high availability of data transfer, which will be critical to enable warning and avoidance applications to operate as required in time-critical, crash-imminent situations.

DSRC is a two-way, short-to-medium range wireless radiocommunications capability that permits rapid transfer of data. The use of DSRC for transport applications is based on the IEEE 802.11p communications protocol, which is in the same family of standards as WiFi. The IEEE 802.11p protocol is designed to enable adhoc peer-to-peer networks, which unlike other wireless mediums allows a DSRC device to transmit data without the need for a centralised access point. V2V communications can occur without any link to a roadside unit (see Figure 2.2). Roadside units may be used at locations where there is benefit in transmitting and/or receiving data to enable V2I and I2V applications or to provide data updates to a vehicle (see Figure 2.3).

**Figure 2.2 – Illustration of V2V**

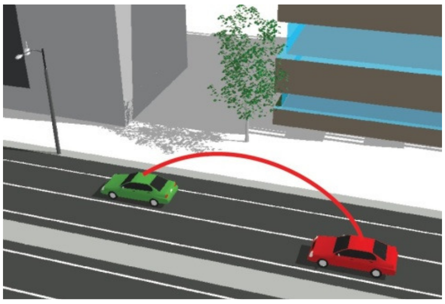
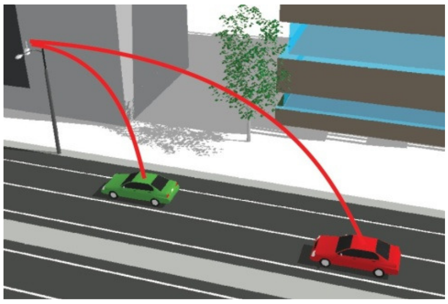


**Figure 2.3 – Illustration of V2I/I2V**



Source: Cohda Wireless

The development of DSRC for vehicle systems is well progressed internationally. However, there are regional differences in the radiofrequency that is used. This has implications for the importation of vehicles to Australia. The following provides an overview of the current radiofrequency allocations for DSRC for C-ITS in key international regions:

| | |
|---|---|
| Europe | 5.9 GHz band (5.855-5.905 GHz) |
| USA | 5.9 GHz band (5.855-5.925 GHz) |
| Japan | 5.8 GHz band (5.770-5.850 GHz)<br>700 MHz band (715-725 MHz) |

It should be noted that while both Europe and the USA have allocated the 5.9 GHz band for C-ITS, there are differences in the allocation of channels with the band. This is illustrated in Appendix A. Further to this, C-ITS equipped vehicles from each of these regions comply with different standards, and therefore will not to be fully interoperable with each other unless their C-ITS equipment is reconfigured. This is further detailed later in this submission.

## 2.4 International Status

The following provides an overview of the status of C-ITS in the major international regions of Europe, USA and Japan, with a focus on C-ITS using DSRC:

Europe

- The European Commission (EC) published decisions in 2008 on the harmonised use of the 5.9 GHz band for ITS in Europe. This included designating the band 5.875-5.905 GHz for ITS safety applications, the band 5.855-5.875 GHz for ITS non-safety applications, and the band 5.905-5.925 GHz be reserved for potential future ITS use.
- The EC established a new legal framework for mobility and transport in July 2010. Under Directive 2010/40/EU, the EC will adopt consistent specifications to address the compatibility, interoperability and continuity of ITS across the EU.
- The EC issued Mandate M/453 in October 2009 in order to prepare a coherent set of minimum performance standards, specifications and guidelines to support European-wide deployment of C-ITS. In February 2014, the EC announced this 'release 1' set of standards had been issued by ETSI and CEN and was ready for industry adoption.
- The Car-to-Car Communications Consortium, which includes vehicle manufacturers and equipment suppliers, has established a Memorandum of Understanding that signals its members intentions to commence harmonised deployment of 5.9 GHz DSRC in vehicles by 2015.

USA

- The Federal Communications Commission (FCC) allocated the 5.9 GHz band (5.850-5.925 GHz) for ITS in October 1999. As highlighted in Appendix A, the US allocation of channels within the 5.9 GHz band is different to the European allocation.
- The US DOT announced in August 2014 its decision to commence a consultative process and progress development of an FMVSS regulation requiring V2V communications technology in light vehicles in the USA (US DOT 2014). A draft FMVSS for regulatory decision making is planned to be finalised in 2016.
- The primary standards on which C-ITS is being developed in the USA are from IEEE and SAE. These have some differences and are not fully compatible with the ETSI and CEN standards on which European C-ITS developments are based.
- The Crash Avoidance Metrics Partnership (CAMP), a public-private research consortium that includes major automotive companies, continues to work closely with the US DOT and other stakeholders towards a collaborative deployment of C-ITS.
- General Motors, one of the CAMP members, has announced it will release its Cadillac CTS model in late 2016 with 5.9 GHz DSRC fitted. This is the first automotive manufacturer in the US to publicly announce DSRC fitment to one of its vehicles.

Japan

- Japan has already commenced deployment of DSRC in selected vehicles. The applications utilising DSRC include electronic toll collection, traveller information services, and Driving Safety Support Systems (DSSS).
- The radiofrequency allocation for DSRC in Japan is not in alignment with the allocations in Europe or the USA. The 5.8 GHz band (5.770-5.850 GHz) has been allocated with a focus on V2I/I2V, and part of the 700 MHz band (715-725 MHz) has been allocated with focus on V2V.

- The Japanese deployment of DSRC is based on international and local standards, including from ISO and the Japanese Association of Radio Industries and Businesses (ARIB), which are not fully compatible with the C-ITS standards used in Europe and the USA.

## *2.5 C-ITS in Australia*

The 'Policy Framework for ITS in Australia' was endorsed by Australia's transport and infrastructure ministers at the meeting of the then Standing Council for Transport and Infrastructure (SCOTI) in November 2011 (SCOTI 2011). This policy framework provides a robust policy platform for ITS, and identifies foundation actions for guiding the development and implementation of ITS in Australia.

While the complete set of policy principles in the policy framework is relevant to C-ITS, the following policy principles are particularly relevant to this submission:

- deliver interoperability – ensure that systems and the underlying business processes have the capacity to exchange data and to share information and knowledge to enable effective ITS service delivery
- promote consistency with international standards – enabling Australian suppliers to compete in the world market and providing Australia access to global technology and supplier solutions

The policy framework also lists priority action areas for ITS in Australia. This includes a foundation action to progress the allocation and ongoing management arrangements for the 5.9 GHz band, for which Austroads is listed as taking a lead role.

The Australian Communications & Media Authority (ACMA) issued Embargo 48 in 2008, which continues to protect the 5.9 GHz band (5.850-5.925 GHz) in Australia and has enabled planning for the use of C-ITS within the band to progress. Appendix A illustrates how this embargo aligns with the European and US allocations for the 5.9 GHz band.

Austroads made a submission to ACMA in April 2014, requesting that the spectrum allocation process be progressed. Key recommendations in the submission to ACMA that are relevant to the MVSA and vehicle import schemes can be summarised as follows:

- Allocation of the 5.9 GHz band, including channel allocation within the band, is aligned with the European band allocation.
- Class licensing is used for licensing 5.9 GHz DSRC in-vehicle devices.

ACMA are currently considering the Austroads submission and its recommendations, and have commenced preparatory work on the spectrum allocation process and licensing options for C-ITS in the 5.9 GHz band for Australia.

# 3 KEY STANDARDISATION ISSUES

The following provides an overview of and recommendations for those standardisation issues that are considered critical for C-ITS equipped vehicles.

## *3.1 Compliance with Harmonised International Standards*

Standards will play a critical role in ensuring that C-ITS equipped vehicles and roadside infrastructure will be able to communicate with each other. Compliance with agreed standards will be needed to ensure that equipment from different manufacturers are interoperable, and to enable the intended safety and mobility benefits.

Harmonisation with international standards will be very important, as it will further assist in achieving the desired safety and mobility outcomes, will reduce market barriers for C-ITS technology to be introduced to Australia, and will negate any unique local requirements that could add unnecessary costs.

Standards for C-ITS have been developed by a number of international standards development organisations, including ISO, CEN, ETSI, IEEE and SAE. Despite efforts to achieve a greater level of global harmonisation, there are differences between the suite of standards used for deployment in each region, and there will therefore be a need to decide which regional suite of standards Australia should align with.

Examples of C-ITS related standards that will be important to enable interoperability and to realise potential safety benefits include but are not limited to the following:

- Applications (eg. for in-vehicle applications, such as those involving interaction with signalised intersections, dynamic speed zones, or other vehicles)
- Messages (eg. the structure and content of data messages transmitted and received by vehicles)
- Communications protocols (eg. defining consistent formats and rules that enable multiple devices to be able to communicate with each other)
- Communications equipment (eg. performance requirements for communications transceivers, such as radiofrequency range and emissions levels)
- Testing standards (to determine compliance with technical standards)

It is likely that very few C-ITS standards will become or be referenced by UNECE vehicle regulations, at least not in the foreseeable future. On that basis, it can also be assumed that few if any of these standards will be referenced by the Australian Design Rules (ADRs) any time soon.

While a policy decision on whether any C-ITS standards should be regulated or not may not occur for some time, there is a definite need to ensure that imported vehicles that are C-ITS equipped comply with certain C-ITS standards (which are yet to be agreed). The implications of not assuring compliance could include a lack of interoperability, safety systems that do not work as intended, and potentially safety systems that compromise safety.

This submission does not intend to propose what type and level of certification may be most appropriate. The purpose is to highlight the need for standards compliance with these emerging technologies, and recommend that this be considered in the review of the MVSA and the various vehicle import schemes.

Recommendation 1:

- The MVSA and the various vehicle import schemes should give consideration to determining compliance with agreed international safety-related standards for C-ITS, and not just those that are referenced by UNECE regulations or an ADR.

## *3.2 Radiocommunications Licensing*

Vehicles are increasingly being fitted with radiocommunications technologies, and many of these will be critical to various vehicle safety applications. Examples of such technologies include distance sensors, Bluetooth, WiFi, radio, GNSS, cellular and DSRC.

Australia is a signatory to the International Telecommunications Union (ITU) Convention. ACMA, as the national regulator of radiofrequency use, gives appropriate consideration to harmonising with ITUs international Radio Regulations when establishing local spectrum allocations and conditions. In line with this, most radiocommunications equipment fitted to vehicles imported from other countries should be consistent with internationally harmonised allocations and conditions, and thus with the ACMAs *Australian Radiofrequency Spectrum Plan*. But due to some regional differences, this is not the case with all radiocommunications equipment fitted to vehicles.

As detailed earlier in this submission, the radiofrequency allocation for DSRC is not globally consistent. This problem is further amplified by the fact that DSRC will be relied upon by various vehicle safety applications. The following summarises some of the issues that need to be considered with vehicles from key international regions:

Europe

- The 5.9 GHz band (5.855-5.905 GHz) has been allocated for C-ITS, with the 5.875-5.905 GHz sub-band allocated for safety applications. The current proposal being considered in Australia is to align with this European allocation. If this proposal is adopted, then there should be minimal risk with importing European specified C-ITS equipped vehicles into Australia.

USA

- The 5.9 GHz band (5.855-5.925 GHz) has been allocated for C-ITS, however the channels with the band that are allocated for safety are different to Europe (as illustrated in Appendix A). IEEE channel 172 (5.855-5.865 GHz) has been allocated for safety in the US, but in Australia this part of the band cannot not be afforded protection from LIPD class licensed devices. IEEE channel 184 (5.915-5.925 GHz) is also allocated for safety in the US, but this is not within the European allocation, which Australia is proposed to align with.

Japan

- The 5.8 GHz band (5.770-5.850 GHz) has been allocated for C-ITS, focussed on V2I and I2V. In Australia, this band is allocated for a range of uses, including Low Interference Potential Devices (LIPD) under a broad Class license. LIPD includes such things as cordless phones, vehicle tolling tags, and various other RFID transmitters. If vehicles with 5.8 GHz DSRC were imported into Australia, this could potentially cause interference to other licensed users of the band. Also, if Australia does proceed with adopting 5.9 GHZ for C-ITS as proposed, these vehicles will not be able to communicate with other C-ITS equipped vehicles that are compliant.

- The 700 MHz band (715-725 MHz) has been allocated for C-ITS, focussed on V2V. In Australia, this band has been allocated to Telstra under a Spectrum license. Therefore, if vehicles with 700 MHz DSRC were imported into Australia, they would almost certainly not comply with current licensing arrangements. Also, if Australia does proceed with adopting 5.9 GHZ for C-ITS as proposed, these vehicles will not be able to communicate with other C-ITS equipped vehicles that are compliant.

Currently the MVSA and the various vehicle import schemes do not appear to have any linkage to relevant radiocommunications regulations, such as the *Radiocommunications Act 1992*, the ACMAs *Australian Radiofrequency Spectrum Plan*, or to relevant radiocommunications licensing. Without any linkage, it can be foreseen that vehicles could be imported to Australia that do not comply with radiocommunications licensing. This would not only mean that non-compliant equipment has been allowed to enter and operate in Australia, but it could potentially lead to safety systems not operating effectively, and could cause interference to existing radiocommunications licenses.

Given that the various vehicle import schemes are essentially the main control point for ensuring that vehicles entering Australia comply with agreed standards, it would appear logical that these schemes have linkages to other relevance compliance requirements, not just the ADRs.

<u>Recommendation 2:</u>

- The MVSA and the various vehicle import schemes should have linkages to Australian communications regulations, to ensure that any radiocommunications equipment fitted to imported vehicles complies with local licensing conditions.

## 3.3 Positioning and Mapping

Vehicle safety systems are being developed internationally that utilise satellite positioning and map data. This is done to determine a vehicle's position as it relates to key attributes of the road network, including road geometry, lane and intersection configuration, and speed zones.

Many of these systems when operating in Europe and the USA rely on an augmented GNSS to determine positioning with a relatively high accuracy and integrity. For example, Europe has access to EGNOS, and North America has access to WAAS. However, Australia does not have access to such an augmented GNSS. Most GNSS receivers used in vehicles in Australia use the US Global Positioning System (GPS) only, without any augmentation or error corrections, which often does not achieve much better than plus or minus 10 metres spatial accuracy. This is not accurate enough for many emerging safety applications.

Further to this, those safety systems that rely on map data to determine a vehicle's position relative to key road attributes will need access to local map data. This has the potential to be a problem for imported used vehicles with map-enabled safety systems, as it is likely they will be using mapping data from the country or region that the vehicle was originally sold in.

Currently there are no ADRs regarding safety applications that require satellite positioning or map data. However, given that it is known that safety applications are being developed internationally that require these, it is considered wise that the review of the MVSA and the various vehicle import schemes consider these emerging issues.

Recommendation 3:

- Vehicle import schemes should give appropriate consideration to safety systems that rely on satellite positioning and mapping data, to ensure that no safety systems are compromised by positioning or mapping systems that do not meet local requirements.

# 4 REFERENCES

## 4.1 References

Australian Transport Commission 2011, *National Road Safety Strategy 2011-2020*, ATC, Canberra, Australia

Austroads 2011, *Evaluation of the Potential Safety Benefits of Collision Avoidance Technologies Through Vehicle to Vehicle Dedicated Short Range Communications (DSRC) in Australia*, AP-R375/11, Sydney, Australia

Standing Council on Transport and Infrastructure 2012, *Policy framework for intelligent transport systems in Australia*, SCOTI, Canberra, Australia.

United States Department of Transportation 2010, *Frequency of Target Crashes for IntelliDrive Safety Systems*, DOT HS 811 381, Washington, USA.

United States Department of Transportation 2014, *Federal Motor Vehicle Safety Standards: Vehicle-to-Vehicle (V2V) Communications*, Docket No. NHTSA-2014-0022, Washington, USA.

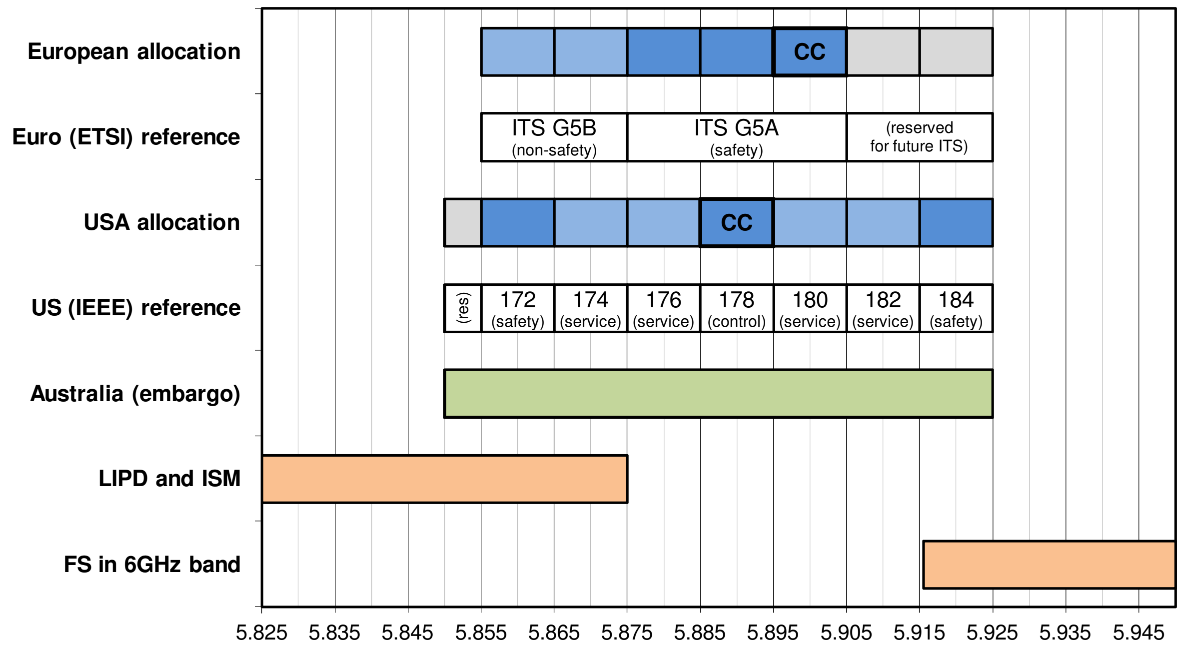
## 4.2 Acronyms

| | |
|---|---|
| ACMA | Australian Communications and Media Authority |
| ADR | Australian Design Rule |
| ARIB | Association of Radio Industries and Businesses |
| C-ITS | Cooperative Intelligent Transport Systems |
| CAMP | Crash Avoidance Metrics Partnership |
| CEN | European Committee for Standardisation |
| DSRC | Dedicated Short Range Communications |
| DSSS | Driving Safety Support Systems |
| EC | European Commission |
| EGNOS | European Geostationary Navigation Overlay Service |
| ETSI | European Telecommunications Standards Institute |
| EU | European Union |
| FCC | Federal Communications Commission |
| FMVSS | Federal Motor Vehicle Safety Standards |
| GNSS | Global Navigation Satellite System |
| GPS | Global Positioning System |
| I2V | Infrastructure to Vehicle |
| ICT | Information and Communications Technology |
| IEEE | Institute of Electrical and Electronics Engineers |
| ISM | Industrial, Scientific and Medical |
| ISO | International Organisation for Standardisation |

| | |
|---|---|
| ITS | Intelligent Transport Systems |
| ITU | International Telecommunications Union |
| LIPD | Low Interference Potential Device |
| LTE | Long-Term Evolution |
| MUARC | Monash University Accident Research Centre |
| MVSA | Motor Vehicle Standards Act 1989 |
| RFID | Radio Frequency Identification |
| SAE | Society of Automotive Engineers |
| SCOTI | Standing Council of Transport and Infrastructure |
| TIC | Transport and Infrastructure Council |
| TISOC | Transport and Infrastructure Senior Officials Committee |
| UNECE | United National Economic Commission for Europe |
| US DOT | United States Department of Transportation |
| V2I | Vehicle to Infrastructure |
| V2V | Vehicle to Vehicle |
| WAAS | Wide Area Augmentation System |

# 5 APPENDIX A

**Current Allocation of 5.9 GHz band for ITS in Europe, USA and Australia**




**Notes:**

- Dark blue represents channels used for safety-related messages
- Light blue represents channels used for non-safety messages
- Grey represents channels that are reserved or protected
- Green represents an embargo
- Orange represents current spectrum licensing for non-ITS use
- CC refers to the Control Channel, on which vehicles transmit their basic safety message up to 10 times per second
- LIPD refers to Low Interference Potential Devices
- ISM refers to Industrial, Scientific and Medical devices
- FS refers to Fixed Service microwave links