SafetyForum

Final Report and Recommendations of the Communications Working Group

Brussels, 10 September 2007

Recommendations of the

eSafety Forum Initiative Working Group Communications

on the Introduction of Vehicle-to-Vehicle and Vehicle-to-Infrastructure Communications to Increase Safety in Road Traffic in the EU

Version 1.0 as of September 10th, 2007

Table of Contents

1. Executive Summary

In summer 2005 the eSafety Forum Steering Group decided to launch a working group focused on wireless communication to increase road safety. In the 17th Steering Group Meeting on September 20th 2005 the Terms of Reference of the WG Communications (WG-C) were approved, focusing its work on standards, spectrum issues and international harmonisation of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication. Several organisations, like the Car-to-Car Communication Consortium (C2C-CC), ETSI, ISO and CEPT, and projects of the 6th FP like COMeSafety, CVIS, Safespot and Coopers, are active on these issues. The eSafety Forum WG-C is a platform to bring all parties together.

The joint effort of all stakeholders led to a situation today where most open issues have been discussed and worked on thoroughly; results have been achieved which well describe an European ITS concept for V2V and V2I communication. End of 2007 the CEPT will deliver a report in response to a mandate from the European Commission which shows that bandwidth of 30-50MHz at 5.9 GHz for ITS applications is justified and that 30 MHz of spectrum in the considered frequency range from 5,855 GHz to 5,925 GHz could be allocated providing the required protection against interference from other services and applications in that band.
The mandate report will be accompanied by a CEPT/ECC decision which designates 30 MHz in the band 5875-5905 MHz for ITS road safety applications and considers the frequency band 5905-5925 MHz for future extension of ITS noting that protection of ITS can not be ensured in this band.
To achieve regulatory certainty for those parties investing in ITS infrastructure and vehicle equipment (both public and private investors) the recommendation of this WG and the mentioned other stakeholders is that the EC should consider an EC decision to ensure a timely and EU-wide implementation of V2V and V2I to increase road safety.
Further action will be needed to achieve international harmonisation to maximise the effect on accident reduction and traffic flow by increasing penetration and reducing unit cost. In the US spectrum has already been allocated in the same band and Japan considers introducing V2V and V2I communication in the 5 GHz band as well. It would be helpful to have similar spectrum designated and standards implemented worldwide. As the vehicle and communication industries are truly global this will allow economies of scale helping to reduce the threshold of implementation for each road user and infrastructure provider.

Worldwide standards have been developed which all allow applications and services considered for safety, efficiency and other use. The exact configuration which will be used for an optimal cost/benefit ratio is still to be defined; from this year on several projects in the EU and worldwide will focus on field operational tests which will ac-

quire the needed statistical data to optimise the overall ITS architectures and systems.
The CALM set of standards offers a framework to choose from for further implementation, where the specifications from the Car2Car Communication Consortium complement this framework with specific technical details on short-range V2V and V2I systems.
Again the field trials will show how the balance can be achieved between the need for low component/operational costs and flexibility/openness for new services.

The Working Group Communications has formulated the following recommendations which have been approved by the eSafety Steering Group and the eSafety Forum Plenary.
The group would like to ask the EC to consider these recommendations for further action to harmonise ITS deployment within and outside the EU and to help increase the speed and certainty of implementation by recommendations or directives to the member states.

2. Recommendations

To increase road safety in Europe the European Commission should consider supporting the member states and the industry to establish a system comprising the following aspects

(1) an designation of protected spectrum in the range of 5.875GHz to 5.925GHz for safety and efficiency related messages between vehicles, other vehicles and/or infrastructure units so that communication can be maintained without delay or interference
(2) each vehicle or infrastructure device offering safety and efficiency applications must perform within a minimum set of mandatory parameters so that communication can be maintained with minimal delay or interference
(3) an EU wide harmonised deployment plan, including infrastructure and vehicle systems, to ensure market development by providing certainty for investment through a sustainable and feasible business model
(4) standardised interfaces for all system components are recommended to allow future functions or commercial applications offering additional revenue streams to leverage system investments
(5) a legal framework for seamless exchange of traffic relevant data in and between MS in an unified way - in line with privacy and data protection regulations
(6) a recommendation to the MS to provide safety relevant traffic data in a standard format free of charge to all road users (in the spirit of COMMISSION RECOMMENDATION 2001/551/EC)
(7) a recommendation to the MS to support the development and adopt common European ITS architecture elements to allow for interoperability in ITS (systems, communication, data, services and functions/applications)

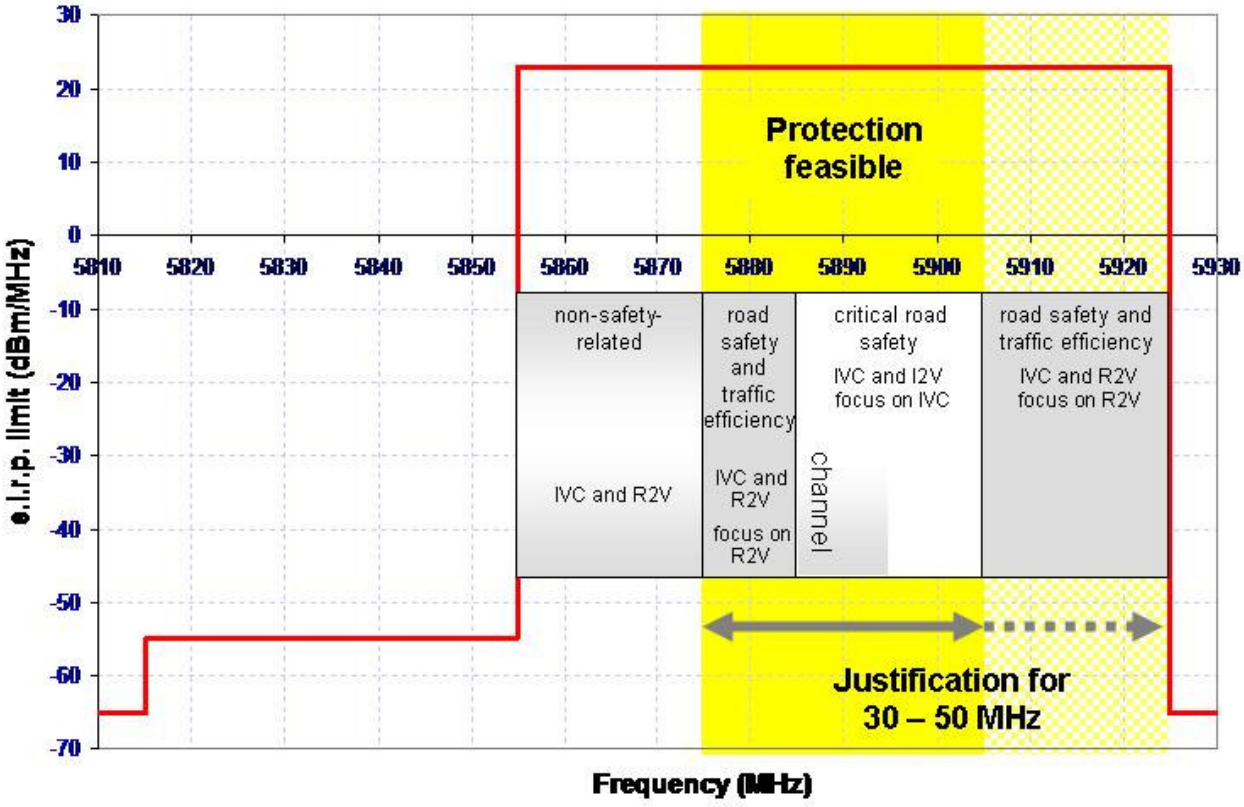
2.1. Explanation of Recommendations

2.1.1. Recommendation (1) Protected Spectrum

The spectrum requirements have been discussed within several bodies. An overview of the technical aspects will be given in chapter 2.6. CEPT has been mandated by the Radio Spectrum Committee (RSC) to validate the spectrum requirements for safety critical applications of ITS in the European Union, to define the needed level of protection, to perform compatibility studies and to propose a work plan. The final report is due by December 2007 and will be the basis of the EU wide spectrum regulation by means of an EC decision.

The CEPT validation of the spectrum requirements for road safety and traffic efficiency ITS applications articulated by the industry resulted in an anticipated need for 30-50MHz. The compatibility study results show that protection will be feasible in the range from 5.875 to 5.905 GHz.

The situation is summarised in the following diagram. For details refer to the ECC Report 101 and the EC Mandate Report of CEPT (to be finalised for approval until End 2007).



Based on the results of internal studies including impact assessment the ECC came to the conclusion that a European wide harmonisation is needed for ITS and the ECC decided to develop and issue an ECC Decision on the allocation of spectrum in the range 5.875 to 5.925 GHz for safety related ITS. The EC Mandate Report of ECC recommends to follow this approach and to make the frequency designation mandatory with an EC Decision in accordance with the provisions of the ECC.

2.1.2. Recommendation (2) Minimum Requirements

V2X communication is per se a highly networked system. Therefore the requirements for minimal delay times, high availability of each node etc. can only be obtained if every device in the network operates strictly according to the standards defined. A weak link in the chain can compromise the whole system and lead to unexpected behaviour. Therefore each component is required to be designed to comply with a minimum set of parameters. The relevant parameters are being defined jointly by ISO TC204/WG16, ETSI ERM TG37, IEEE 802.11 and C2C-CC and will be verified and refined during the planned field operational tests (FOTs) in the 7th framework programme and in national FOTs.

2.1.3. Recommendation (3) Deployment Plan

Safety relevant applications based on wireless communication need a minimum rate of vehicles equipped with communication devices and an infrastructure which provides wireless coverage at least at critical points. Dangerous intersections must be equipped with the necessary roadside systems to provide intersection collision warning. At least 10% of the vehicles on the roads need to carry V2V devices to take effect on road safety and to increase traffic efficiency; when higher penetration rates are achieved, more advanced functions can be implemented. The industry and road operators will only invest in building such systems if all parties follow a harmonised deployment plan so that the V2X functions become effective at a planned date. An EC decision following the CEPT mandate report would provide the required regulatory certainty regarding the availability of spectrum in the countries of the EU so that one investment risk would be reduced.

2.1.4. Recommendation (4) Standardised Interfaces

The first generation of V2X devices cannot be designed to accommodate all possible future functions as the acceptance by users and commercial or public investors very much depends on a low cost level. Therefore the devices must be equipped with open, standardised interfaces so that future extensions will be possible. Currently the 6th Framework projects CVIS, Safespot, Coopers, Sevecom and others are working on the definition of such open interfaces. Future extensions will be additional safety functions as well as commercial services using the same equipment to provide i.e. services like traveller information or

fleet management. The possibility to create additional revenue streams to refinance the initial investment will lower the barrier to market introduction of the whole system. Open standards will foster the development of 3rd party solutions which will increase the attractiveness to users and service providers.

2.1.5. Recommendation (5) Legal Framework for Data Exchange

Data exchange between traffic control centres, vehicles and service providers is essential not only for traffic efficiency applications or traffic management but also for safety functions. As an example, hazard spot warnings must be carried across borders with minimum delay and without the risk that vehicles threatened by the incident do not receive or understand the warning. Therefore an EU wide harmonised data format and communication protocols are needed. This will need a legal framework to ensure harmonisation, data protection and privacy. One approach for an European data exchange standard for ITS has been made with the IGATE project.

2.1.6. Recommendation (6) Availability of Safety Related Traffic Data

In addition to the legal framework of recommendation (5) it is essential that safety relevant traffic data must be available free of charge so that vehicle based systems can leverage the effects on road safety. The commission recommendation 2001/551/EC together with the final report of the eSafety RTTI working group already covers the distribution of safety relevant traffic data by broadcast communication. The same logic shall apply to data exchanged by V2X communication (see Final Report of the RTTI WG, Doc. no. 070309-1 of 16.03.2007) and to the use of Floating Car Data (ISO 22837 or SAE J2735). Public traffic data as well as privately acquired data which could avoid fatalities or severe accidents must be made publicly accessible without hindering existing or new business models offering additional commercial services based on the same data sources.

2.1.7. Recommendation (7) Common European ITS Architecture Elements

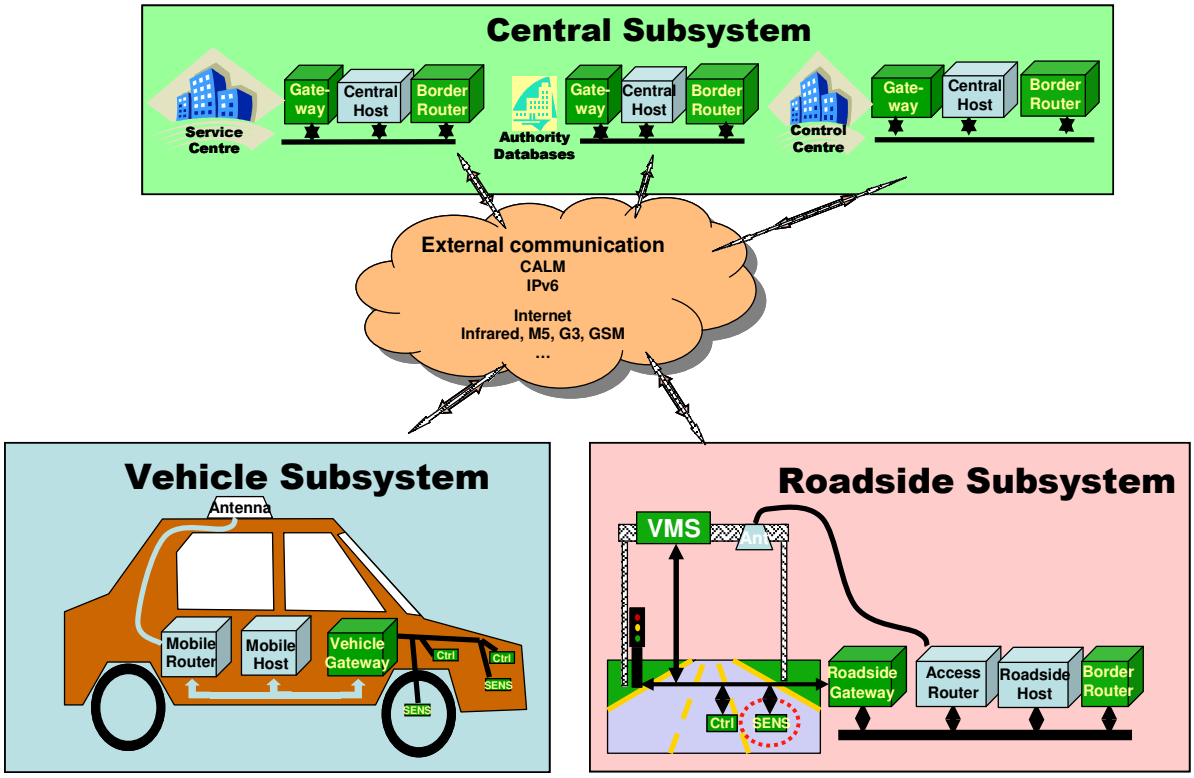
As already explained in recommendation (2) the V2X environment is dependent on seamless network performance across borders and between all connected devices in vehicles or infrastructure. The system performance depends on the different member states' ITS architectures and how they will be interlinked. Common architecture elements are needed to achieve interoperability and data exchange without loosing information or time.
With EC support CEN TC278 WG13 is working on how to integrate national ITS architectures. The eSafety WG-C endorses this effort to reach the goals mentioned above. In this area close cooperation with architecture groups focused on roadside systems is needed, the use of the results of the FRAME project may help to define a top level architecture covering the different systems and countries' ITS solutions.

2.2. Why is EC action needed?

There are several obstacles to establish an eSafety system based on vehicle communication driven by market mechanisms only:

- there is a threshold problem (the minimum penetration rate of such systems in moving traffic and infrastructure before the system works) which hinders vehicle owners and drivers to buy such systems, hence industry is reluctant to invest without a clear legal and commercial framework
- new (possibly joint) business models are required as revenue may go to other entities than those who invest (the cost of accidents and fatalities affect insurance companies, public health care etc., not by the parties investing)
- spectrum is available in principle, but CEPT cannot force its members to assign spectrum to ITS; a harmonised action is needed (see recommendation (1),(3))
- many functions (like crossing assistants) will need infrastructure devices to support vehicle assistance systems; public (and private) road owners are reluctant to invest (see business model issues above) without a political mandate or clear figures showing the benefit of those investments in comparison to other road safety measures (the planned FOTs, see below, will provide this data in the future).
- sufficient traffic data for inter-regional and urban traffic management exist but public (police, public transport systems, cities, counties and states) and private data owners are currently not willing to publish those data and their formats are not harmonised
- cross border data exchange does hardly exist
- an EU wide ITS architecture and strategy does not exist

2.3. CALM structure of a V2X Based System to Increase Road Safety



2.4. Standards

Several standards and pre-standards for V2I and V2V communication exist or are under way. There is a common understanding that the IEEE802.11p standard will offer a good technical basis and allow the use of cheap off-the-shelf components. The general system design for V2X and other related standards to be used are still under discussion. There is the CALM set of standards which defines a comprehensive platform for V2X communication and there is the work done in the Car2Car Communication Consortium which is focused on IEEE802.11 protocols and applications which are both used in several FP6 and FP7 projects. During field operational tests and standardisation in 2008 and 2009 there will be a good opportunity to reach a consensus leading to a compromise between versatility/flexibility and cost considerations.

2.5. Spectrum

While in the USA the development of the communication based ITS system WAVE was initiated by the allocation of 75 MHZ of spectrum in the range from 5.850 … 5.925 GHz the European industry raised the spectrum request for a European ITS system after some years of development. In Europe nearly the same band from 5.855 … 5.925 GHz for development and deployment of road safety and traffic efficiency as well as for non-safety applications was identified from a

propagation and spectrum availability point of view. The automotive industry is in favour of the harmonisation of the spectrum selected in the USA and in Europe, in particular by using the same frequency for the control channel 5.885 … 5.895 GHz, which allows the integration of the same communication hardware in both markets providing economy of scale and simplifying of trading.

The efficiency of road safety applications based V2V and V2R communications is highly dependant on the performance of the data exchange, which is defined by the reliability and the delay of the message transfer. The acceptable delay depends on the individual traffic situation, e.g. a hazard warning is time critical for a direct following vehicle but could be delayed for vehicles in a longer distance. It is the same with the reliability. The network topology of V2V communications is highly dynamic. Constantly new communication units appear or disappear in the range of one communication unit and often there are only small communication windows, in particular for communication with oncoming vehicles or at crossings. It is obvious that other applications and services using the same frequency in the same environment would reduce the performance of the V2X communication by interference and delay in the channel access which finally is on the account of road safety.

The CEPT/ECC compatibility study has shown that in the frequency range from 5.875 to 5.905 GHz a V2X communication system would not suffer from excessive interference with existing applications and services. For this 30 MHz of spectrum protection is feasible and necessary to exclude interference with upcoming new applications. In the adjacent 20 MHz of spectrum in the range from 5.905 to 5.925 GHz V2X communication can suffer from interference with Fixed Services (FS) which restricts the feasibility of this spectrum to less safety relevant applications mainly based on V2R communications, because the installation space of roadside units provide more technologies to reduce the impact of FS than vehicle units.

In the course of the CEPT/ECC studies on the spectrum requirements for road safety and traffic efficiency within the 5.9 GHz band it was confirmed that a realistic estimate of the needed bandwidth is between 30 … 50 MHz, i.e. the minimum spectrum requirement fits to the available 30 MHz of spectrum, where compatibility is given and protection is feasible.

Based on this result the CEPT/ECC is developing an ECC Decision, which designates in a first step the 30 MHz of spectrum from 5.875 … 5.905 GHz for ITS safety applications and considers the 20 MHz from 5.905 … 5.925 GHz for future extensions of ITS applications.

Today's' modern telecommunication standards often do no longer use a channel raster with fixed channels for each application or service but advanced technologies like TDMA, which uses a time slicing protocol to transmit data sets of several applications on the same set of frequencies. Therefore it will be needed to monitor progress of the relevant standards and to re-define the V2X system definition if needed.

2.6. Technology

Technology development happens in many system areas in vehicle and roadside equipment. Therefore in the future the use of additional frequencies in the range of 64 GHz has been discussed. These were considered in the SRD/MG and CEPT discussions as well. In the development of advanced driver assistance systems (ADAS) a secondary use of short and long range radar (SRR and LRR) systems for V2V communication has been discussed and evaluated. It can be anticipated that this communication channel (at 24 and 79 GHz) can complement other technologies. Other ADAS technologies and applications will certainly contribute to road safety and their influence on functions which can be realised with V2X technologies must be regularly analysed. This again calls for an open interface approach and an architecture which allows for future extensions.

2.7. Business Related Issues

When the WG-C was launched the focus of the terms of reference of this working group was set on spectrum and standardisation issues. The development of business models or the analysis of commercial viability of applications was explicitly exempted. Therefore only a brief description of the situation shall be given here.

The first hurdle for viable business models is a threshold problem. For vehicle owners a system is only attractive and will be bought which offers tangible experience. For example considering a V2V system a minimum of 5-10 % of the moving vehicles must be equipped to profit from safety and efficiency functions. This means that drivers would not experience such functions within the first years of their investment even if the majority of new vehicles in the EU were equipped with the necessary components. A similar effect occurs for a V2I system even if the public sector or road operators invest quickly into infrastructure devices but vehicles will be equipped hesitantly. Therefore a business model has to be found which takes into account that cash flow from the end user will come in late in the investment phase.

In addition the typical scenario of the car industry is to launch new technologies in their top models. With the current number of expensive cars on the roads in the EU the threshold will never be reached, in addition it would not be socially acceptable if only owners of expensive cars would benefit from reduced risk of injury and death.

Therefore a deployment strategy is needed where almost all new vehicles will be equipped with such devices and used vehicles can be retrofitted without creating high costs. It is unlikely that this will happen driven by market forces only.

Additional services which offer benefits for subscribers or by per use payments can help to refinance the investment if the devices, systems and infrastructure are designed with open interfaces and the architecture of the ITS system allows “payloads” on a non-interfering basis (i.e. reducing the cost of toll collection or conventional traffic management for road operators by using the same ITS system).

Service providers for commercial services will only invest into their systems if legal and regulatory certainty can be reached, thereby reducing the risk of failure.

The last major point is the availability of safety related traffic data. Such data exists in many cases in the public sector and at road operators, but is stored in many different, incompatible formats and is often seen as private property of the data owner, not to be shared with others.
The overall investment in eSafety ITS systems will only be successful if this data will be shared and freely available for all safety relevant applications. Commercial use of data will not be jeopardised by such openness as services like tourist and traveller information, route guidance, navigational map updates etc. can still be offered with a clear benefit to customers. Most safety related information is needed within a much shorter timeframe (Milliseconds to seconds) than commercial utilised data (which is purchased or processed minutes, hours or even longer before the related incident).
Therefore it is anticipated that commercial and safety related services can easily coexist if the system architecture has been designed properly.

3. References and Abbreviations

3.1. Examples of Road Safety and Traffic Efficiency Applications

Traffic Signal Violation Warning
Left Turn Assistant
Approaching Emergency Vehicle Warning
Blind Merge Warning
Cooperative Forward Collision Warning
Emergency Vehicle Signal Pre-emption
SOS Services
In-Vehicle Signage
Cooperative Collision Warning
Wrong Way Driver Warning
Work Zone Warning
Safety Recall Notice
Vehicle-Based Road Condition Warning
Lane Change Warning
Highway Merge Assistant
Cooperative Vehicle-Highway Automation System (Platoon)
Cooperative Adaptive Cruise Control
Road Condition Warning
Intelligent Traffic Flow Control
Instant Messaging
Pedestrian Crossing Information at Designated Intersections
Stop Sign Violation Warning
Stop Sign Movement Assistance
Intersection Collision Warning
Adaptive Drive train Management
Intelligent On-Ramp Metering
Enhanced Route Guidance and Navigation
Post-Crash Warning
Curve Speed Warning
Low Parking Structure Warning
Low Bridge Warning
In-Vehicle Amber Alert
Just-In-Time Repair Notification
Emergency Electronic Brake Lights
Blind Spot Warning
Visibility Enhancer
Vehicle-To-Vehicle Road Feature Notification
Highway/Rail Collision Warning
Pre-Crash Sensing
Cooperative Glare Reduction
Adaptive Headlamp Aiming
Turning/Crossing Assistant

4. References

Documents

- COMMISSION RECOMMENDATION 2001/559/EC
- C2C-CC Manifesto V1.0 21-May-2007
- ETSI TR 102 492 - 1
- ETSI TR 102 492 - 2
- Draft IEEE 802.11p
- Draft ISO 21210 (CALM Network)
- Draft ISO 21215 (CALM M5)
- Draft ISO 21217 (CALM Architecture)
- Draft ISO 21218 (CALM medium SAPs)
- Draft ISO 24102 (CALM interface manager)
- Draft ISO 29281 (CALM non-IP communication)
- Final Report of the RTTI working group, Ver. 070309-1
- Impact Assessment SRDMG(07)057
- ECC Report 101: COMPATIBILITY STUDIES IN THE BAND 5855-5925 MHz BETWEEN INTELLIGEN TRANSPORT SYSTEMS (ITS) AND OTHER SYSTEMS
- ISO 22837 (vehicle probe data)
- Draft ISO 29284 (event based probe data)
- Draft Final Report from CEPT to EC in response to Mandate on the harmonised radio spectrum use for safety critical applications of Intelligent Transport Systems (ITS) in the European Union(to be finalised for approval until Dec. 2007), currently SRDMG(07)067

Organisations/Bodies

- Conférence Européenne des Administrations des Postes et des Télécommunications (CEPT)
  European Communications Committee (ECC)
  European Radio communications Office (ERO): www.ero.dk
- European Committee for Standardisation (CEN)
  Technical Committee for Road Transport and Traffic Telematik (RTTT) (CEN TC278): www.nen.nl/cen278
- European Telecommunication Standards Institute (ETSI): www.etsi.org
- Internet Engineering Task Force (IETF): www.ietf.org
- International Organisation for Standardisation (ISO)
  Technical Committee for Transport Information and Control Systems (ISO TC 204): www.isotc204.com
  Working Group for Wide Area Communications/Protocols and interfaces (ISO TC 204 WG 16): www.calm.hu
- Car to Car Communication Consortium (C2C-CC): www.car-to-car.org

Abbreviations

ADAS	Advanced Driver Assistance Systems
CEPT	Conférence Européenne des Administrations des Postes et des Télé-communications
EC	European Commission
EU	European Union
ETSI	European Telecommunication Standards Institute
FOTs	Field Operational Tests
LRR	Long Range Radar
MS	Member States
OBU	On Board Unit
RSC	Radio Spectrum Committee (of the EC)
RTTI	Real Time Traffic Information
SRD/MG	Short Range Devices / Maintenance Group (of ECC)
SRR	Short Range Radar
V2I	Vehicle to Infrastructure (Communication), also called V2R (roadside)
V2V	Vehicle to Vehicle (Communication)
V2X	V2I and V2V together
WG-C	eSafety Forum Initiative Working Group Communications

5. List of Members of the WG-C and *cc: Recipients*

Bodi, Enrique	enrique.bodi@robotica.uv.es
Boethius, Eva	*eva.boethius@ec.europa.eu*
Bolte, Friedrich-Franz	*Bolte@bast.de*
Daniel, Uwe	uwe.daniel@silicon-networks.com
Dedene, Nele	nele.dedene@mow.vlaanderen.be
Evensen, Knut	knut.evensen@q-free.com
Fond, Michel	*michel.fond@orangefrance.com*
Gaillet, Jean-Francois	*gaillet@ygomi.com*
Hallstrom, Bengt	*bengt.hallstrom@vv.se*
Heddebaut, Marc	*Marc.Heddebaut@inrets.fr*
Hedlund, Björn	b.hedlund@clepa.be
Hess, Soeren	hess@comesafety.org
Jaaskelainen, Juhani	Juhani.Jaaskelainen@ec.europa.eu
Jeftic, Zeljko	z.jeftic@mail.ertico.com
Kirchner, Alexander	*alexander.kirchner@volkswagen.de*
Knibb, Brian	*BrianKnibb@kgpauto.com*
Kompfner, Paul	p.kompfner@mail.ertico.com
Kosch, Timo	Timo.Kosch@bmw.de
Kühn, Alexander	alexander.kuehn@bmwi.bund.de
Kunert, Holger	Holger.Kunert@bnetza.de
Ludwig, Peter	peter.ludwig@tri-consult.de
Luebke, Andreas	andreas.luebke@volkswagen.de
Mann, Peter	Peter.Mann@BNetzA.de
Martin Arndt	*Martin.Arndt@etsi.org*
Mäurer, Hans-Jürgen	*hans-juergen.maeurer@dekra.com*
Mietzner, Rudy	Rudolf.Mietzner@softlab.de
Mokaddem, Abdelkader	abdelkader.mokaddem@renault.com
Quoidbach, Lievin	*Lievin.Quoidbach@navteq.com*
Rowell, Andrew	*rowell@t-online.de*
Schalk, Andreas	A.Schalk@efkon.com
Schecter, Pierre-Henri	*Pierre-Henri.Schecter@maaf.fr*
Scheuch, Gudrun	*Gudrun.Scheuch@bmvbw.bund.de*
Schulze, Matthias	*Matthias.M.Schulze@daimlerchrysler.com*
Seeberger, Dieter	dieter.d.seeberger@daimlerchrysler.com
Segarra, Gerard	*Gerard.segarra@renault.com*
Silva, Irina	*i.silva@mail.ertico.com*
Spell, Sabine	*sabine.spell@volkswagen.de*
Stoelhorst, Henk	*h.j.stoelhorst@avv.rws.minvenw.nl*
Szafko, Tamas	szafko@connexis.com
Uhlemann, Elisabeth	elisabeth.uhlemann@volvo.com
Williams, Bob	bw_csi@compuserve.com

6. Version History

	Version	Comments	Editor	Date
1	0.1	Initial version	U. Daniel	09-JAN-07
2	0.2	Recommendations worked and agreed upon in WG meeting	U. Daniel	18-JAN-07
3	0.3	Integration of Recommendations as agreed on in Vienna, 17.04.07	U. Daniel	18-APR-07
4	0.4	Update for discussion at the next WG meeting	U. Daniel	08-JUN-07
5	0.5	7th WG meeting results and written input of Dieter Seeberger	U. Daniel	17-JUN-07
6	0.6	Editorial work to prepare online discussion by the WG End of June	U. Daniel	27-JUN-07
7	0.7	More editorial work, CVIS architecture diagram included	U. Daniel	13-JUL-07
8	0.8	Missing paragraphs completed (Exec Summary, 2.3 – 2.6)	U. Daniel	28-AUG-07
9	0.9	Completed editing of contributions by online consultation, group consensus	8th WG-C meeting	05-SEP-07
10	1.0	Transfer of results into the final version	U. Daniel	10-SEP-07
11				
12				