Radio interference risks for smart tachograph enforcement

Executive summary

CEN DSRC and the 5.8 GHz radio spectrum band play a key role implementing EU transport policy. The enforcement of drive and rest times, as well the check on on-board weighing systems depend on CEN DSRC and the 5.8 GHz frequency band. Since 2019 the smart tachograph is mandatorily installed in every new truck and the equipped fleet is permanently growing. The smart tachograph is an efficient enforcement instrument preventing driver fatigue and accidents related to it. The radio interface of the smart tachograph will in future also enforce Europe's weights & dimensions rules and hence the prevent the overloading of trucks, which poses a serious risk to road safety, causes over-proportional infrastructure wear and socio-economic costs. A mandatory CEN DSRC antenna assures that the smart tachograph can be checked by fixed installations or mobile ones, maybe in police vehicles, whilst the vehicle is in motion. This CEN DSRC antenna runs on the 5.8 GHz frequency band. This allows for the efficient enforcement of drive and rest times and weight rules, as trucks only need to be stopped in case of infringements, whilst compliant hauliers save time.

Harmful radio interference on the 5.8 GHz frequency band may disrupt the remote enforcement function of the smart tachograph and put the health and safety of truck drivers and motorists in question and encourage the manipulation of the smart tachograph.

The following three requests for spectrum use are critical for the interference-free operation of the smart tachograph:

1.) There is a potential 'in-band' interference risk through the possible use of Wi-Fi as a short range device in the 5.8 GHz frequency band

2.) There is a potential 'in-band' interference risk through the possible use of Wi-Fi with a higher transmission strength in the 5.8 GHz frequency band

3.) There is a potential 'out-of-band' interference risk from LTE-V2X in the 5.9 GHz frequency band

4.) There is a potential 'out-of-band' interference risk from beam forming antennae on the 6 GHz frequency band

Running these services on these bands may cause harmful interference to the remote detection of smart tachograph manipulation or misuse. They would also be difficult to prevent, since they could be legal in some EU Member States. In the case RLAN/Wi-Fi this may lead to 'legal jamming'.

European radio regulators, organised in the 'CEPT', examine possible interference risks to CEN DSRC. CEPT reports outline under which conditions the interference-free operation of radio services is possible.

Active key stakeholders

CEPT (European Conference of Postal and Telecommunications Administrations): The CEPT is the organization of the European radio regulators. It is older than the EU Institutions and also encompasses countries outside of the EU. The CEPT elaborates recommendations on how radio spectrum in Europe can be used efficiently and free of harmful interference. These recommendations then find recognition in European and national spectrum regulation. Inside of the CEPT the Electronic Communications Committee, abbreviated ECC, is the most senior decision-making body on radio spectrum. The ECC itself has numerous working groups that are subordinated to it and to which industry experts may contribute.

ASECAP (Association of European Toll Road Operators): ASECAP, as a trade association, takes an advocacy role at EU level. In addition that it plays an active role implementing radio spectrum policy: it administers the 'Protected Zone Database' (PZDB), a reference database that contains the positions of toll gantries for road charging. This database prevents radio interference, as other radio services are aware of the positions of the toll gantries and have to mitigate radio interference in their vicinity. ITS devices use the PZDB and it is also suitable for so-called 'wireless industrial applications' or Wi-Fi. The PZDB is essential for protecting CEN DSRC. Note: it can only protect fixed installations. The PZDB does not protect enforcement devices, since they are mobile and their location should not be known[1]. ASECAP experts participate in ECC working groups to advise on how to mitigate the risk of radio interference for electronic road charging systems.

ETSI (European Telecommunications Standards Institute): ETSI is one of the three European standardisation institutes and responsible for drafting specifications for most radio services. In the field of mobile telephony ETSI cooperates with standardisation body 3GPP and adopts 3GPP standards into European harmonized standards.

Radio regulatory aspects of the smart tachograph

CEN DSRC is a standardised short-range communication technology. It is based on European Norms (EN): namely EN 12253, EN 12795, EN 12834, EN 13372 and EN 300674. CEN DSRC broadcasts on the 5795-5815 MHz frequency band. This frequency band is colloquially referred to as the 5.8 GHz band in the context of transport. CEN DSRC is a very secure and robust radio technology. From a regulatory point of view CEN DSRC devices are classified as 'short-range devices'. They are specified in Implementing Decision 2019/1345 on 'harmonised technical conditions in the area of radio spectrum use for short-range devices' as 'TTT' –

[1] ETSI TR 102 792 , Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (CEN DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range' describes mitigation mechanisms for CEN DSRC road charging, as well as the smart tachograph to protect them from ITS-G5 related interference risks. The 'Protected Zone database' (PZDB) is one way of mitigating the risk for fixed road charging installations and a beacon system for the smart tachograph and mobile control equipment.

'Transport and Traffic Telematic devices'. TTT cover road tolling applications, smart tachograph and weights and dimensions applications[2].

Worker protection

The smart tachograph regulation prescribes a remote communication between the tachograph and control authorities for the early detection of infringements[3]. This radio interface is specified as CEN DSRC[4]. The Weights & Dimensions Directive also obliges a CEN DSRC radio interface to pre-check the weight of trucks[5]. The tachograph and weights and dimensions are most likely to share the same interface in the truck.

It should be noted the smart tachograph as well as weights and dimensions also play a key role for road safety, fair competition and preventing infrastructure wear, in addition to health and safety role they play protecting truck drivers.

Technical aspects & risks

The smart tachograph and the radio interface of Directive 2015/719 use the same technology and radio spectrum as electronic road charging systems on the 5.8 GHz frequency band. Interest in the 5.8 GHz frequency band has increased over the past few years. Radio services that share radio spectrum with CEN DSRC implement various mitigation methods to protect CEN DSRC from harmful interference.

The prevention of radio interference takes place at the approval stage, before the deployment of a service. This counts particularly for transport, since equipment is mobile, culprits are next to impossible to trace after causing interference and enforcement through the recall of equipment, as is feasible with fixed equipment, cannot be done in the field of transport.

Potential risks to CEN DSRC on the 5.8 GHz frequency band:

- *RLAN as a short range device*

The interference risk is high. Note that the term Wi-Fi is commonly used for RLAN devices. A high density of RLAN devices in the CEN DSRC radio spectrum 5795-5815 MHz could crowd the radio spectrum and so cause interference to CEN DSRC. As stated above: it would be next to impossible to identify interferers. Even if RLAN devices are intended for indoor-use, there is no way preventing their use in vehicles. The use of RLAN devices may even be permitted in individual EU Member States. The CEPT already examined the use of RLAN on the 5.8 GHz

[2] Commission Implementing Regulation (EU) 2019/1345 'amending Decision 2006/771/EC updating harmonised technical conditions in the area of radio spectrum use for short-range devices', see Band 62
[3] Regulation (EU) 165/2014 'on tachographs in road transport', recital 9 and article 9
[4] Commission Implementing Regulation 2016/799 'requirements for the construction, testing, installation, operation and repair of tachographs and their components'
[5] Directive 2015/719 'laying down for certain road vehicles circulating within the Community the maximum authorised dimensions in national and international traffic and the maximum authorised weights in international traffic', recital 13 and article 1 insert 10 d (5)

frequency band[6]. The CEPT recommends that the RLAN has to implement mitigation measures to protect CEN DSRC from harmful interference. Currently it is possible to operate RLAN on the 5.8 GHz frequency band, if the output strength is kept below of 25 mW and if EU Member States grant their permission:

- Norway permits RLAN use on the 5.8 GHz frequency band, except on the 20 MHz that CEN DSRC uses (5795-5815 MHz). The smart tachograph is protected. Interference may occur through 'out-of-band' emissions from neighbouring frequency bands.
- Czech Republic granted permission for RLAN use on the 5.8 GHz frequency band in 2021. To protect road charging from harmful interference a database similar to the PZDB has to be used. It protects only fixed installations, not mobile control units as used to enforce the smart tachograph.
- The United Kingdom permits RLAN use with a signal strength up to 200 mW for indoor use. Fixed outdoor use is not permitted, without stating enforcement. The use of roving devices is a legal grey area. Above-mentioned CEPT/ECC report shows that CEN DSRC is prone to harmful interference if no protective distance is kept.

- *Higher transmission strength RLAN*

In its 'ECC Report 330' the CEPT analyses the possible use of RLAN at higher transmission power than already permitted on the 5.8 GHz frequency band under a regime based on national permissions[7]. An EU-wide permission is out of question, since many radio regulators are convinced that it is not feasible to protect the smart tachograph and road charging, if RLAN would be permitted on the 5.8 GHz frequency band. The report in itself poses no risk. A risk may arise swiftly, should too many states individually grant permission to operate RLAN on the 5.8 GHz frequency band. There is also the risk that this report would be interpreted as a recommendation for granting national permission to operate RLAN on the 5.8 GHz frequency band, without considering the interference risk for CEN DSRC (e.g.: because there is no electronic road charging system present, or the radio regulator lacks expertise about the properties of the smart tachograph or for the lack of human resources). The awareness of the smart tachograph is often limited, since the smart tachograph is only in use since 2019 and it only slowly permeating the vehicle fleet. Furthermore the awareness of interference risks for the smart tachograph is lower than for road charging. Permissions to use RLAN on 5.8 GHz hold a particular risk for the smart tachograph, since devices could legally jam the smart tachograph would be present together with the incentive to jam. This would make the remote pre-check of the smart tachograph either difficult or impossible.

This issue would be best addressed at national level raising awareness of radio regulators of the risk of harmful interference to the smart tachograph.

[6] ECC Report 244, 'Compatibility studies related to RLANs in the 5725-5925 MHz band'
[7] ECC Report 330 'To enable WAS/RLAN use on a national basis in the band 5725-5850 MHz but also ensure the protection of RTTT/Smart Tachograph and radars (including Fast Frequency Hopping) taking into account free circulation of WAS/RLAN'

- *LTE-V2X*

The interference risk from LTE-V2X would be high, since LTE-V2X is envisioned to be installed in every vehicle by its manufacturers. LTE-V2X is foreseen to broadcast on the EU-wide ITS frequency band 5875-5935 MHz[8]. The CEPT has requested changes to the LTE-V2X standard for it to meet the requirements for band use[9].

LTE-V2X is a technology that is foreseen to enable the direct communication between vehicles (V2V) and between vehicles and the road infrastructure (V2I). It is originally standardised by standardisation body 3GPP. Currently the detection of CEN DSRC and mitigation is not yet fully specified, the use of the PZDB to protect fixed CEN DSRC installations is foreseen, the smart tachograph is not considered. The ECC has analysed the impact of vehicle-to-vehicle communication based on ITS-G5[10] and has shown a low interference risk[11]. This interference risk would be higher with LTE-V2X because of several reasons; retransmissions (HARQ)[12], simultaneous transmissions[13] and more transmitted messages for segmented payloads[14]. This situation requires urgent clarification.

There is no ECC study on the impact of LTE-V2X on the smart tachograph. A compatibility study similar to the ECC Report 291 would be useful in this context.

- *Cellular beam forming technologies on 6.4-7 GHz*

The interference risk here is spatially limited and difficult to predict. Mobile network operators would like to use the 6.4-7 GHz frequency band for future 5G cellular networks, idea here would be to use dynamic beam forming to follow mobile devices. First calculations here assume a transmission strength of 72 dBm, or 16 kW EIRP[15], in the direction of the radio beam. This transmission strength would be significantly higher than that in use by current beam forming antennae. The ECC has just started examining this idea, which would be due for discussion at the World Radio Conference 2023. This use of 5G on the 6.4-7 GHz frequency

[8] Commission Implementing Decision 2020/1426 'on the harmonised use of radio spectrum in the 5 875-5 935 MHz frequency band for safety-related applications of intelligent transport systems (ITS)'

[9] ECC Liaison statement to ETSI requesting changes to the LTE-V2X standard: https://www.cept.org/Documents/wg-fm/66803/fm-21-155annex17_ls-to-etsi-on-road-its-technologies-coexistence

[10] ITS-G5 is currently used for V2V and V2I communication and would be used for automated driving or 'platooning'. It is a standardised technology that allows instant, direct and ad-hoc V2V and V2I communication and broadcasts short-range. ITS-G5 and LTE-V2X fulfil the same purpose, both are ad-hoc short-range communication technologies. ITS-G5 is mature and already deployed by several European motorway operators and serialised in Volkswagen's Golf and ID series. At policy level ITS-G5 and LTE-V2X would be considered as C-ITS (cooperative ITS). ITS-G5 also plays a role in enforcing vehicle weight in Europe: Commission Implementing Regulation (EU) 2019/1213 'laying down detailed provisions ensuring uniform conditions for the implementation of interoperability and compatibility of on-board weighing equipment pursuant to Council Directive 96/53/EC', Annex II 4.1 mandates ITS-G5 for the exchange of weight data between the tractor and the trailer of a truck.

[11] ECC Report 291, 'Compatibility studies between smart tachograph, weight & dimension applications and systems operating in the band 5795-5815 MHz and in the adjacent bands'

[12] ETSI TS 103 723, Intelligent Transport Systems (ITS); Profile for LTE-V2X Direct Communication

[13] ECC Report 290, 'Studies to examine the applicability of ECC Reports 101 and 228 for various ITS technologies under EC Mandate (RSCOM 17-26Rev.3)'

[14] ECC Report 290, 'Studies to examine the applicability of ECC Reports 101 and 228 for various ITS technologies under EC Mandate (RSCOM 17-26Rev.3)' same as reference 13

[15] Figures are calculated based upon ECC PT1(21)229_Annex 2 and ITU 'Electromagnetic field compliance assessments for 5G wireless networks'

band merits deeper analysis and the smart tachograph ought to be adequately considered at the World Radio Conference.

The interference risk stems from fixed 5G installations, the location of which would need to be considered for the tachograph enforcement. Furthermore the beam forming and radio-technical properties of these fixed 5G installations would need to be considered for tachograph enforcement as well. This would require: 1.) solid understanding on the propagation of radio waves on the side of enforcement authorities and 2.) up-to-date maps detailing the areas where controls of the tachograph enforcement would risk interference from 5G.

*The **DSRC Interest Group** promotes the benefits of CEN DSRC technology to reach socio-economic and environmental goals in Europe. The DSRC Interest Group is registered in the EU transparency register (Transparency Register Number: 551694339025-26).*

CEN DSRC plays a key role implementing EU transport policy and generating socio-economic benefit. It is a key to implementing the 'user pays' and 'polluter pays' principles in road transport and hence is key to protecting the environment and maintaining Europe's road network. It plays a key role keeping our roads safe, since CEN DSRC helps protecting motorists from overloaded trucks or fatigued truck drivers. Through the tolls it helps to collect and enforce, CEN DSRC internalizes external transport cost and helps keeps Europe's roads infrastructure safe. Enforcing rules on Weights & Dimensions of trucks or the drive and rest times of truckers CEN DSRC also helps maintaining working conditions and fair competition in Europe's road haulage sector.

CEN DSRC is in wide use across the EU. Electronic road charging approximately 80.000 kilometres of roads relies on CEN DSRC for localization or enforcement. There are millions of pieces of CEN DSRC equipment in circulation, be that on-board units or digital tachographs.