

ITS, automotive sensors and future railway radiocommunications

ITU Regional Seminar for CIS and Europe "Development of modern radiocommunication ecosystems", 6 to 8 June 2018, St. Petersburg, Russian Federation

Europe: Current EC Mandates to CEPT

- EC Mandate to CEPT to study the extension of the Intelligent Transport Systems (ITS) safety-related band at 5.9 GHz
 - Extending the upper edge of the EC harmonised safety-related ITS band (5875-5905 MHz) by 20 MHz up to 5925 MHz;
 - In addition to road transport, allowing other means of transport such as Urban Rail using Communication Based Train Control (CBTC) in the EC harmonised safety-related ITS band.

- Permanent Mandate to CEPT on SRD (7th Update running now)
 - Concerns non-safety related ITS in 5855-5875 MHz;
 - Concerns new Smart Tachograph, Weight and Dimensions Applications in 5795 – 5815 MHz;
 - Concerns also ITS in 60 GHz (possible move of 63-64 GHz).

CEPT: ITS General Principles and Concept for Future Spectrum Regulation

- Technology neutrality
- Does not preclude definitions of minimum technical requirements for shared spectrum access;
- Mitigation techniques developed through ETSI standardisation;
- Uncompromised safety services for all users in case of multiple technologies implementation;
- All technologies are at least capable to coexist in the same frequency band;
- No segmentation and segregation of the band 5875-5925 MHz.
- In line with spectrum access requirements, Urban Rail (CBTC) ITS should be able to use any up-to-date technology.
- Avoid deployment issues. This may imply transition periods. 3

Technologies under Consideration

- **Road ITS** - ITS-G5 and LTE-V2X. LTE-V2X uses in the 5.9 GHz band only the PC5 air interface. ITS-G5 is based on IEEE 802.11/11p specifications.
- Channel loading, decentralized communication traffic congestion control, very high predictability to be received by other ITS stations. Future safety related ITS application (e.g. truck platooning) have increased requirements and will support more and more automated driving possibilities, compared with the existing initial driver alert applications in ITS.
- **Urban Rail (CBTC) ITS**: DSSS/TDMA, full or modified IEEE 802.11 technology, OFDM based, 3GPP TD-LTE (used in China at 1.8 GHz, not implemented in Europe yet)
- If trains cannot transmit messages, they will not be authorised to move.

Future Mobile Railway Communications

- CEPT will receive in July 2018 a mandate from the EC
- Follow-on of GSM-R to be investigated
 - Extended GSM-R band 873-880/918-925 MHz (or somewhat ‘squeezed’)
 - Alternatives in UHF (complementary)
 - mmWave (complementary)
 - Dedicated, MNO-based, Hybrid solutions under discussion
 - New activities in 3GPP on mission-critical and network slicing can potentially have great impact.
 - UIC participating in CEPT work

Europe: 63-64 GHz

Major Review started for 57-66 GHz – ITS / Automotive may change

- ITS 63-64 GHz (can also be used for radar sensors) is not questioned in total (a policy opinion suggests to keep it) BUT a process is on-going to find a better harmonisation approach for all applications under general authorisation regime.
- The focus is on fixed application under license-exempt regulation in the 57-66 GHz range for 5G small cells backhauling and wireless access.
- The effect of alignment of the ITS band with the channelling of the wideband data transmission system should also be considered.

Preparations towards WRC-19 Agenda Item 1.12

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|------|--|-----|-------|---|---|
| 1.12 | to consider possible global or regional harmonized frequency bands, to the maximum extent possible, for the implementation of evolving Intelligent Transport Systems (ITS) under existing mobile-service allocations, in accordance with Resolution 237 (WRC-15) | PTD | WP 5A | <p>Co-coordinators:</p> <p>Andrianilana Rakotondradalo France andrianilana.rakotondradalo@anfr.fr</p> <p>Tobias Vieracker Germany tobias.vieracker@volkswagen-infotainment.com</p> |   |
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CPG PTD
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- 1.1 Amateurs
- 1.11 Tracksides
- 1.12 ITS
- 1.16 RLAN 5GHz
- 9.1.5 Protection criteria 5GHz
- 9.1.6 Wireless power transmission

- Preliminary CEPT Views:
- existing regional harmonisation measures for ITS in 5855-5925 MHz and 63-64 GHz are sufficient
- No changes to the RR
- measures for ITS on ITU-R level can be achieved through the development of an ITU-R Recommendation (and an ITU-R Report if needed)

Sensors 76-77 GHz

Studies completed for 76-77 GHz Fixed Radars vs Automotive Radars- ECC Report 262

- Regulatory framework has been revised - Aim: Ensure future coexistence conditions – Change in ERC Recommendation 70-03 in 2017:

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|----|---------------|----------------------|----------|---------------|----------------|---|
| f1 | 76GHz - 77GHz | 55 dBm peak e.i.r.p. | (note 1) | Not specified | ECC Report 262 | 50 dBm average power or 23.5 dBm average power for pulse radar only. For ground based vehicle and infrastructure systems only. The frequency band is also included in Annex 4 |
|----|---------------|----------------------|----------|---------------|----------------|---|

Note 1 Fixed transportation infrastructure radars have to be of a scanning nature in order to limit the illumination time and ensure a minimum silent time to achieve coexistence with automotive radar systems.

- Detailed technical parameters (scanning nature, illumination time, silent time) for fixed radars will be reflected in the harmonised standard ETSI EN 301 091-3 for fixed radars.

Sensors 77-81 GHz

- **77-81 GHz** has been designated for long term solution in Europe – though
24.05-24.25 GHz -> no time limitation in Europe
24.25-24.50 GHz-> no continuation (above 24.25 GHz: 5G in future in Europe)
- ECC Decision (04)03 for 77-81 GHz is under reviewed
- New ETSI Proposal (System Reference Document) for the Revision Regulation for 77-81GHz for automotive radars in preparation
 - **Common regulation 76-81 GHz** (no split 76-77 GHz and 77-81 GHz - Include 76-77 GHz in the 77-81 GHz regulation.
 - **Power limit** defined as -3dB / -9dB behind the bumper in ECC/DEC(04)03 and Decision 2004/545/EC. Proposal to simplify and withdraw the naming of the bumper loss.

Global Implementation Overview

- USA: in July 2017 the FCC expanded the 76-77 GHz band to include the entire 76-81 GHz band for car radars.
- Canada and Brazil follow the FCC
- China: study triggered in 2017. Target: SRRC /SRTC new regulation
- Japan: will follow outcome under AI 1.18 of WRC-15
- Note that implementation of WRC-15 results may take some years.
- **I.e. 76-81 GHz materialises as the band for automotive radar sensors in the coming years**

Other Sensor Applications will join in 74-81 GHz

- Several proposals underway in Europe:
 - **Level Probing Radars**
 - Widened scope of applications – not only radiating downwards
 - **GBSAR**
 - Currently at 17 GHz moving to HD- Ground-based SAR
 - Surveillance of changes e.g. volcanos, big buildings, bridges
- Don't be afraid: new applications will be studied for their impact on other applications in the spectrum incl. automotive radars
- The location, the usage density of such new radar sensor applications, the technical details of the transmissions may not make interference very likely
- But the success of automotive radar in 76-81 GHz will create other sensor applications as we have seen in 76-77 GHz (wingtips, helicopters, level crossings, fixed radars)

Sensors > 95 GHz

- A considerable part of the spectrum above 100 GHz shows entries for passive services.
- FCC action noted - Opening 95-475 GHz to Commercial Use – FCC 14-177
- A potential demand is seen for sensor applications, also within the automotive field.
- There are no existing military applications above 100 GHz
- The allocation status is identical for all three ITU-R regions.
- Fixed Service channelisation arrangements (ECC Recommendation (18)01) published for operating in the bands 130-134 GHz, 141-148.5 GHz, 151.5-164 GHz and 167-174.8 GHz
- A promising frequency option could be 134/136-141 GHz (with radiolocation, amateur and RAS allocations) while there is also a radiolocation allocation up to 148.5 GHz (above 141 GHz, also FS and MS allocations)
- **This could also bring radar and lidar technologies closer together**

Thank you for you attention

Questions??

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