Session 4: Major topics on spectrum

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Current hot topics in spectrum for ECC

1. 5G – new spectrum and update of existing regulations
2. Spectrum for RLAN (Wi-Fi) above 6 GHz
3. ‘New Space’ – spectrum for large constellations of low-orbiting satellite
4. Intelligent Transport Systems
5. Improving accuracy of coexistence studies
5G – the next generation of mobile broadband

- 5G aims to provide:
  - Higher data-rates – *peak rates of tens of Gbps*
  - Low latency – *order of 1 ms*
  - Increased density of devices – *1 million per km²*  
    *not all at the same time*
- Seamless connectivity and user experience
- To support a range of ‘vertical’ applications:
  - ‘Internet of things’ and M2M
  - Automotive
  - Augmented/Virtual Reality (AR/VR)
  - Home automation
  - Smart cities
  - Industrial automation and sensors
  - Healthcare,
  - Mission critical applications
- Full scale 5G deployments are planned by **2020**
  - Early commercial deployments and trial networks in several countries
  - Deployment of 5G cities and pan-EU 5G corridors
  - A range of 5G devices are now available
5G technical challenges

- In order to meet the ambitious capacity targets, wide channel bandwidths are required – *100s of MHz or even several GHz*!
- Smart antenna technology (active antenna systems and ‘massive MIMO’) is being researched to provide localised coverage to individual users from a dense network of base stations
- All of this points to a requirement for large amounts of spectrum in *higher frequency bands – up to around 90 GHz*
- How to specify limits and measure antenna gain?
The CEPT roadmap for 5G was developed in 2016 following a dedicated 5G workshop and is updated regularly.

The roadmap identifies the following frequency bands as the priority bands for 5G:
- 3.4-3.8 GHz (‘C Band’)
- 24.25-27.5 GHz (‘26 GHz’)
- 40.5-43.5 GHz
- 66-71 GHz

A range of other tasks were identified, including review of regulations in other bands and consideration of verticals.

EC issued Mandates to CEPT to study C Band, 26 GHz and review harmonised technical conditions in existing bands below 3 GHz.
CEPT Pioneer 5G bands: 3.4-3.8 GHz ‘C Band’

- Limited existing use and large bandwidths available
- Existing regulations were updated to address active antenna systems ([ECC Decision (11)06, ECC Report 281, CEPT Report 67](#))
- There is a need to ‘de-fragment’ existing licences (allowing large continuous blocks of spectrum for 5G). [ECC Report 287](#) provides guidance to assist administrations
- [ECC Report 296](#) provides guidance on synchronisation options
- Ongoing work on cross-border coordination, including synchronisation
CEPT Pioneer 5G bands: 24.25-27.5 GHz ‘26 GHz’

- Harmonisation in [ECC Decision (18)06](#)
- EC Mandate response in [CEPT Report 68](#)
- Coexistence challenges with a range of existing services:
  - Passive services below 24 GHz – out-of-band limits
  - Fixed links – [ECC Report 303](#)
  - EESS/SRS earth stations – [ECC Recommendation (19)01](#)
  - Transmitting FSS earth stations (including future sites) – ongoing work
- Synchronisation options – [draft ECC Report 307](#)
- Authorisation schemes – ongoing work
- Cross-border coordination – ongoing work
Spectrum for 5G – Existing mobile bands

- Regulation for mobile broadband is technology neutral
- Bands already harmonised in Europe could be used for 5G
- Some adaptations are necessary to accommodate 5G characteristics – in particular for active antenna systems (in bands above 1800 MHz only)
- ECC has updated existing regulations in existing bands to ensure they are 5G compatible:
  - 900 MHz and 1800 MHz: [ECC Decision (06)13](#) and [ECC Report 297](#)
  - 2.1 GHz: [ECC Decision (06)01](#) and [ECC Report 298](#)
  - 2.6 GHz: [ECC Decision (05)05](#) and [draft ECC Report 308](#)
- Also work under EC Mandate for these bands: [CEPT Report 72](#)
Spectrum for 5G – Global allocations

- The following frequency ranges are under consideration for ‘IMT-2020’ (5G) identification under WRC-19 Agenda Item 1.13:
  - 24.25-27.5 GHz ✓
  - 31.8-33.4 GHz
  - 37-40.5 GHz
  - 40.5-43.5 GHz ✓
  - 45.5-50.2 GHz
  - 50.4-52.6 GHz
  - 66-71 GHz ✓
  - 71-76 GHz
  - 81-86 GHz ✓
  - = CEPT support for IMT identification

- ECC PT1 has conducted studies and contributed to ITU-R WP5D and TG 5/1
Wireless Access Systems (WAS)/Radio Local Area Networks (RLANs), most commonly known as Wi-Fi, are ubiquitous with billions of devices in operation.

Rapid growth is also expected in future with increased demand for higher data rates, meaning wider bandwidths are required (channels up to 160 MHz).

Wi-Fi (IEEE 802.11) is still the dominant technology, but increased use of unlicensed cellular (Licensed Assisted Access, MulteFire, 5G New Radio) is expected.

Existing spectrum bands:
- 2.4 GHz (2400-2483.5 MHz) - widely used and heavily congested
- 5 GHz (5150-5350 MHz, 5470-5875 MHz) – fragmented and restrictive regulations
- 57-71 GHz – high capacity ‘WiGig’ links, limited range

WRC-19 is studying possibility of opening up more ranges at 5 GHz, but this is proving challenging due to coexistence with other applications.

Interest is now in the range above 5925 MHz to allow large contiguous channels.
The US has opened access to 5925-7125 MHz, including sharing with existing licensed services – database approach

ECC started studies in 5925-6425 MHz in 2017

EC Mandate issued in December 2017
  - Task 1: compatibility studies and coexistence conditions
  - Task 2: harmonised technical conditions

ETSI SRDoc TR 103 524 in 2018: requested access to 5925-6725 MHz
  - The range above 6425 MHz is not considered feasible by ECC due to prevalence of fixed links

SE45 and FM57 are undertaking the work
  - ECC Report 302 published in May 2019 – studies with fixed links, satellite, intelligent transport systems, radio astronomy and ultra-wide band systems
  - Draft CEPT Report 73 currently under public consultation (Task 1)
  - 2nd CEPT Report with harmonised technical conditions (Task 2) to be published in 2020
  - An ECC Decision will also be developed to provide a wider CEPT harmonised framework
New Space – satellite innovations

- Traditional model: small number of physically large (=expensive) satellites in geostationary orbit (36000 km)
- Move to large constellations of small low-cost satellites in Low Earth Orbits (<1000 km)
  - Increased capacity, lower latency, ubiquitous coverage – opportunities for a range of applications
  - Regulatory challenges – frequency and orbit allocations, risk of collisions/debris
- New antenna technology – high throughput satellites with spot beams
Connectivity on the move

- Improving connectivity for ‘moving platforms’ (aircraft, ships, trains) – ‘earth stations in motion’ (ESIM)
- ECC has been working to update or develop new regulations in a range of bands
- Coexistence challenges with existing services – including fixed links and radioastronomy
Satellite 5G

- **ECC Report 280** considered the role of satellites in complementing 5G:
  - Communications on the Move - *ESIM*
  - Hybrid Multiplay – *video and home broadband*
  - Trunking and Head-end Feed – *remote areas and special events*
  - Backhauling and Tower Feed – *surge capacity to overloaded cells, content delivery*
• FM44 is currently studying the role of satellites to support M2M/IoT – draft ECC Report 305:
  – Recent interest from new players
  – Opportunities to provide coverage in remote locations
  – But more lower frequency spectrum needed (below 8 GHz)
  – Possibility for ‘hybrid’ networks
Intelligent Transport Systems - Railway

• Existing railway networks use a range of radio systems, e.g.:
  – GSM-R – voice and data comms (dedicated railway variant of 2G GSM cellular system)
  – Balise – track-based transponders
  – RFID – record information on rolling stock
  – Object detection radar
  – Video surveillance

• Two major ongoing initiatives:
  – Future Railway Mobile Communication Systems (FRMCS) – *GSM-R replacement*
  – Urban Rail Intelligent Transport Systems (ITS), *including Communication Based Train Control (CBTC)*
Future Railway Mobile Communication Systems

- GSM-R currently operates in 2x4 MHz: 876-880 MHz (uplink) and 921-925 MHz (downlink)
  - Wide deployment across Europe for 20 years
  - In some cases wider ranges of 873-880 MHz and 918-925 MHz are used
- Future of wider GSM system is uncertain, meaning GSM-R may become difficult to support in the long-term
- ETSI produced SRDoc TR 103 333 on FRMCS in 2017, requesting additional 2x3 MHz of spectrum below the existing range
- The rail industry has invested heavily in GSM-R infrastructure
  - Looking to replace it with a network that maximises data throughput and revenue
  - New features to improve safety, improve punctuality and increase line capacity
  - Enhanced passenger services, mobile broadband connectivity
EC Mandate on FRMCS

- In 2018 the EC issued a Mandate to CEPT to study the following bands for FRMCS:
  - 874.4-880 MHz and 919.4-925 MHz (additional 2 x 1.6 MHz below existing range)
  - 1900-1920 MHz – but also interest from other technologies including drones, DECT, …
  - 2290-2400 MHz – possible use on a tuning range basis
- Slicing of commercial bands may also be considered
- FM56 is currently developing 2 CEPT Reports in response to the Mandate
- ECO recently held a questionnaire to CEPT administrations on the 2290-2400 MHz range
- SE7 and PT1 are undertaking compatibility studies with other systems
- The work is planned to conclude in 2020
Urban Rail ITS in 5.9 GHz

- **Urban Rail** refers to metro and underground transport networks using dedicated infrastructure
  - More cities are deploying these systems and existing systems are expanding
  - Increasing density of trains means increasing demand for connectivity - CBTC
- 5875-5925 MHz has previously been harmonised in CEPT for road based Intelligent Transport Systems
  - Slow uptake due to competing technologies
- In 2017 the EC issued a Mandate to CEPT to study the use of other ITS applications in this band including **urban rail**
- **CEPT Report 71** was published in March 2019 based on results from **ECC Report 290**, proposing harmonisation of the entire 5875-5935 MHz range
  - Removal of restrictions for exclusive use by road ITS
  - Road ITS should have priority below 5915 MHz
  - Urban Rail should have priority above 5915 MHz
  - Co-channel sharing and mitigation techniques to be developed by ETSI
Coexistence studies underpin the majority of ECC’s work on spectrum. But how to ensure accuracy of studies and avoid worst-case analysis? Many studies take existing regulatory limits for transmitter unwanted emissions as a baseline, but measurements in ECC Report 249 showed this does not match reality – limits can overestimate level of emissions – leading to pessimistic results. ECC Recommendation (19)02 provides guidance on ensuring realistic assumptions for unwanted emissions. SE21 is in the process of updating ECC Report 249 with further measurements.
Improving accuracy of coexistence studies

- Radio Equipment Directive in 2014 and ECC Strategic Plan 2015-2020 – new focus on impact of **receivers** on spectrum management
  - ETSI need to ensure standards now specify receiver performance
  - ECC needs to accurately account for receiver performance in technical studies
- SE21 is currently studying the role of receivers in coexistence studies
  - Draft ECC Report to be completed soon
  - Possible future ECC Recommendation on receiver performance
- These activities on both transmitters and receivers aim to improve accuracy of coexistence studies on both sides, and therefore allow more efficient use of spectrum
What next?

- New ECC strategic plan for 2020-2025 – to be defined in the coming months
- WRC-19 outcome, and preparation for WRC-23
- 6G?
Thank you - any questions?