

# Spectrum and Regulatory Considerations for the 5G

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# Introduction

- ▶ A set of common regulatory objectives and principles,
  - as well as common procedures at EU level,
  - with a central implementation role for independent national regulators is considered.
- ▶ It is based on a balance between mandatory European rules and regulators' discretionary power.
- ▶ This balance of competences has helped to ensure that Member States and their regulators all push in the same direction towards the single market,
  - while ensuring that they are able to effectively address the specific, different challenges raised in their respective national markets.

# Introduction

- ▶ 5G will need several aspects to be commercially viable, including
  - a global standard, which should emerge from the standardisation process and
  - access to harmonised spectrum in Europe and other regions.
- ▶ The ITU has begun looking at spectrum for IMT.
- ▶ Additionally, Member States and the Commission are starting to think about availability of suitable spectrum.

# Spectrum Management

- ▶ Spectrum management should ensure that the benefits of European and international harmonisation are achieved, for example through the development of equipment for a global market.
- ▶ Far-reaching harmonisation is already a reality at a European level.
- ▶ Member States actively co-ordinate use of spectrum through well-established processes at both global and regional levels.
- ▶ Europe has deployed 4G mobile services, and identified 1200 MHz of spectrum for mobile broadband.

# Spectrum Management

- ▶ Avoiding delays in the release of spectrum.
- ▶ The 800 MHz experience is illustrative of the complexities of releasing spectrum in practice, with twelve derogations being granted.
- ▶ Member States encountered practical difficulties in meeting the dates set for making the band available,
  - mainly due to the time necessary for organizing the switchover from analogue to digital broadcasting
  - or migrating digital broadcasting below 790 MHz and/or negotiations with countries outside the EU.

# Spectrum Management

- ▶ The sharing of spectrum between different uses
  - is not a new approach to spectrum management,
  - but it has the potential to be substantially enhanced through new technologies
  - that enable new forms of sharing, and sharing to a much greater extent than previously.
- For example, cognitive radio, sensing and dynamic databases of spectrum use can be deployed, and
- there are already trials underway of new forms of sharing at the national level.

# Spectrum Management

- ▶ Licensed spectrum should be the core 5G spectrum management model.
- ▶ Unlicensed spectrum can play a complementary role.

# Award mechanisms of 5G Spectrum

- ▶ Auctions
- ▶ Beauty contests
- ▶ Hybrid approaches
- ▶ First come first served



# Licensing Aspects of 5G Spectrum

## Licensed Bands

- ▶ The process of gaining exclusive rights also differs depending on specific countries/regions and may involve:
  - Public auctions to grant the right to use the spectrum for a service
  - Obligations to build the specified services within a defined time frame, and/or
  - Reservation of rights granted for a public-service (e.g., Public Safety, Aviation, etc.)

# Licensing Aspects of 5G Spectrum

## Shared Licensed Bands

- To enable shared spectrum models,
  - Authorized Shared Access (ASA)/
  - Licensed Shared Access (LSA) regulatory frameworks
  - and supporting technical aspects have been developed.
- With a central database holding the information on the usage of the spectrum,
  - the second tier user for the spectrum can automatically be granted the rights to use the spectrum
  - in a geographical area for a specified and limited time period.

# Licensing Aspects of 5G Spectrum

## ▶ Unlicensed Bands

- Unlicensed/license-exempt bands are spectrum
- that has been defined for use collectively by an undetermined number of independent users
- without registration or individual permission.
  
- For unlicensed bands, the regulator establishes rules for how applications, technologies and industries shall use the spectrum
  - that allows applications and users to coexist under limited interference with each other.

# Spectrum Considerations for the 5G

## The Key Bands

5G Spectrum Bands	Current Allocation	Possible Use
700 MHz (low-range)	DTT	The Regulators have not yet assigned spectrum to operators.
3 GHz bands (mid-range)	Spectrum from 3.4–3.6 GHz is globally allocated for mobile and identified for IMT, with another 50 countries also identifying 3.3–3.4 GHz for IMT.	It is considered the 3400–3800 MHz band to be the primary band suitable for the introduction of 5G-based services in Europe, even before 2020.
24 GHz and above (high-range)		From the WRC-19 agenda item, millimeter wave spectrum above 24 GHz will become a key part of 5G networks. It is possible to open 28 GHz for mobile services, as the U.S. has done. Other priority ranges for deployment include 24–27.5 GHz, 27.5–29.5 GHz and 37–43.5 GHz The 24.25–27.5 GHz is considered as a pioneer band for 5G above 24 GHz.

# Spectrum Considerations for the 5G

- ▶ In addition to the above identified bands, regulators should facilitate the use of existing IMT bands for 5G usage.
- ▶ 3GPP identified several existing IMT bands in the early 5G New Radio release.
- ▶ It is important that regulators allow 5G in existing bands.
- ▶ 3GPP Release 15 includes an objective to develop co-channel coexistence between LTE and New Radio.

# Spectrum Considerations for the 5G

5G Spectrum Bands	Current Allocation	Possible Use
24.25–27.5 GHz (3250 MHz bandwidth)		The range 24.25 – 27.5 GHz (“26 GHz”) carries the potential to become a preferred range of spectrum in Europe, and is being studied in ITU toward WRC-19.
31.8–33.4 GHz (1600 MHz bandwidth)	Allocation to Radio Astronomy and passive Space Service use in adjacent bands. This band is not allocated to the Mobile Service in the table of allocations of the ITU Radio Regulations.	It is promising for 5G and could be made available relatively easily by many European administrations, taking into account the existing fixed service deployment in this band. This frequency band will need further studies in order to assess the future availability.
37–43.5 GHz (6500 MHz bandwidth)	This range is currently distributed over several services.	
The upper sub-range 40.5 – 43.5 GHz	It has been designated to terrestrial fixed service point-to-multipoint systems	This band is considered suitable for 5G, both access systems and backhaul.
The lower sub-range 37–39.5 GHz	It is already allocated partly to mobile, while the mid-band 39.5–40.5 GHz. Currently not allocated for mobile terrestrial service.	
40.5–43.5 GHz	The general balance between mobile and satellite sector to access the 40/50 GHz range should be taken into account .	RSPG considers the band as a viable option for 5G in the longer term.

# Spectrum Considerations for the 5G

5G Spectrum Bands	Current Allocation	Possible Use
45.5–47 GHz, 47–50.2 GHz and 50.4–52.6 GHz (4700 plus 2200 MHz bandwidth)	Currently allocated to Satellite services, and markedly, not allocated to the Mobile Service.	
66–71 GHz (5000 MHz bandwidth)	Currently in use in some countries for mobile backhaul. The bands currently have several allocations covering inter-satellite, mobile, mobile satellite, radio navigation and radio navigation satellite services.	The band is being considered for possible unlicensed use. For example, in the U.S. the FCC has already decided on unlicensed use.
71–76 GHz and 81–86 GHz (10000 MHz bandwidth)	Termed the E-band, It is currently in use for mobile backhaul.	It is also being considered as a possible band for unlicensed services.
3.5 GHz (400 MHz bandwidth)	The band is unfortunately fragmented in terms of arrangements, usage and license expiry dates. The C-band normally provides paired assignments but is used for the fixed and FWA services, and some few fixed satellite service incumbents earth stations still remain in the band.	It is regarded as suitable for the introduction of 5G services in Europe before 2020. This band is already harmonized for 5G and consists of up to 400 MHz of continuous spectrum.

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# Conclusions

## The Role of Regulators

- Creating a spectrum roadmap (this can happen now for spectrum that is already identified)
- Speed of rollouts in 5G
- Consider Quality of service and Coverage levels Issues
- Ensuring all mobile licenses are technology and service neutral

# Conclusions

- ▶ Having 2020 as the common deadline for repurposing the 700 MHz frequency band is appropriate also because it ties in with initial 5G deployment.
- ▶ Flexibility of use for sub-700 MHz spectrum makes it easier to mitigate interference and makes it possible to create an innovative ‘ecosystem’ promoting investment and new business models.

# Conclusions

- ▶ For spectrum policy, additional low-range spectrum ( $<3$  GHz) is needed, with a particular focus on the 600 and 700 MHz bands.
- ▶ Mid-range spectrum (3–6 GHz), particularly in the 3–4 GHz range, is also proving to be an important 5 GHz ingredient, as demonstrated by the activities of both European and U.S. regulators.
- ▶ Finally, broad swaths of millimeter wave spectrum above 6 GHz are necessary to support a growing range of services that 5G networks will offer.

# Thank you

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