FORWARD THINKING FOR SPECTRUM

Getting ready for 5G

GSMA-GSA seminar, ITU World Telecom
16th November 2016
Co-hosted by

[Logos of GSMA and GSA]
Panel

Progress and advances in 5G trials and the importance of spectrum harmonization for a new technology
Panel:

Progress and advances in 5G trials and the importance of spectrum harmonization for a new technology

- **Moderator**
  - Peng Zhao, Regional Spectrum Policy Director, GSMA

- **Panellist:**
  - Rob Middlehurst, Vice President International Regulatory Affairs, Etisalat
  - Hiroyuki Atarashi, Director, NTT Docomo
  - Julie Garcia Welch, Senior Director and Head of Government Affairs, Southeast Asia & Pacific, Qualcomm Incorporated
  - Hakan Ohlsen, Director of the Spectrum and Radio Technology Strategy, Ericsson
Potential spectrum for early “5G” development

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<th>Country</th>
<th>Below 6GHz</th>
<th>Above 6GHz</th>
<th>Source</th>
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| Japan   | • 3.6-4.2GHz  
           • 4.4-4.9GHz | • 27.5-29.5GHz | Report on “Spectrum policy initiative towards 2020” by MIC |
| China   | Steps 2 trial in 2016 and onwards  
Step 3 trial in 2017 and onwards  
• 3.4-3.6GHz  
• Other frequency bands including 3.3-3.4GHz & 4.4-4.5GHz (TBD) | Step 3 trial in 2017 and onwards  
• Frequency bands in 6-100GHz (TBD) | “Spectrum consideration on 5G R&D trial” by IMT-2020 (5G) PG |
| Korea   | For 5G trials in 2018  
• 26.5-29.5GHz |             | Presentation at 5G workshop in MWCS |
Timeline of 5G development in Japan

- **Timeline of 5G development has been presented by MIC.**
  (Ministry of Internal Affairs and Communications)

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Forward Thinking For Spectrum

Julie Garcia Welch
Senior Director and Head of Government Affairs
Southeast Asia & Pacific
Qualcomm Incorporated

GSMA and GSA Panel at ITU World Telecoms 2016
Shared spectrum will be important for 5G

Building on LTE-U/LAA, LWA, CBRS/LSA and MulteFire

5G New Radio (NR)
Sub 6GHz + mmWave

- Spectrum aggregation
  - LTE-U / LAA
  - NR based LAA
- Technology aggregation
  - LWA (LTE + Wi-Fi)
  - Multi-connectivity: NR, LTE, Wi-Fi
- Tiered sharing (incumbents)
  - CBRS, LSA
  - NR based tiered sharing
- Standalone unlicensed
  - MulteFire
  - NR based MulteFire

LTE Advanced Pro
Spectrum below 6 GHz

1 Licensed-Assisted Access (LAA), LTE Wi-Fi Link Aggregation (LWA), Citizen Broadband Radio Service (CBRS), Licensed Shared Access (LSA)
The FCC is driving key spectrum initiatives to enable 5G
Across low-band, mid-band, and high-band including mmWave

- **Low-band**
  - Broadcast Incentive Auction
  - First stage auction opened up 126 MHz in 600 MHz band, auction failed to close with clearing cost set at $88.4B
  - Third stage auction underway for 108 MHz.
  - Spectrum availability timing aligns with 5G

- **Mid-band**
  - Citizens Broadband Radio Service
  - Opening up 150 MHz in 3.5 GHz band
  - 3-tier spectrum sharing with incumbents, PAL\(^1\), and GAA\(^2\)
  - CBRS Alliance formally launched to drive an LTE-based ecosystem

- **High-band**
  - Spectrum Frontiers Ruling\(^3\)
  - Opening up 11 GHz in multiple mmWave bands
  - 70% of newly opened spectrum is shared or unlicensed
  - Unanimously approved by FCC with additional candidate bands identified for IMT-2020

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1 Priority Access Licenses to be auctioned; 2 General Authorized Access; 3 FCC ruling FCC 16-89 on 7/14/2016 allocated 3.25 MHz of licensed spectrum and 7.6 MHz of shared/unlicensed spectrum.
United States FCC Spectrum Frontiers ruling for 5G mmWave

Shared and unlicensed spectrum will also be needed

**Licensed access**
- 27.5 - 28.35 GHz: 850 MHz (2x425 MHz)
- 37.6 - 38.6 GHz: 1 GHz (5x200 MHz)
- 38.6 - 40 GHz: 1.4 GHz (7x200 MHz)

**Total spectrum**
= ~11 GHz

**Shared and unlicensed access**
- 37 - 37.6 GHz: 600 MHz (3x200 MHz)
- 64 - 71 GHz: 7 GHz expansion of existing 60 GHz band

**Additional candidate bands that the FCC indicated it would study**
Include 24.25-24.35, 24.75-25.25, 31.8-33.4, 42-42.5, 47.2-50.2, 50.4-52.6, 71-76 GHz
The FCC’s July 14\textsuperscript{th} Spectrum Frontiers ruling is “the final piece in the spectrum trifecta of low-band, mid-band, and high-band airwaves that will open up unprecedented amounts of spectrum, speed the rollout of next-generation wireless networks and re-define network connectivity for years to come.”

- FCC Chairman Tom Wheeler, June 20, 2016

“While recognizing that there is no consensus definition of 5G, most agree that it will integrate current and future infrastructure, along with low-, mid-, and high-band spectrum to achieve the connectivity we seek.”

- FCC Commissioner Michael O’Rielly, June 27, 2016
Driving technology innovations to mobilize mmWave
Operator trials & early deployments expected to start late 2017/early 2018¹

802.11ad 60 GHz chipset commercial for mobile devices 1.79 cm

5G mmWave prototype system and trial platform

Qualcomm Technologies’ First 5G Modem

Qualcomm® 802.11ad 60 GHz technology with a 32-antenna array

End-to-end system operating at 28 GHz demonstrating NLOS operation and robust mobility

28 GHz support, 4G/5G Multi-mode with dual connectivity, up to 5 Gbps download speed

¹ For limited regional fixed wireless deployments, e.g. Korea and US (VZ 5GTF and KT 5G-SIG) operating at 28 and 39 GHz; also will be utilized for mobile wireless access trials to drive 5G NR standardization.
EUROPEAN SPECTRUM POLICY AND HARMONISATION

RADIO SPECTRUM POLICY GROUP (RSPG)
- Opinion
- Report

EC Decisions

EC Mandates

CEPT Reports

EC Electronic Communications Committee

Spectrum regulation
- ECC Decisions
- ECC Recommendation
- ECC Reports

Placing equipment on the market
- Harmonised Standards
- ...
European Commission 5G Action Plan

“Keeping EU in the head of the race”
✓ A common roadmap for the deployment of 5G with coordinated national action plans across Europe for commercial launch

“A 5G-ready Europe”
✓ Availability of Spectrum
✓ Availability of fiber connectivity and capacity for backhaul
✓ Availability of base station sites for dense deployment

“5G in support of economic growth”
✓ Commission as facilitator of cross-sectoral business synergies
✓ Innovative ecosystems and collaboration
✓ Pan-European 5G trials / pilot projects

“5G Global Interoperability for consumers”
✓ Promote common global standards

Diagram:
- Early 5G launch in selected areas 2018
- Commercial launch of 5G services in at least one major city in all Member States 2020
- 5G in all urban areas and along main transport paths 2025
European Commission 8 Actions on 5G

1. Member state trials, launch and deployment of 5G
2. Pioneer spectrum
3. Spectrum bands and approach for authorization
4. Fiber and cell deployment
5. Standardisation
6. Testing of terminals and applications through 5G PPP
7. 5G for public safety and security
8. Trigger 5G innovation eco-system by venture financing

RSPG OPINION (November 9, 2016);
“STRATEGIC ROADMAP TOWARDS 5G FOR EUROPE”
Pioneer bands for 5G;
• 700 MHz
• 3400-3800 MHz
• 24.25-27.5 GHz
RSPG Current work on DRAFT opinions

- A Spectrum Roadmap for IoT
- Spectrum Aspects of Intelligent Transport Systems

CEPT WORKSHOP November 4-5, Mainz
“5G mobile communications”

- CEPT should review as a matter of urgency the suitability of 3.4-3.8 GHz ECC decision for 5G
- CEPT should be ready to help administrations in solutions for defragmenting the 3.4-3.8 GHz band
- CEPT should develop a harmonisation decision for 26 GHz
- CEPT should review ECC decisions in existing MFCN bands to ensure they are “5G compatible”
- CEPT should consider the impact of future “flexible duplex” on the management of existing FDD bands

EC mandate to CEPT

- Draft Mandate to CEPT to develop harmonised technical conditions in the Union for next-generation (5G) terrestrial wireless systems in EU-harmonised frequency bands and in frequency bands above 24 GHz