SSA 5G Spectrum
Building a roadmap for success
Welcome Remarks

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Roadmaps for 5G Spectrum: Sub-Saharan Africa

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The Study

- Details of which spectrum is envisioned for 5G use in SSA.
- International best practice in awarding 5G spectrum.
- A categorisation of countries based on the current state of awards so the GSMA can identify which countries are most advanced in their plans for 5G release, and which suffer from significant constraints on release of spectrum.
- An overview of how spectrum should be released, including details of the identification, clearance, award and assignment stages.

Data provided by GSMAi, country regulators and operators
Current Status in the 5G Universal Roadmap

4G will have a key role in the 5G era as well, coexisting alongside 5G into the 2030s.
1) Identification of Spectrum

Key frequency bands 700 MHz, 3.5 GHz and 26 GHz. Identify other bands such as 2.3 and 2.6 MHz. Look into upper 3.5 GHz, 4.8 GHz and 6 GHz.

<table>
<thead>
<tr>
<th>Country</th>
<th>5G frequency bands (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameroon</td>
<td>700</td>
</tr>
<tr>
<td>DRC</td>
<td>700, 3500</td>
</tr>
<tr>
<td>Cote d'Ivoire</td>
<td>2300, 3500</td>
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<td>Kenya</td>
<td>700</td>
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</tr>
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<td>Senegal</td>
<td>3500</td>
</tr>
<tr>
<td>South Africa</td>
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Source: Global mobile Suppliers Association
2) Spectrum Clearance

Step 2
Spectrum clearance

Essential to understand incumbent use and potential to refarm bands and associated timescales for release.

Will vary depending on incumbents and specifics such as density of users, geographic location, impact on services and users, potential for sharing with 5G.

May require licences to be terminated and existing users and uses to be removed or provided using alternative frequencies or technologies.

Possibility of geographic sharing if incumbent use limited (e.g. governmental use).

Frequencies already assigned to MNOs that support 4G and 5G can potentially be realigned to provide contiguous frequencies. May require technology neutral licences.
3 and 4) Technology and Valuation

**Step 3**

Technology definition and restrictions

Provides necessary information for licence award on any restrictions (e.g. frequency and geographic) and technical conditions (e.g. block edge masks, network synchronisation requirements, transmitter power limits).

**Step 4**

Spectrum valuation

Spectrum valuation used to set annual fees and reserve prices if spectrum auctioned. Important to take into account any differences in spectrum being awarded (e.g. geographic or technical limitations on part of a band making it less attractive)

Spectrum valuation should take account of considerable investment needed in networks and impact of high prices and fees on network roll-out, quality of service, availability and end user prices.
There are 3 main approaches to spectrum award: beauty contest, auction and direct award. Decision needs to be based on market status and policy objectives.

Award design will need to take account the amount of spectrum available and the need for specific conditions such as spectrum caps, spectrum sharing, leasing.

Timing of spectrum release may have an impact. May be necessary to hold a number of separate awards such as in Saudi Arabia rather than a single multiband award.

The output of previous steps should result in an Award Information Memorandum and implementation of the award process.
All countries studied have existing LTE networks

However many have not upgraded to LTE-A or LTE-A Pro
  - It is unclear whether this is due to cost or lack of demand

Before investing in 5G it is crucial existing networks are optimised
  - 5G initially runs alongside LTE-A networks in non-standalone mode

4G will continue to play key role in mobile networks as 2G and 3G are phased out and 5G introduced.

It is important existing licences are technology neutral to allow operators to refarm current spectrum for LTE expansion if needed based on the market and their network and service planning
▪ **Rwanda** informs to have upgraded the network to LTE-A but there have been no LTE-A connections registered by nPerf or OpenSignal

▪ **Benin, Cameroon, DRC, Côte d’Ivoire and Senegal** are all awaiting LTE-A Pro upgrades
Countries on 5G Roadmap

- **Ethiopia** is considered to be at Step 1 on the roadmap
  - Recent market liberalisation should provide incentives for new technology investment – the regulator to act to award 5G spectrum quickly.

- **Kenya** is at Step 2
  - Although 5G has been running, and a partial network is in place, this has been achieved by Safaricom using refarmed 2600 MHz spectrum. Other operators do not have this facility.
  - Decisions over spectrum awards to be made.
Countries on 5G Roadmap

- **Nigeria** is at step 4 on the roadmap
  - Spectrum has been identified and the regulator is working to decide how it should be awarded.
  - Regulator should strike a balance between distribution of spectrum and effective contiguous bandwidths.
- **South Africa** is at step 5
  - Valuation exercises have taken place but continued debates over award process are delaying decisions.
Other Recommendations

▪ All countries should adopt Region 1 band plans to minimise interference issues – in particular cross border. This is particularly important where 850 MHz was used.

▪ Those countries where the bands 2300, 2600 and 3500 MHz have been awarded for FWA should investigate the options and potential to allow for 4G and 5G services.

▪ All licences should be technology and services neutral to allow MNOs to upgrade networks and services to meet market developments.
Roadmaps for 5G Spectrum: Sub-Saharan Africa
Policies to support the Roadmap Implementation

Caroline Mbugua
Senior Policy Manager, SSA, GSMA
Licensing Best Practices

LICENCE TERMS & CONDITIONS CAN SUPPORT NETWORK EVOLUTION & INVESTMENT

- License duration of 15 to 20 years
- Remove service and technology restrictions
- Use coverage obligations with caution and target them
- Avoid restrictive and onerous conditions
- Use annual fees to recoup costs – not maximise revenues

RENEWAL PROCESS SHOULD AVOID RISKING INVESTMENT & SERVICE CONTINUITY

- Establish a license-renewal process including consultation 3-4 years in advance
- A presumption of renewal (unless terms breached) supports service continuity and investment
- Renewal should be predictable and avoid introducing new terms which jeopardise RoI
High Spectrum Prices Negatively Impact:

- Network Coverage
- Network Quality
- Consumer Prices

Analysis based on 229 operators in 64 countries (34 high income and 30 low & middle income) from 2010-2017
Coverage Policy Measures

• Assign sufficient amounts of mobile spectrum to operators in a timely manner - including coverage bands
• Do not inflate spectrum prices. Also, look for trade-offs between reduced spectrum fees and carefully considered wider coverage obligations
• Avoid licence terms and conditions that discourage network investment and innovation and needlessly increase costs
• Reduce mobile-specific taxes and fees that impede rollouts and harm internet affordability
• Provide non-discriminatory and timely access to public infrastructure
• Simplify and streamline the planning approval process for new base stations to incentivise and speed-up deployments
• Adopt a competition policy which supports investment in high quality mobile networks
• Allow infrastructure sharing on a voluntary basis
• Only consider state intervention to support coverage once all regulatory measures to maximise coverage through market-driven mechanisms have been exhausted and after a careful assessment of different options.
  – Ensure that Universal Service Funds (USFs) are targeted, time-bound, robustly supported by the regulatory framework and managed transparently following best practices. If this cannot be achieved within a reasonable timeframe, adopt a roadmap to phase out USFs;
  – Consider whether community networks can play a role in enabling rural coverage in areas that are not commercially viable, taking care not to deter wider mobile rollouts or damage a level playing field in the provision of telecom services;
  – Consider carefully planned and executed Public Private Partnership projects to widen access in areas where commercial networks are not viable and existing regulatory best practice has not worked but avoid the Single Wholesale Network (SWN) approach.
Technology Neutrality and Spectral efficiency

• Spectrum is a scarce resource

• Key focus of technical development is to get the most out of every Hertz of spectrum, i.e. to maximise the spectral efficiency in terms of bits per Hz.
Technology Neutrality: Impact on GDP

- The key benefit of refarming spectrum to a new technology is that subsequent mobile generations deliver higher mobile broadband speeds.

- A doubling of mobile data use leads to an increase in the GDP per capita growth rate of 0.5 percentage points.

- For a given level of total mobile penetration a 10% substitution from 2G to 3G increases per capita GDP by 0.15 percentage points.

- An increase in the number of connections within a population has a direct positive impact on GDP.
  - A ten line increase from 10 to 20 lines per 100 people yields a 1.40% GDP impact.
  - A ten-line increase from 20 to 30 lines per 100 people yields a 0.82% GDP impact.
  - The increase in broadband connections per 100 people contributed to a cumulative GDP increase of 4.34%.
Refarming improves broadband penetration

- 850 MHz (2G)
- 900 MHz (2G)
- 1800 MHz (2G)
- 2100 MHz (3G)

3G or 4G

3G or 4G

4G

4G
In Summary, Spectrum should be made available:

**AT THE RIGHT TIME**
- The earlier the better
- Use a spectrum roadmap

**UNDER THE RIGHT CONDITIONS**
- Technology Neutrality is very important

**IN SUFFICIENT QUANTITY**
- Capacity crush in cities will define the commercial offering of an operator
- Work with the operators to understand how much is needed

**AT THE RIGHT PRICE**
- Auctions should determine the price
Spectrum Harmonisation and Needs

Ross Bateson
Special Advisor, Government Affairs, GSMA
Coverage and Cost

92% of the world’s population is covered by Mobile Broadband.

Mobile Broadband now connects around 4 BN people to the internet.

3.7 BN more people are not connected but 3.3 BN live within mobile broadband coverage.
Spectrum Needs of 5G
Harmonising for cost efficiency and coverage

Low-band
470-960 MHz

Mid-band
3300-3800 MHz
4800-4990 MHz
6425-7125 MHz

Capacity bands
10-10.5 GHz and existing mmWave capacity
Wide, contiguous channels provide:

- Higher data rates
- Better performance and capacity / throughput
- Less dense networks
- Lower terminal complexity
- Lower power usage
Cost Efficiency

Planning 5G with enough spectrum to allow sufficient bandwidth will increase performance and significantly reduce costs.

Wider channels mean fewer base stations

<table>
<thead>
<tr>
<th>CHANNEL SIZE IMPACT</th>
<th>100 MHz</th>
<th>60 MHz</th>
<th>INCREASE IN NUMBER OF CELL SITES</th>
</tr>
</thead>
<tbody>
<tr>
<td>64%</td>
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<td>64%</td>
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WRC-23 can make huge savings on 5G roll-out

<table>
<thead>
<tr>
<th>GLOBAL BENEFITS</th>
<th>ADDITIONAL 300MHz</th>
<th>ADDITIONAL 700MHz</th>
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<tbody>
<tr>
<td>$50bn</td>
<td>$80bn</td>
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Adding additional bandwidth to the baseline 200 MHz in 3.5 GHz range

https://www.gsma.com/spectrum/resources/3-5-ghz-range-for-5g/
Lower band capacity improves rural access and affordability

**Wide-Area Spectrum Capacity**

- Spectrum capacity below 1 GHz can lower digital divide and provide consistent user experience
- Affordable 5G will support achievement of social goals and enhance digital inclusion
- IoT and MMTC can receive better access to low frequency spectrum and drive economic development
- Sub-1 GHz spectrum will support improved capacity in rural areas
Broadband for All in the 2020s

Sub 1 GHz
- Rural 5G capacity below 1 GHz will help lower digital divide
- 7/800 MHz needed now; 600 MHz future
- Consistent user experience between urban/rural and in-building capacity development

3.3-3.8 GHz
- Optimal (100 MHz) channels required to lower broadband costs
- Optimal spectrum assignments save billions
- 5G launch band with biggest device ecosystem

6 GHz
- Identification of upper band (6 425-7 125 MHz) at WRC-23 will harmonise mobile use
- African support for process is crucial and will help harmonise
- FWA will produce significant demand away from fibre
- Backhaul needs to be protected
Q&A Session

Alain Betu
Policy Manager, SSA, GSMA
Closing Remarks

Seyni Fati
Senior Policy Manager, SSA, GSMA