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SSA 5G Spectrum

Building a roadmap for success

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Welcome Remarks

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Roadmaps for 5G Spectrum: Sub-Saharan Africa

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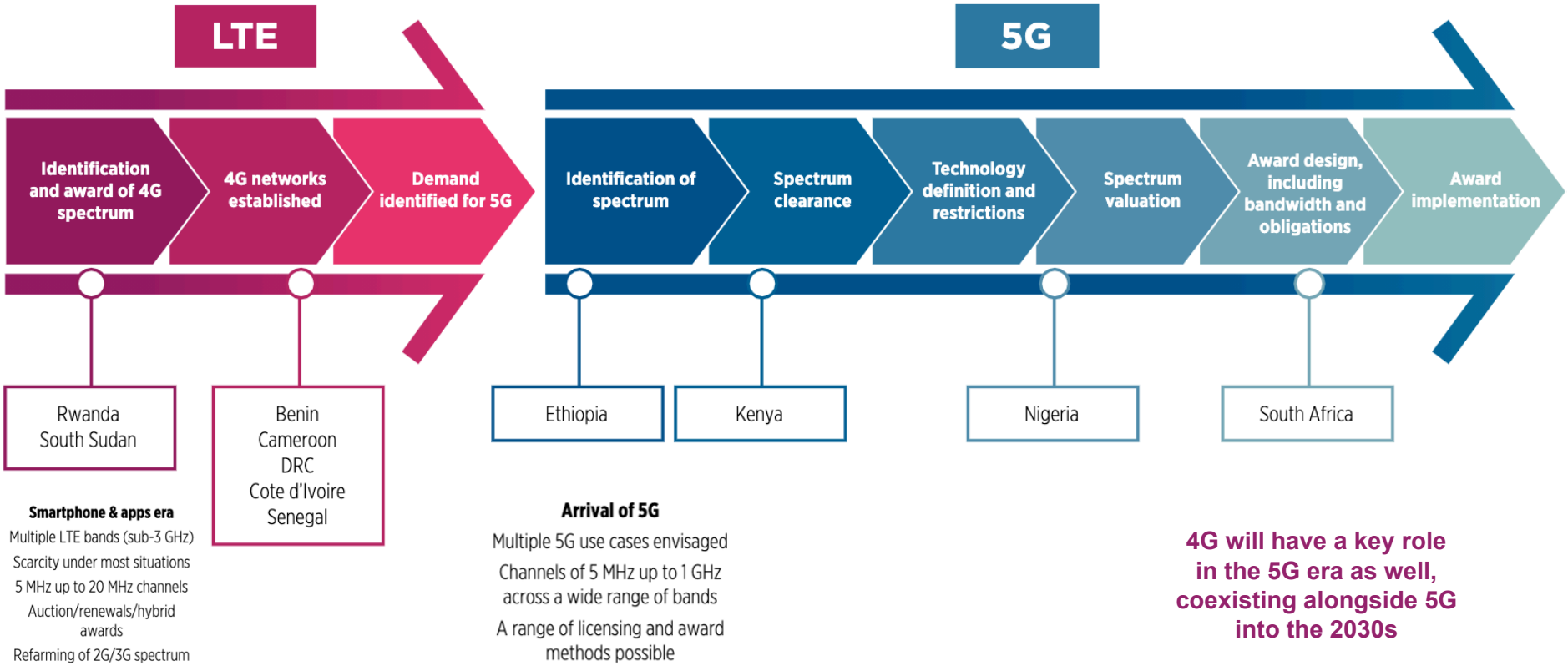
The Study

- 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.

Benin
Cameroon
Cote d'Ivoire
DRC
Ethiopia
Kenya
Nigeria
Rwanda
Senegal
South Africa

Data provided by GSMAi, country regulators and operators

Current Status in the 5G Universal Roadmap



1) Identification of Spectrum

Step 1
Identify 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.

Country	5G frequency bands (MHz)
Cameroon	700
DRC	700, 3500
Cote d'Ivoire	2300, 3500
Kenya	700

Country	5G frequency bands (MHz)
Nigeria	700, 3500
Rwanda	700
Senegal	3500
South Africa	3500

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.

5 and 6) Award Design and Implementation

Step 5
Award design

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.

Step 6
Award implementation

The output of previous steps should result in an Award Information Memorandum and implementation of the award process

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Roadmaps by Country

- 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

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Countries on 4G Roadmap

- **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

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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.

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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.

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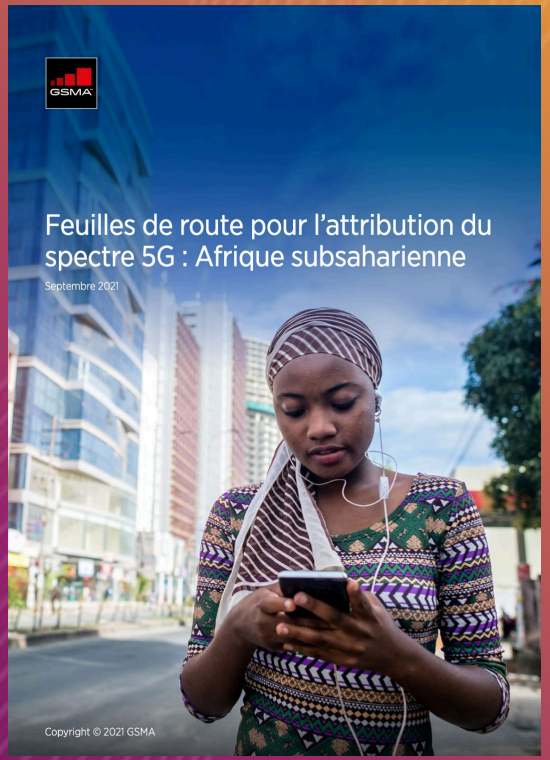
Roadmaps for 5G Spectrum: Sub-Saharan Africa



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Policies to support the Roadmap Implementation

Caroline Mbugua

Senior Policy Manager, SSA, GSMA

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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 inc 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

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Spectrum Pricing

High Spectrum Prices Negatively Impact:

Network Coverage

Network Quality

Consumer Prices

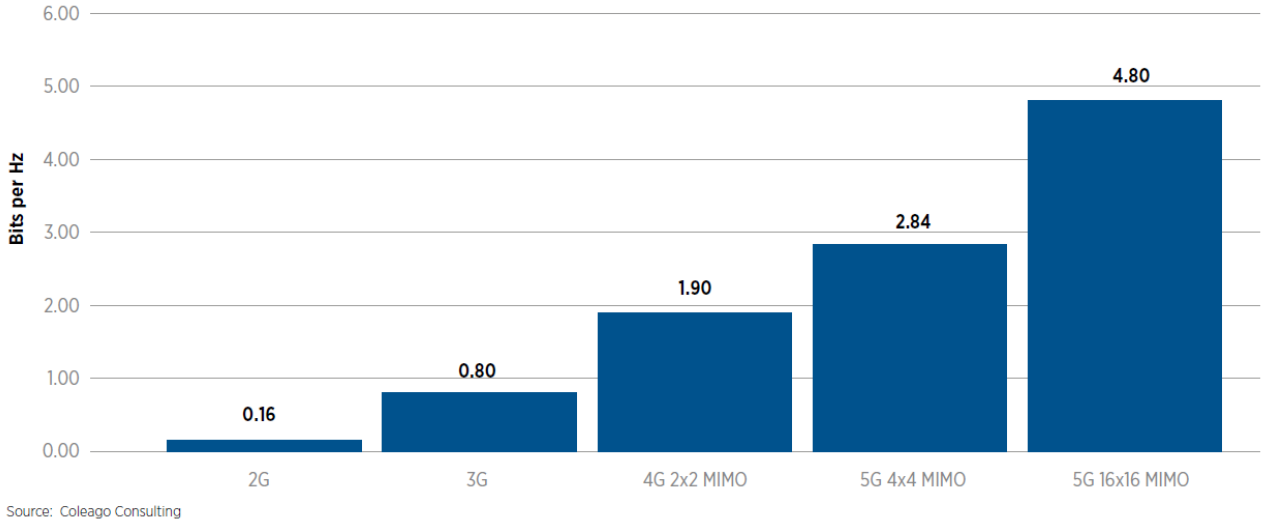
Analysis based on 229 operators in 64 countries (34 high income and 30 low & middle income) from 2010-2017

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.



Source: Coleago Consulting

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%.

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Refarming improves broadband penetration

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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

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Spectrum Harmonisation and Needs

Ross Bateson

Special Advisor, Government Affairs, GSMA

Coverage and Cost

GSMA MWC™ Africa

Coverage

92%

of the world's population is covered by Mobile Broadband

Mobile Broadband now connects around

4BN

PEOPLE TO THE INTERNET

Usage Gap

3.7BN

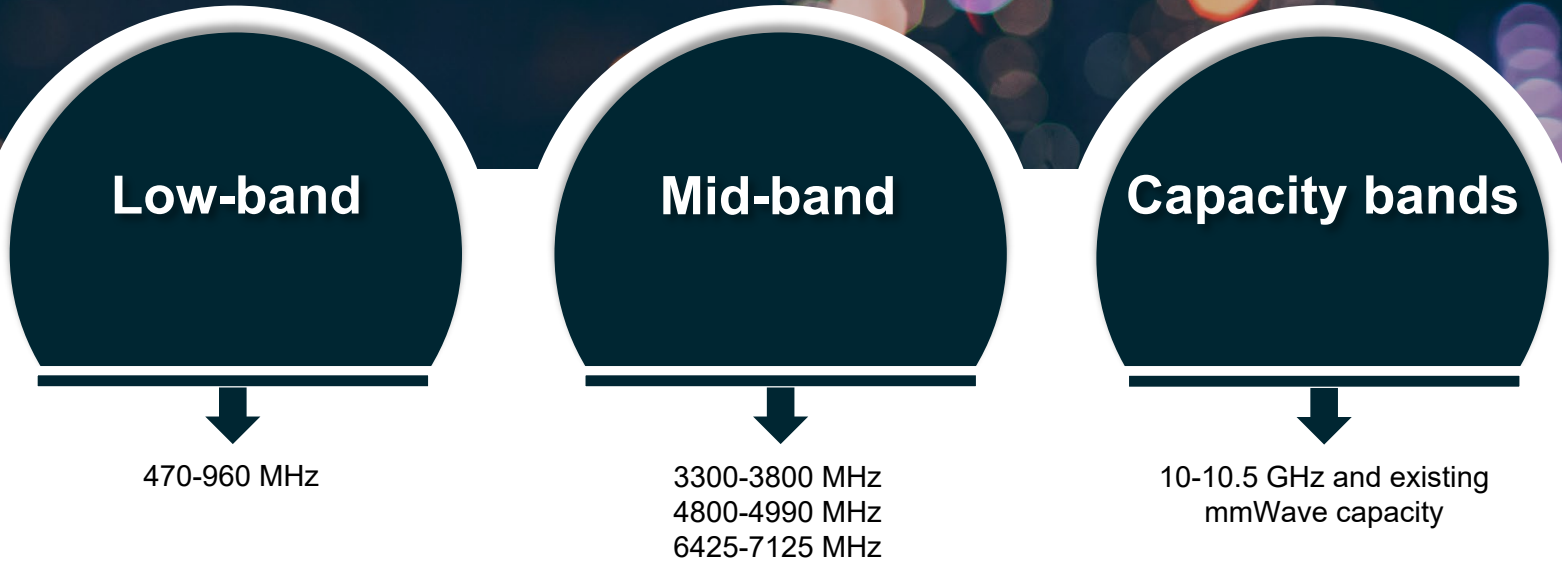
MORE PEOPLE ARE NOT CONNECTED BUT

3.3BN

LIVE WITHIN MOBILE BROADBAND COVERAGE

Spectrum Needs of 5G

Harmonising for cost efficiency and coverage



Channel bandwidth and network performance

Wide, contiguous channels provide:

Cost Efficiency

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

Wider channels mean fewer base stations

CHANNEL SIZE IMPACT

100 MHz → 60 MHz

64%

INCREASE IN NUMBER OF CELL SITES

WRC-23 can make huge savings on 5G roll-out

GLOBAL BENEFITS

Adding additional bandwidth to the baseline 200 MHz in 3.5 GHz range*

ADDITIONAL 300MHz

$50bn

ADDITIONAL 700MHz

$80bn

https://www.gsma.com/spectrum/resources/3-5-ghz-range-for-5g/

Wide-Area Spectrum Capacity

Lower band capacity improves rural access and affordability

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

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Q&A Session

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Closing Remarks

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