



NOKIA

Unlocking the 5G Opportunity

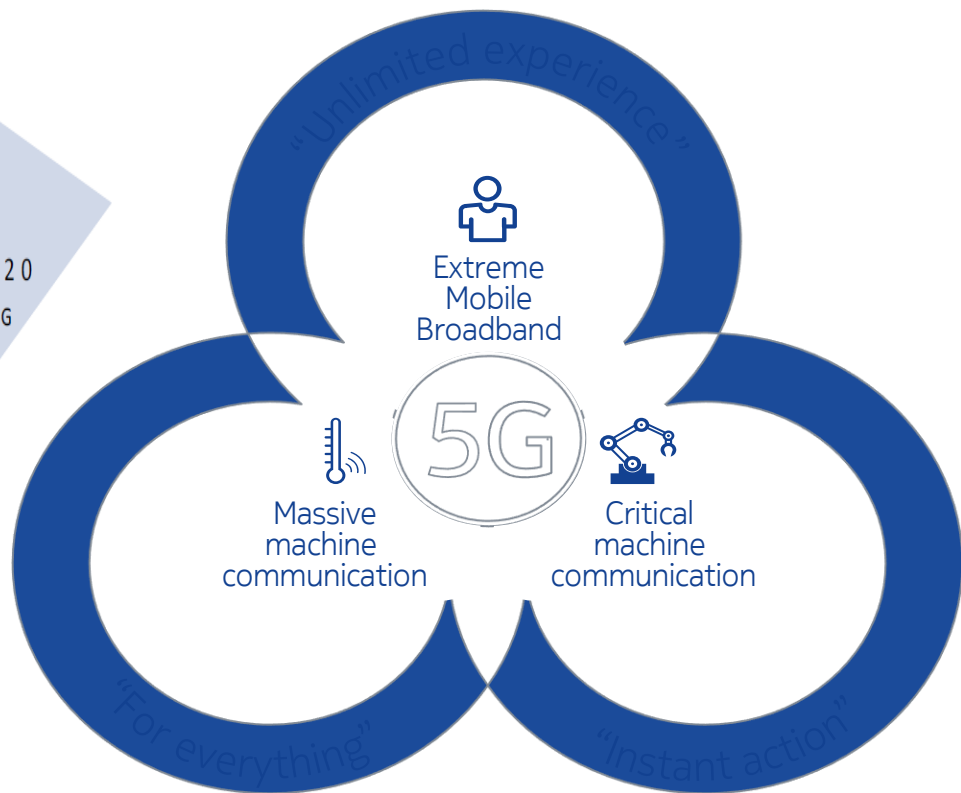
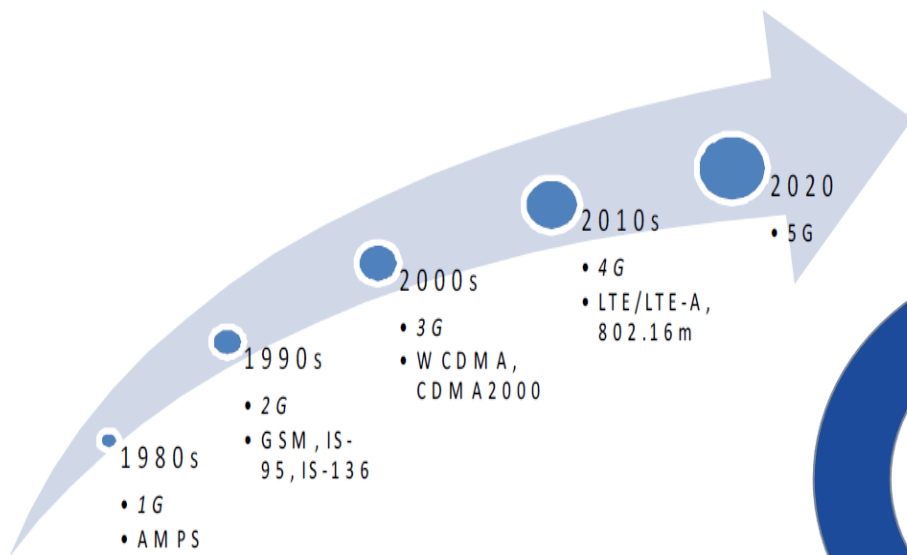
ITU Regional Forum on Emerging Technologies
23-24 Apr -2019
Tunis, Tunisia

Dr. Brahim GHRIBI

Nokia



5G is Now





We have **30 + commercial 5G deals**, including the following (public):

- A1 (Austria)
- Antel (Uruguay)
- AT&T(US)
- Docomo (Japan)
- KT (S. Korea)
- Optus (Australia)
- Rain (South Africa)
- Salt (Switzerland)
- SK Telecom (S. Korea)
- Sprint (US)
- Saudi Telecom Company (Saudi Arabia)
- Telenor Group (Denmark)
- Telia Company (Finland)
- TIM (San Marino)
- T-Mobile (US)
- US Cellular (US)
- Vodafone Italy (Italy)

100+ engagements with our customers

<https://networks.nokia.com/5g/5g-in-action>

The Diverse Impact of 5G

Business
Models

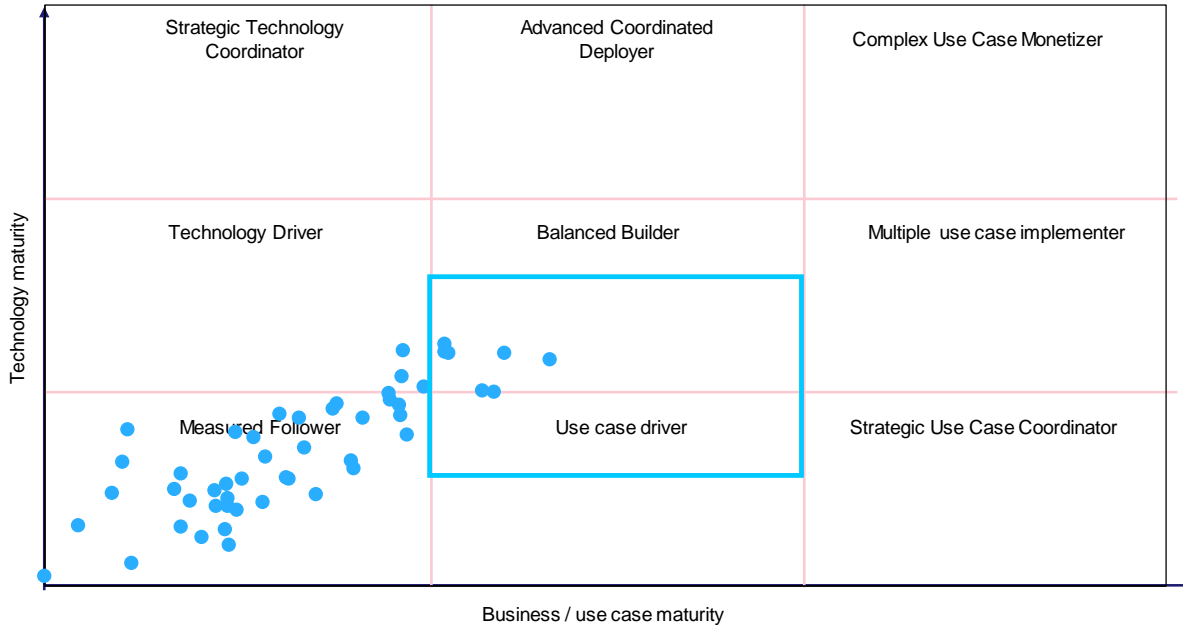
Network
Investments

Spectrum

Industry 4.0
& The Economy

Policy and Regulatory Collaboration / Harmonization

Nokia 5G Maturity Index



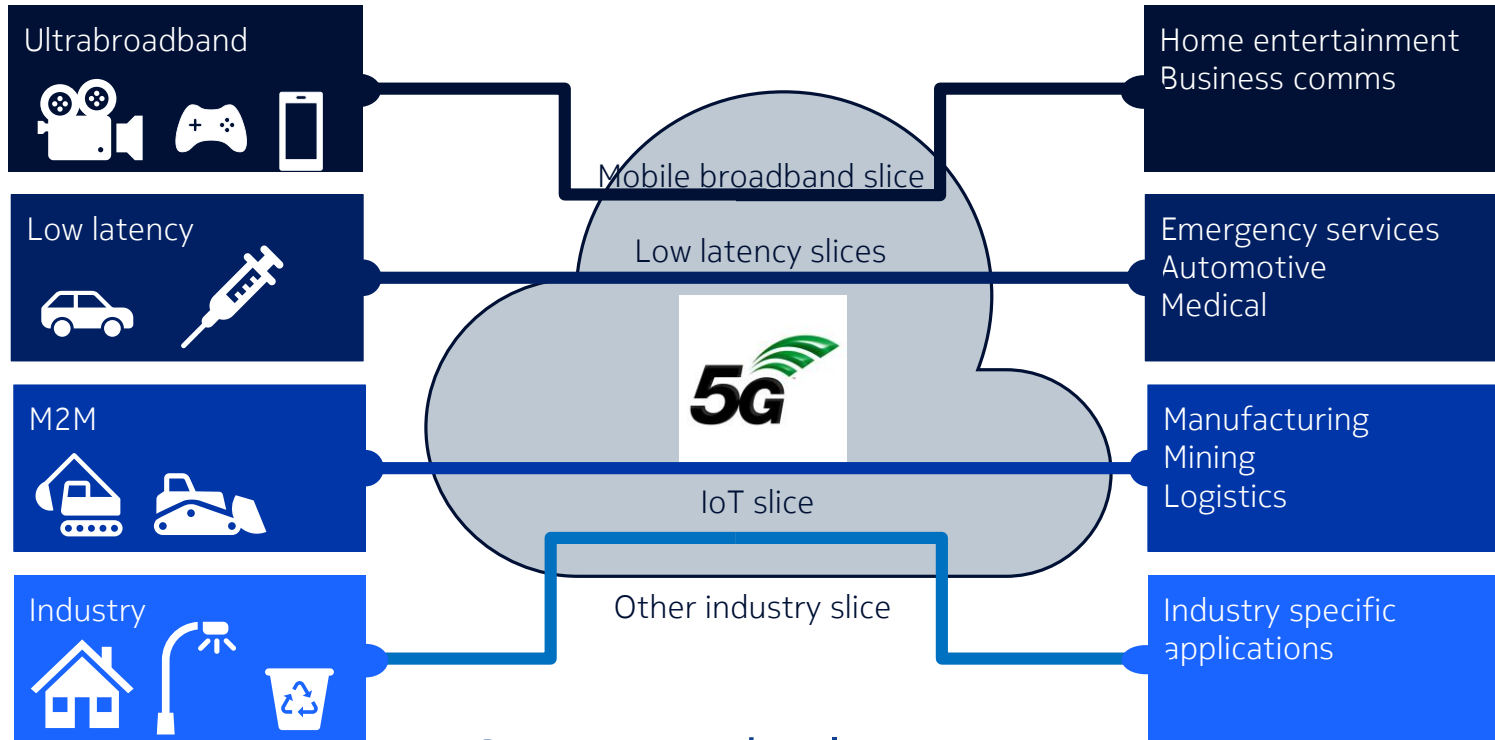
Two third expect 5G to generate new revenue streams

70% of operators are focused on 5G to help improve existing consumer services

Those operators most advanced in 5G transformation are focused on **six to eight use cases**.

Source: Analysys Manson 2019

Build virtual e2e networks to suit diverse use cases and applications

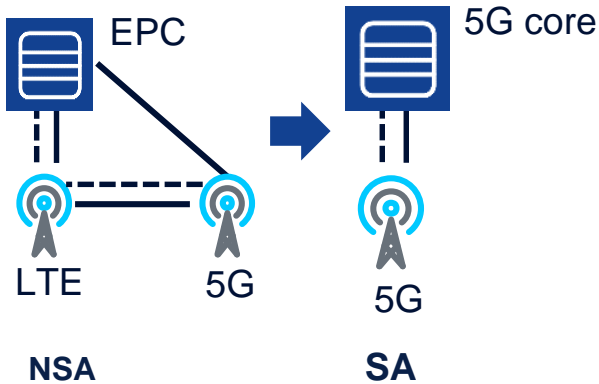


5G network slicing

5G NETWORK INVESTMENT

REALITY #1

5G is full E2E. 5G NR (New Radio) and Core



5G end-to-end is key for new services with lower latency and setup time

REALITY #2

Sitac, Civils, Power plants and Real-estate are largest cost-drivers

REDUCING CELL UNIT COST

PRIVATE	Sitac and Real-estate complexity. Fear of wireless. Right of Way & First Refusal. Multi-agency permitting. Streamlined approvals.
PUBLIC	Access to public utility assets. Guidelines to access.
SHARING	Allow deeper infra sharing – neutral/open hosting. Cost of energy in data centers.

Legacy regulations are not always aptly suited for 5G NR layers and- fast high-density small cell deployments

REALITY #3

5G architecture is use-case driven

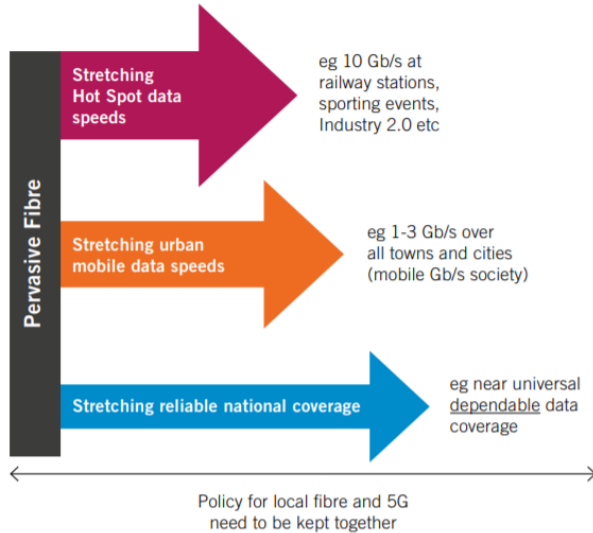


A variety of digital technologies to enhance the impact of 5G are needed Including automation, AI/ML, programmable network, Cloud-native core,...

5G NETWORK INVESTMENT

REALITY #4

5G and Fiberization policies are inseparable



REALITY #5

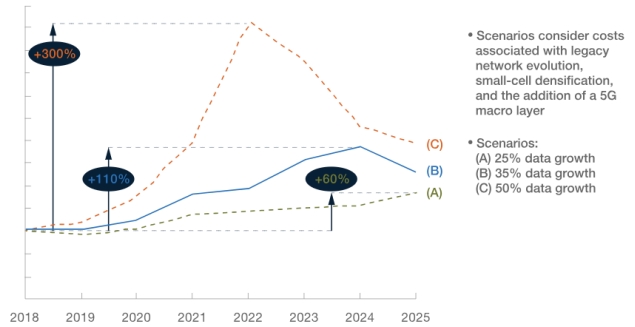
5G will boost Universal Coverage & support achieving the SDGs



REALITY #6

Capital & cost issues cannot be addressed by markets/private sector alone

Total cost of ownership for mobile access networks will increase.



Note: Total cost of ownership includes capital expenditures and operational expenditures for radio access network and transmission but not core networks. Data are based on 3 operators in a European country. Results are rounded.

McKinsey&Company

Fiber will complement and backhaul 5G Traffic

Progressive Policy at Rural / Remote Areas. Preventing 5G Inequality. Experimentation in vital sectors to be encouraged (education, health, finance,..)

Gov't can have a role

- to accelerate investments
- streamline infrastructure regulations
- national wireless policy
- driving 5G testbeds & use-cases

Industry 4.0 & The Economy

5G to Drive Next-Wave of Innovation
Digital Health, Automotive, Smart City, Fintech, etc.



5G as part of Backbone of Digital Economy
New skill-set & mindset

Fair 5G access by Industries

Equity and Neutrality

5G industry SLAs

Network Quality and Reliability
Guarantee

**5G Public
Facilities**

Transportation
Public Safety
Ports
Government Services

Fair Digital Policies

Device-Network-Content
Digital Inclusion
Preventing digital dominance &
5G Inequality

Training & National Testbed

Hub & Spoke Centers

Embedded 5G

Import
Export
5G Manufacturing
Type Approvals



Airport



Port



Shopping



Financial Centers
CBD



Stadium

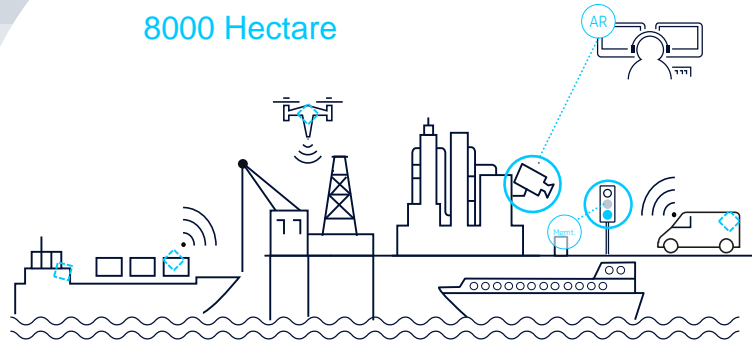


Amusement /
Parks



5G Smart Sea Port

8000 Hectare



Focus on 3 use cases with immediate results

Operations support at water-gates or construction sites

Improved harbor operations, experience and security

Traffic light management: 5G slicing to connect to mgmt.

Better traffic flow

Mobile sensors

Improved pollution control

Nokia AirScale radio access and cloud packet core

Slice-aware scheduler & core network to enable slices

Life cycle management for network slices

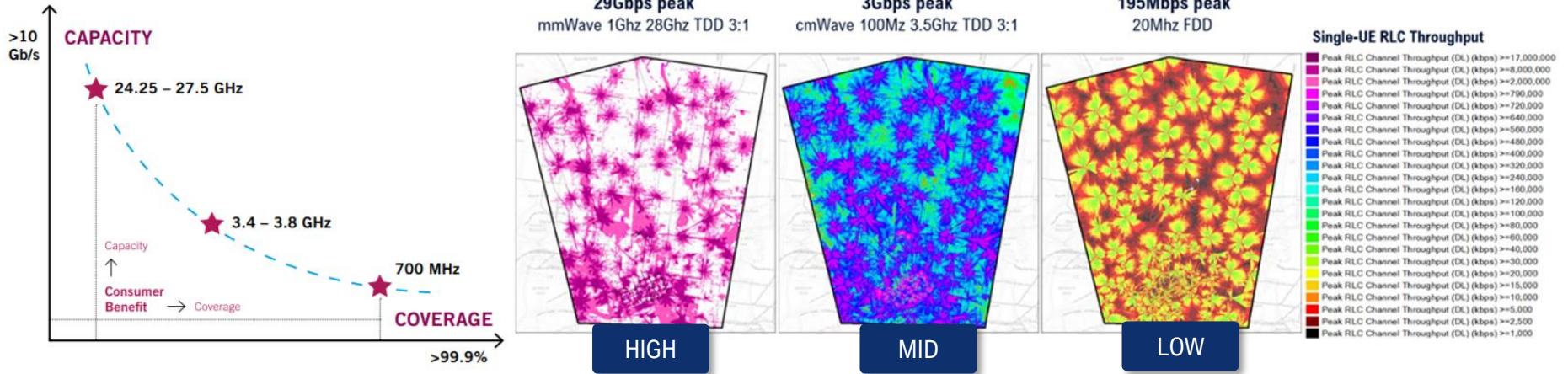
5MHz FDD Carrier at 713/768, i.e., UL@713-723 / DL@768-778



Hamburg Port: first 5G network slicing trial in large industrial environment

SPECTRUM

Accelerating spectrum allocation in high, mid, and low band is critical

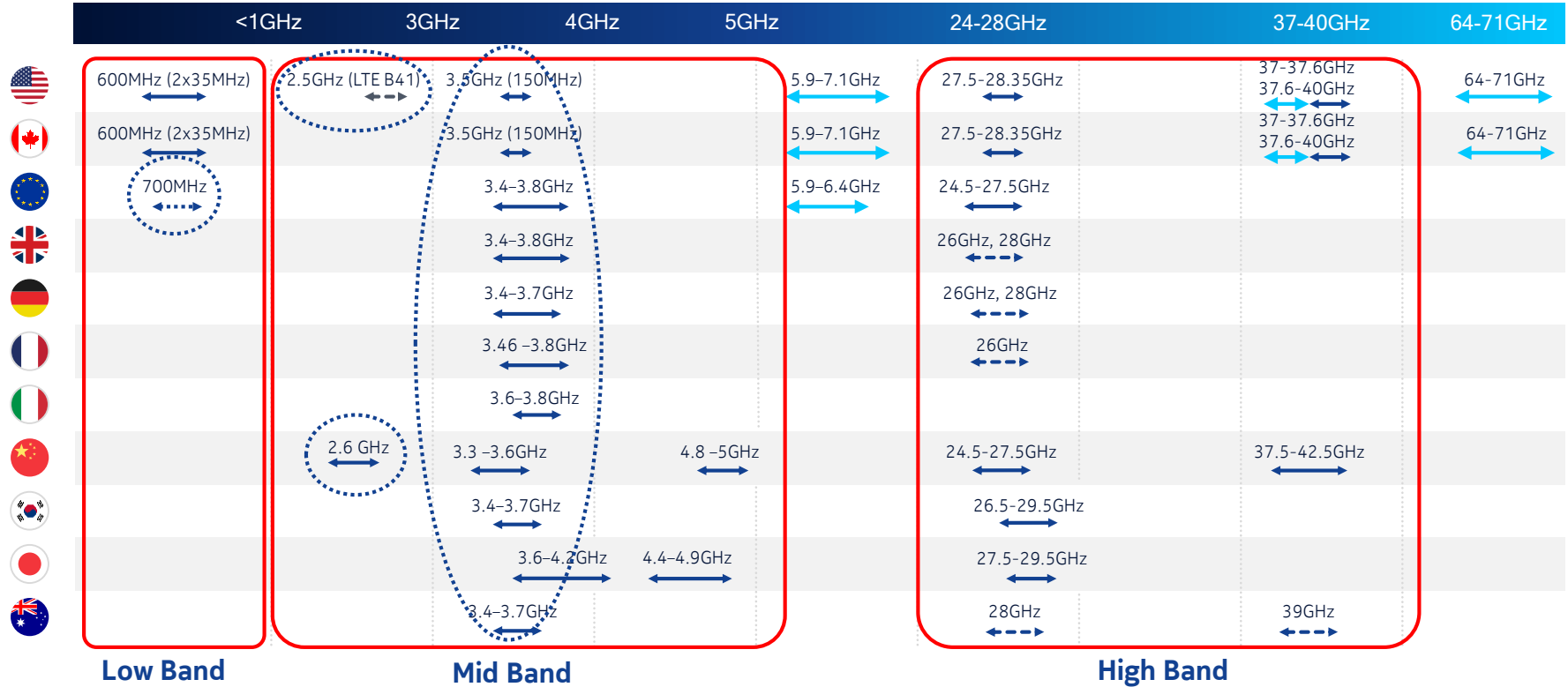


Low bands will help achieve 5G Universal Coverage

Mid-band coverage and capacity is central to any 5G Strategy
Contiguous 60-100Mhz of spectrum in 3.3-5Ghz is ideal to realize 10x increase in capacity with good coverage

High Band capacity is needed for extremely localized high capacity services

SPECTRUM



ARAB NATIONS MAKE THE RIGHT MOVES FOR 5G LEADERSHIP, SAYS GSMA

December 20, 2018

Press Release

Dubai: The GSMA today welcomed the decision by **the Arab Spectrum Management Group (ASMG)** to release the use of the **3.3 to 3.8 GHz** spectrum range to mobile broadband. This important step will increase the availability of the right type of harmonized spectrum for 5G deployment across the Arab world and help accelerate ultra-fast 5G network rollouts in the region.

The ASMG, which represents **22 Arabic countries**, coordinates on issues related to spectrum management and the ITU's World Radiocommunication Conferences between Arab nations. **The group has approved the use of the 3.4 to 3.8 GHz range for mobile broadband use across the entire Arab region**, while the **3.3 to 3.4 GHz range is available for partial use** as some countries continue to reserve this band for other services.



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