

THE USE OF 3300-3800 MHZ FOR 5G EARLY ROLLOUT: OPPORTUNITIES AND CHALLENGES

5G Spectrum and Policy Forum

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Global mobile Suppliers Association

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The Spectrum Group within GSA

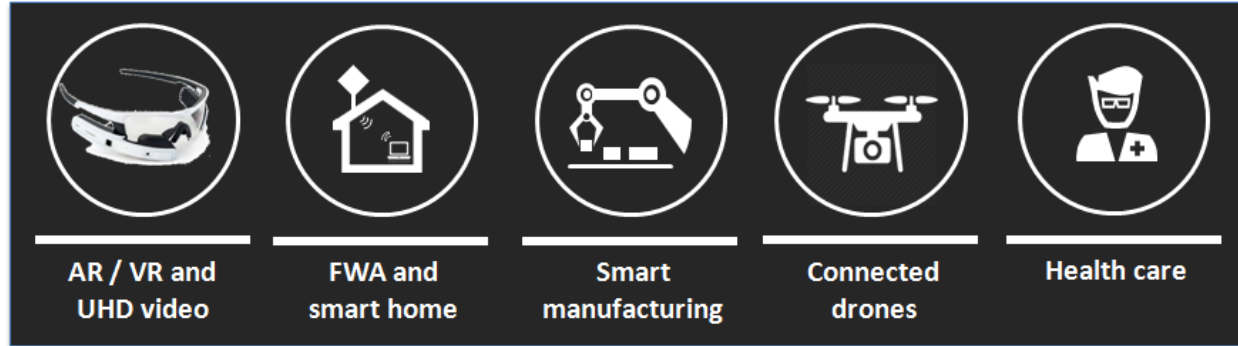
is the GSA focus group for policy matters related to the radio frequency spectrum and radio regulatory matters

pertaining to the successful evolution of International Mobile Telecommunication (IMT) of ITU and associated administrative, operational and technical aspects.



5G APPLICATIONS AND REQUIREMENTS

The 3300-3800 MHz band will support a wide range of applications.



Ultra High Definition Video requirements

30-40 Mbit/s (4K), 80-100 Mbit/s (8K)

20 ms (end-to-end latency)

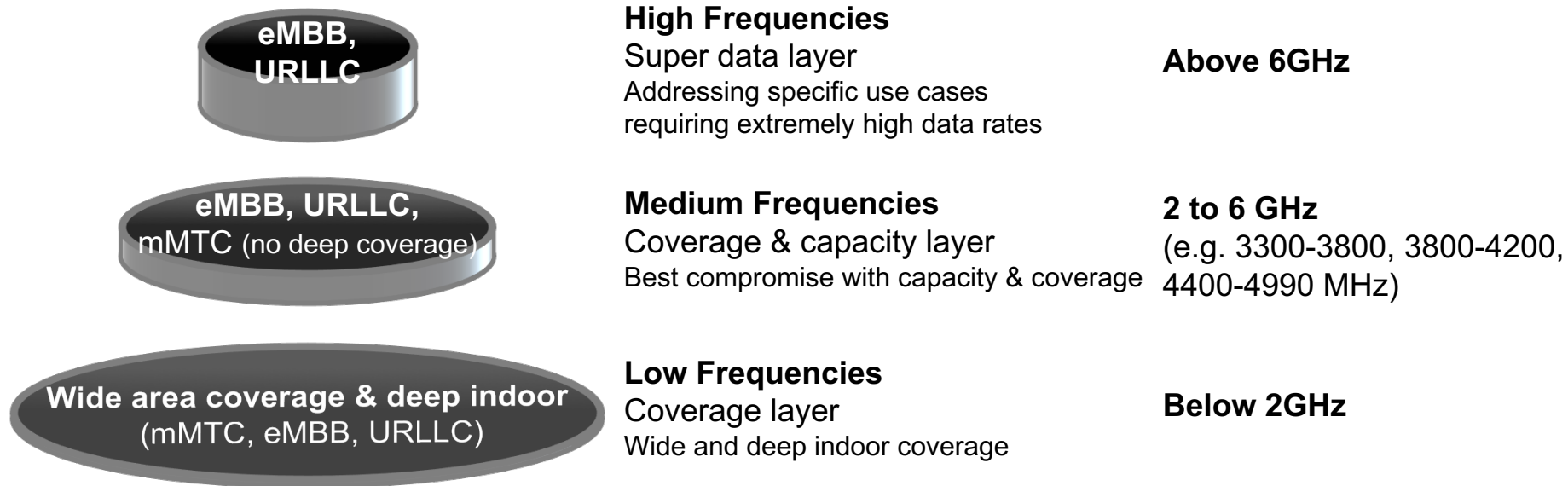
Augmented Reality / Virtual Reality requirements

50 Mbit/s to 1 Gbit/s

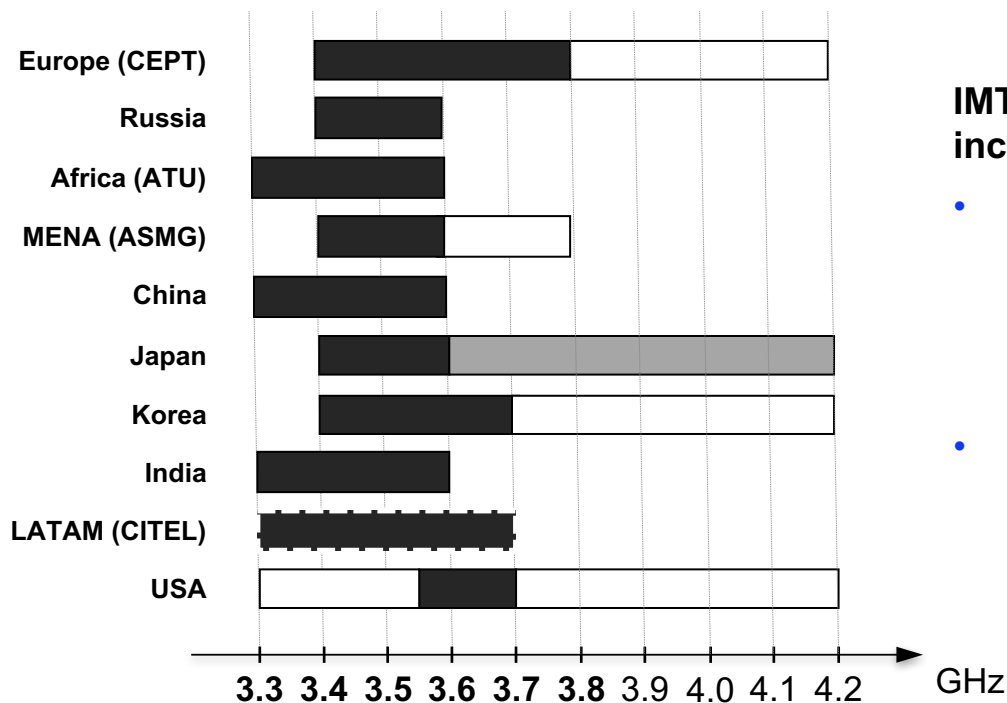
10 ms latency (end-to-end latency)

MULTI LAYER APPROACH

Various 5G applications and services will require access to appropriate spectrum from within the three layers.



C-BAND GLOBALLY – NATIONAL & REGIONAL PREFERENCES



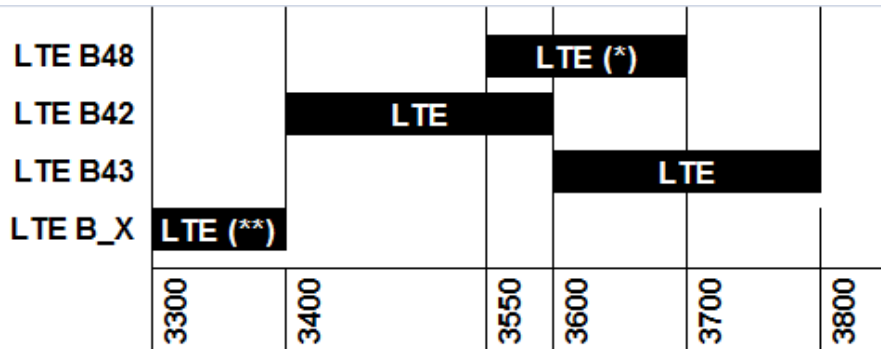
IMT take up within 3300-4200 MHz range is increasing:

- 3400-3600 MHz is now almost globally available, and a large number of countries in all regions are taking action in order to reach 200-400 MHz of contiguous bandwidth in the 3300-4200 MHz range for 5G (3300-3800 MHz especially).
- The largest contiguous bandwidth for IMT below 6GHz.

- Already available for IMT / official plans
- ▤ Different LatAm countries have identified different blocks within the range
- Considered for IMT by regulators
- Potential for future IMT use

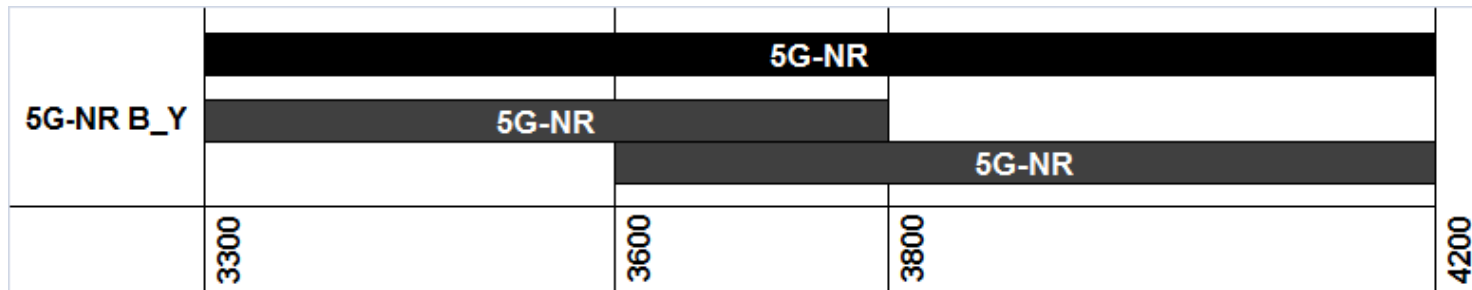
Status and plans for the 3300-4200 MHz range in some regions and countries as well as the GSA expectations for the future, based on publicly available information.

3GPP CHANNEL ARRANGEMENTS



(*) 3GPP Band 48 is currently only adopted in the U.S.
 (**) The new LTE band being defined in 3GPP may extend above 3400 MHz.

3GPP channel arrangements for LTE Evolution and 5G-NR.



The 3GPP is working on the 5G-NR channel arrangements for 3300-4200 MHz.

An important first step toward the creation of a 5G ecosystem across the whole range.

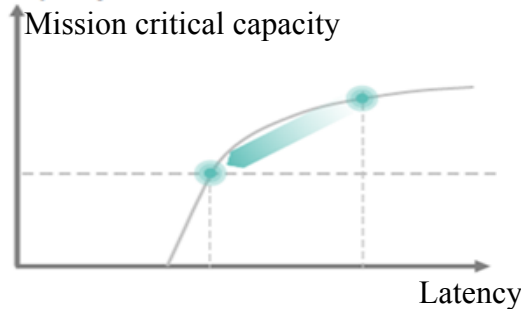
It is clear that not all of the 3300-4200 MHz range will be available in any country in the foreseeable future, and that the needs of incumbent services (FSS, FS, Radiolocation) should be given careful consideration.

THE IMPORTANCE OF WIDE CHANNEL BANDWIDTH

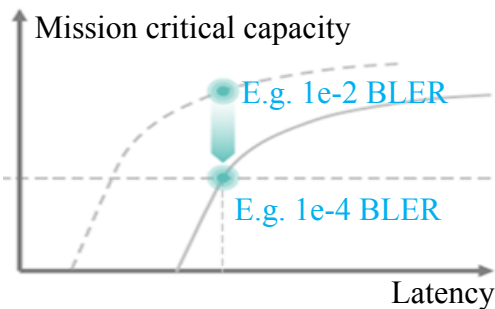
5G-NR is being designed to inherently take maximum advantage of wideband channels to deliver improved spectral efficiency, higher capacity and improved user experience.

| RF channel Bandwidth | Peak data rates* | Average data rates* | 5th percentile data rates* |
|------------------------------------|--------------------------------------|---|---|
| 100 MHz At 3300-3800 MHz | 3 Gbit/s 30 bit/s/Hz in DL | 0.78 Gbit/s 7.8 bit/s/Hz in DL, dense urban | 22.5 Mbit/s 0.225 bit/s/Hz in DL, dense urban |

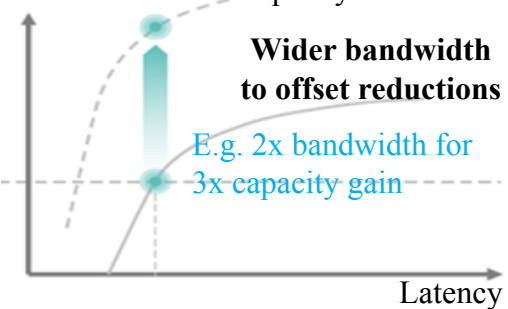
Latency vs. capacity



Reliability vs. capacity



Mission critical capacity

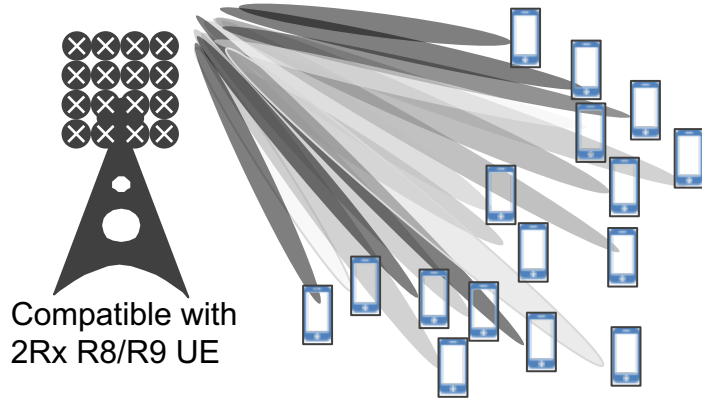


Wide contiguous spectrum assignments to operators in the order of 100 MHz or more will allow operators to reap the full benefits of the 3300-3800 MHz frequency range for 5G.

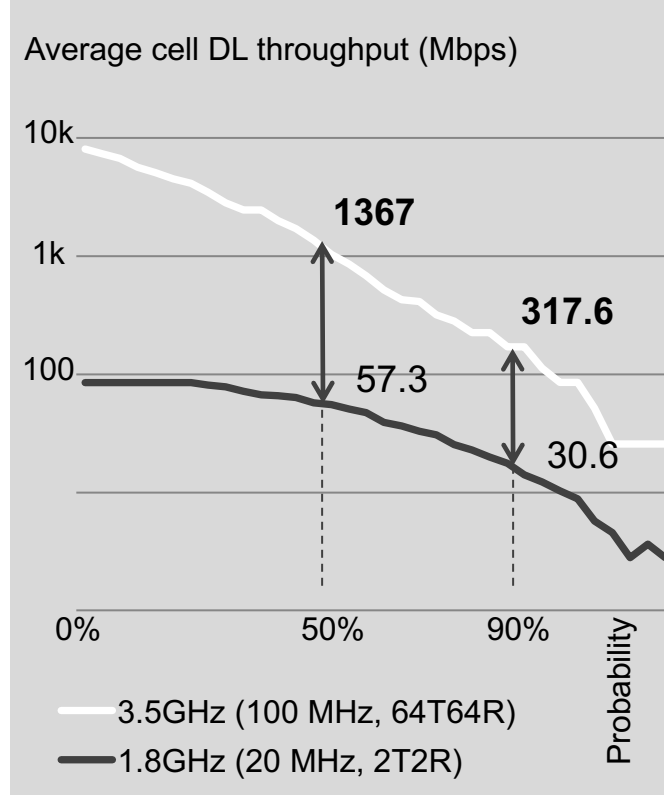
(*) theoretical 5G data rates per channel bandwidth

MASSIVE MIMO

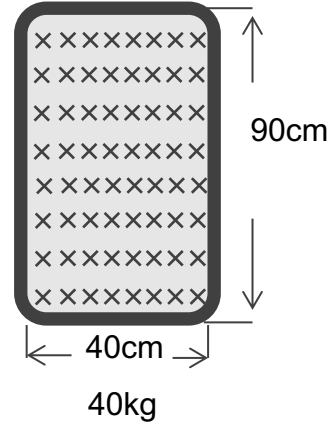
64T64R boosts downlink capacity with 16+ layers multi user beamforming



Massive MIMO: more antenna elements, more aggregated energy, more beamforming layers, better cell throughput, better cell coverage, compatible with 2Rx 3GPP Rel. 8/R9 UEs



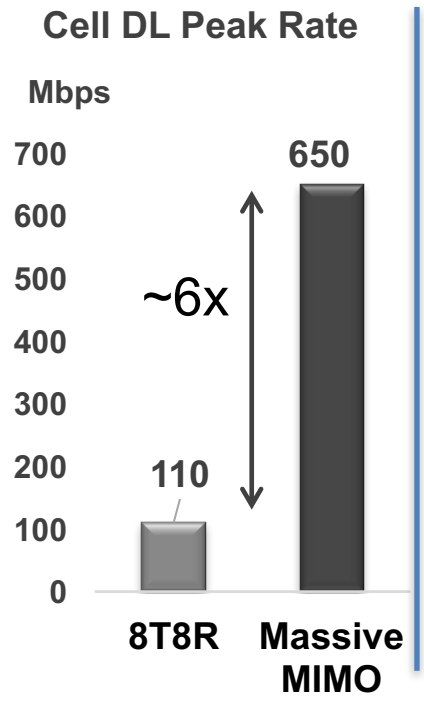
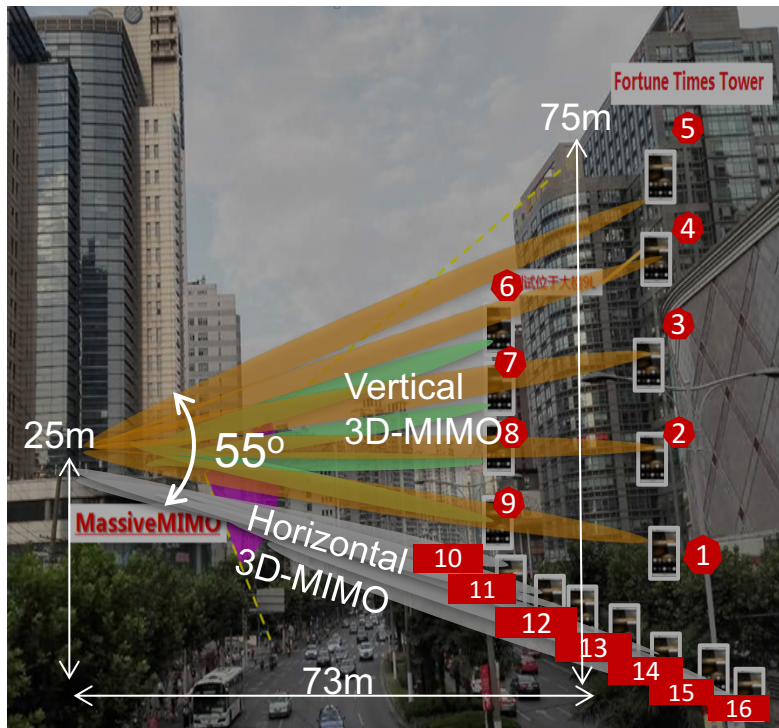
Massive MIMO delivers 10x ~ 24x improvement in average cell DL throughput



Massive MIMO Antenna geometry (3300-4200 MHz)

MASSIVE MIMO – IN THE FIELD

CMCC Shanghai. Nov. 2016: 2600 MHz, 20 MHz bandwidth, 16 commercial smartphones

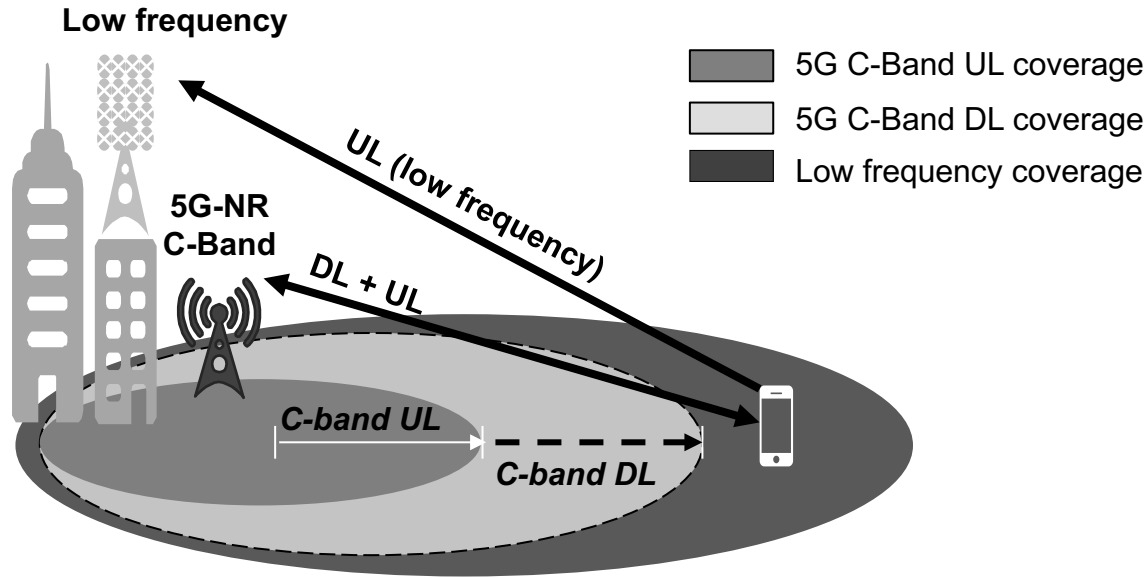


Japan, Feb. 2017:

the world's first
3400-3600 MHz
massive MIMO field tests
 demonstrating **1.4 Gbit/s**
 with 16 layers massive
 MIMO and
2 Component Carriers
 Carrier Aggregation.

FURTHER COVERAGE IMPROVEMENTS THROUGH LOW FREQUENCIES

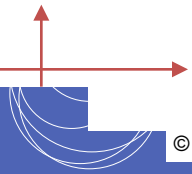
The available lower frequencies may be used in combination with 3300-4200 MHz 5G-NR to provide additional coverage improvement, facilitating the reuse of existing sites.



SHARING VS. CLEARING

The needs of current incumbent services such as Fixed Satellite Service (FSS), Fixed Service (FS) and Radiolocation should be given careful consideration. Depending on the local situation, type of incumbent and the associated deployment density, regulators may consider either spectrum clearing or sharing, or a combination of the two

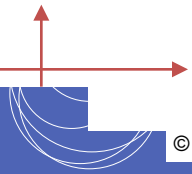
- In general, [GSA advocates clearing the bands to be used by 5G, to enable maximum efficiency and coverage of 5G deployments](#), especially considering the separation distances required between 5G and for example FSS earth stations
- Nevertheless, in some instances sharing may be possible, for example where the incumbent stations are few and located in areas where appropriate protection can be provided.



SHARING

FSS earth stations Known locations

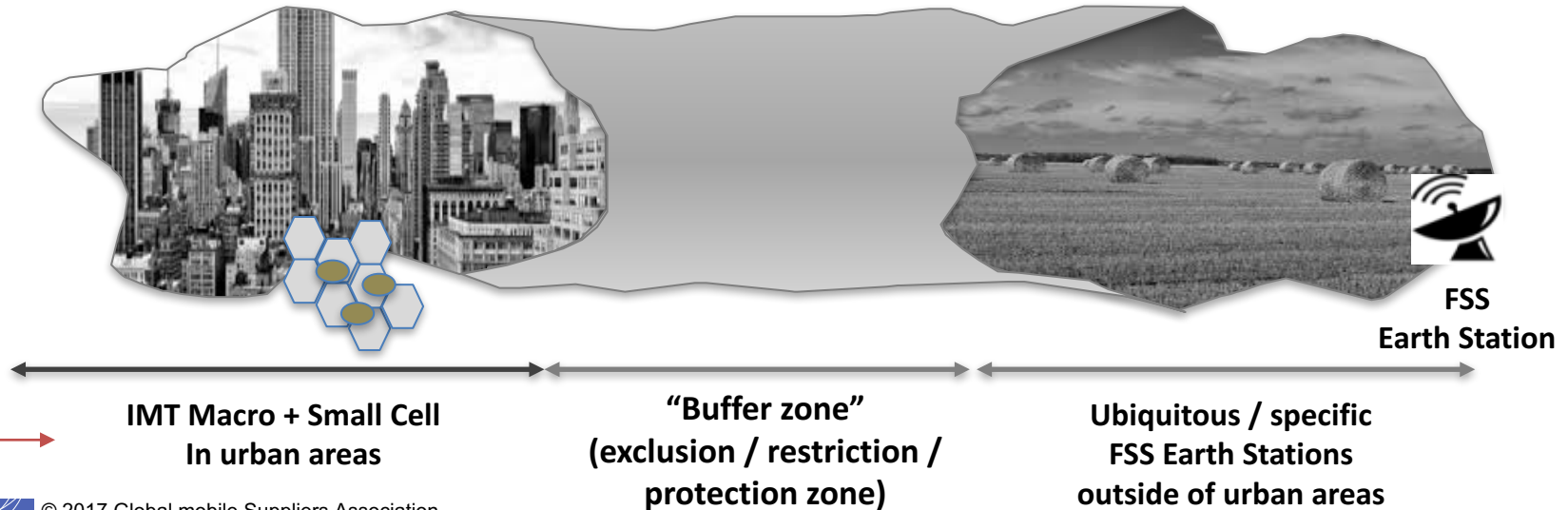
- Sharing is difficult when earth stations are densely deployed, clearing the band and/or relocation is necessary.
- Possibilities for sharing exist where there are few earth stations deployed, in particular if they are located in rural areas and/or can be shielded. Some FSS earth stations may need to be re-located.



SHARING

FSS earth stations at unknown locations

- Sharing is not possible in the same geographical area if the earth stations are protected.
- When FSS earth stations are deployed in specific areas, sharing may be possible by geographical separation, otherwise clearing is necessary.

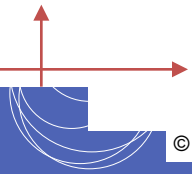


5G EQUIPMENT AVAILABILITY

3300-3800 MHz 5G equipment availability, clear focus in industry.

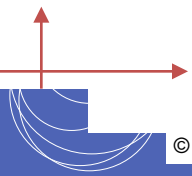
To enable broader commercialization from 2019:

- 5G trials and interoperability testing (both LTE Evolution and 5G-NR) in the 3300-3800 MHz range will start late in 2017
- GSA expects commercial readiness of the 5G-NR ecosystem in 2018



EFFECTIVE ASSIGNMENTS, GSA RECOMMENDATIONS

1. GSA supports the adoption of the widest arrangements within the 3300-4200 MHz range.
2. GSA supports the TDD mode for this spectrum, adopting common synchronization and alignment of UL/DL transmissions between operators.
3. GSA believes that it would be important to allow operators access to contiguous unpaired nation-wide spectrum assignments in the order of 100 MHz or more.
4. GSA supports spectrum assignments with technology neutral and service neutral licenses





Promoting the Mobile Broadband Technology Roadmap

“THE FUTURE OF IMT IN THE 3300-4200 MHZ FREQUENCY RANGE”

Download the new GSA White Paper at www.gsacom.com

<https://gsacom.com/paper/future-imt-3300-4200-mhz-frequency-range/>