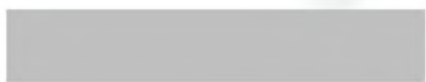


# Spectrum policy



Personal Data

Commercial interests



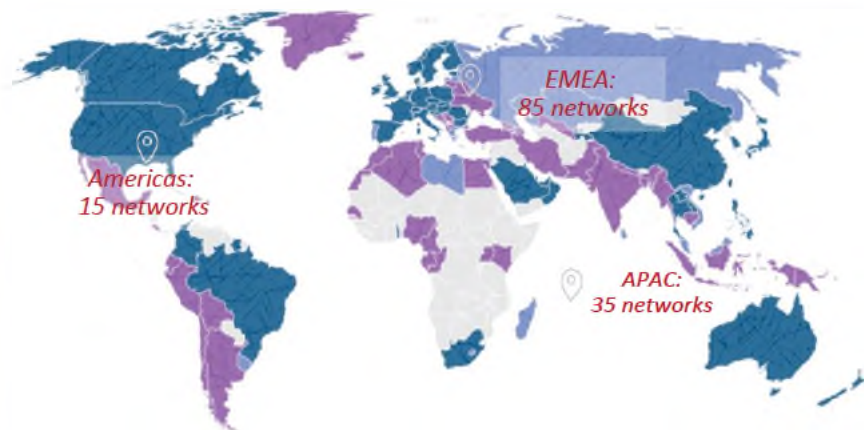
# Outline

- ☐ 5G deployment status globally
- ☐ Mid-bands spectrum needs for evolution of 5G
- ☐ Industrial uses and spectrum
- ☐ Spectrum sharing

# Global 5G development is gearing up

## 130+ MNOs in 40+ countries have launched 5G

- Operator(s) that have deployed 5G, services launched
- Operator(s) that have deployed/are deploying 5G, but precommercial
- Other operators investing in 5G



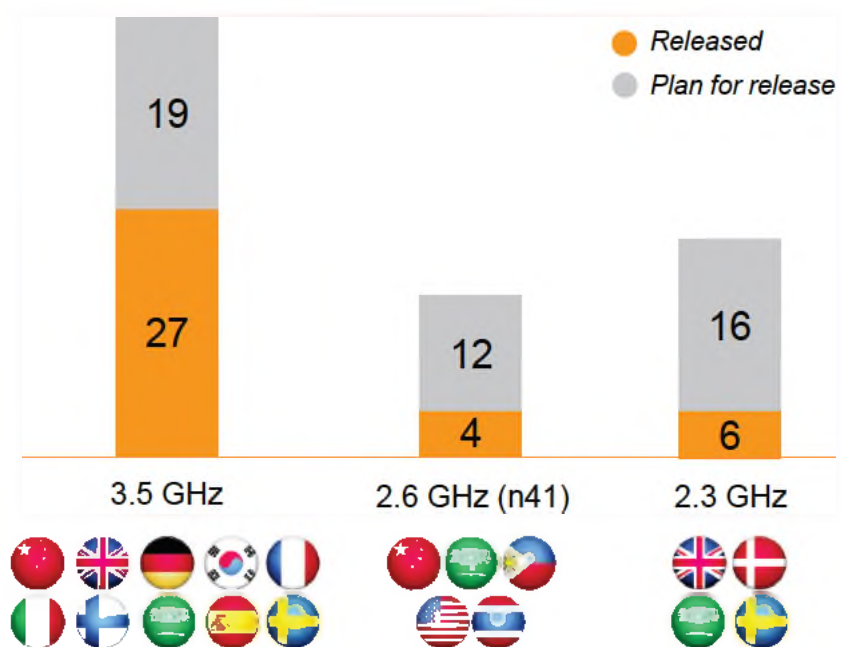
1,000,000 5G sites



240,000,000 5G users

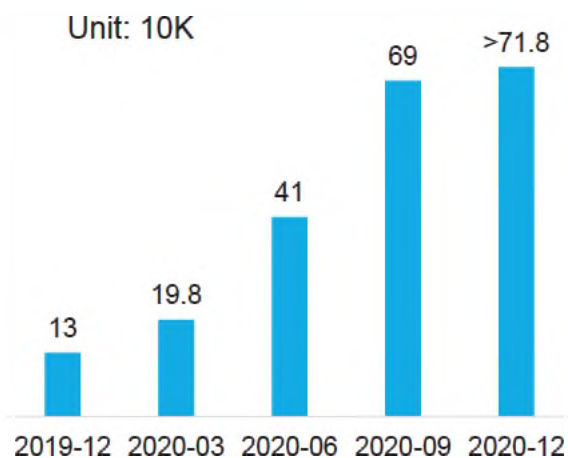
Source: GSA & Statista 2020 Report

## 3.5/T2.6/2.3 GHz have become 5G primary bands



## Status in China

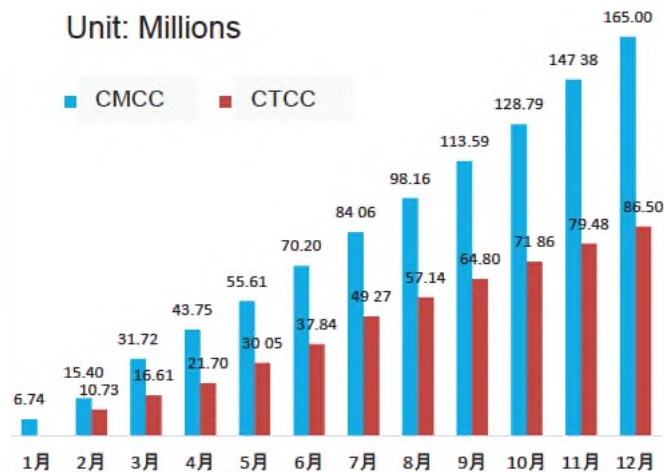
### Base stations deployed



Source: MIIT, Ministry of Industry and Information Technology

- **580K** new deployed 5G sites in 2020.
- **330K** co-construction and sharing sites.
- **718K** 5G sites in China by the end of 2020.

### 5G subscribers in 2020



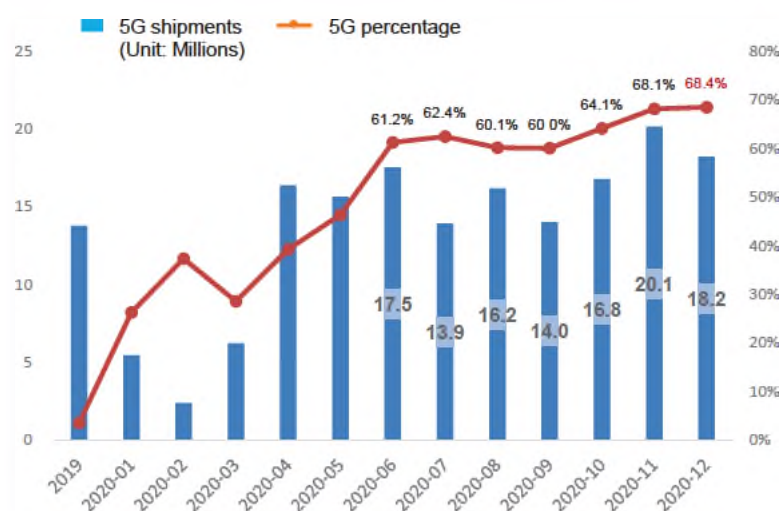
Source: Monthly Operation Data of CMCC & CTCC

- **> 251 Million** customers had subscribed to 5G tariff plans by the end of 2020.

# Status in China

5G terminals are becoming the mainstream, with price drop driving penetration

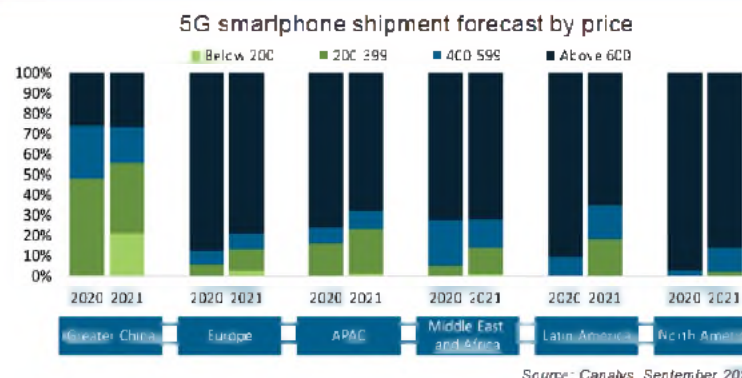
## 5G smartphones accounted for 60%+ of shipments in the past consecutive 7 months



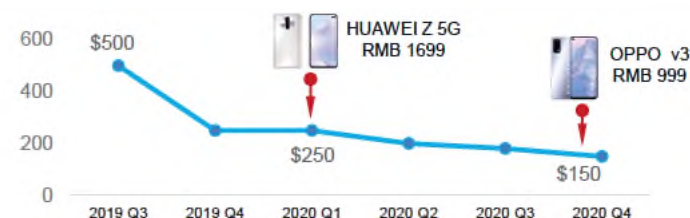
Source: CAICT, China Academy of Information and Communications Technology

- 163m @ 52.9% 5G mobile phones shipped in 2020.
- Total 5G shipment reached 176m (including 2019).

## In 2021, 60% of 5G phones will cost less than \$400

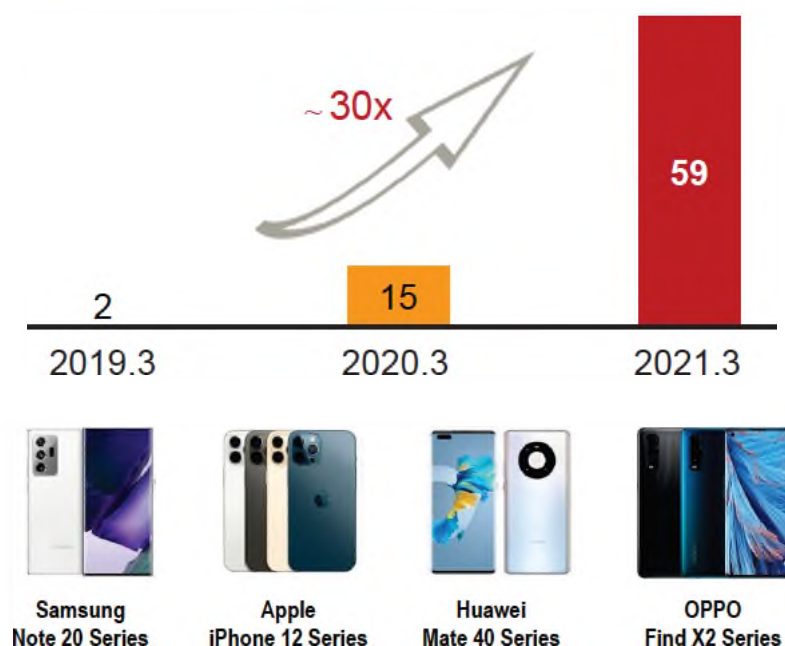


## < \$150 5G smartphone on sale in China



# 5G E2E ecosystem at 2.3 GHz is ready for commercial from 2020

## 5G terminal availability at 2.3 GHz is growing



## More 5G networks will be deployed at 2.3 GHz



### Global 2.3 GHz band 5G commercial status

Region	MNO	Test	Commercial	BW@2.3GHz
ME	KSA <b>STC</b>	20H2	21-	100M
Africa	SA <b>Telkom</b>	20H2	21-	60M
APAC	Australia <b>Optus</b>	19H2	20H2	98M
APAC	Thailand <b>DTAC</b>	20H2	21-	60M
APAC	Indonesia <b>TSEL</b>	20H2	21H1	60M
APAC	Sri Lanka <b>Dialog</b>	20H2	21-22	60M
APAC	Hong Kong <b>H3G</b>	20H2	21H1	30M
APAC	Myanmar <b>TPG</b>	21H1	21-22	50-100M
APAC	Vietnam <b>Mobifone/VNPT</b>	21H1	21-22	40-90M
Europe	Russia <b>ROS</b>	21~	22	100M
Europe	Sweden <b>H3G</b>	21H1	22	80M
LATAM	Peru <b>Entel</b>	21H1	22	60M
LATAM	Brazil <b>TIM</b>	21H1	22	80M

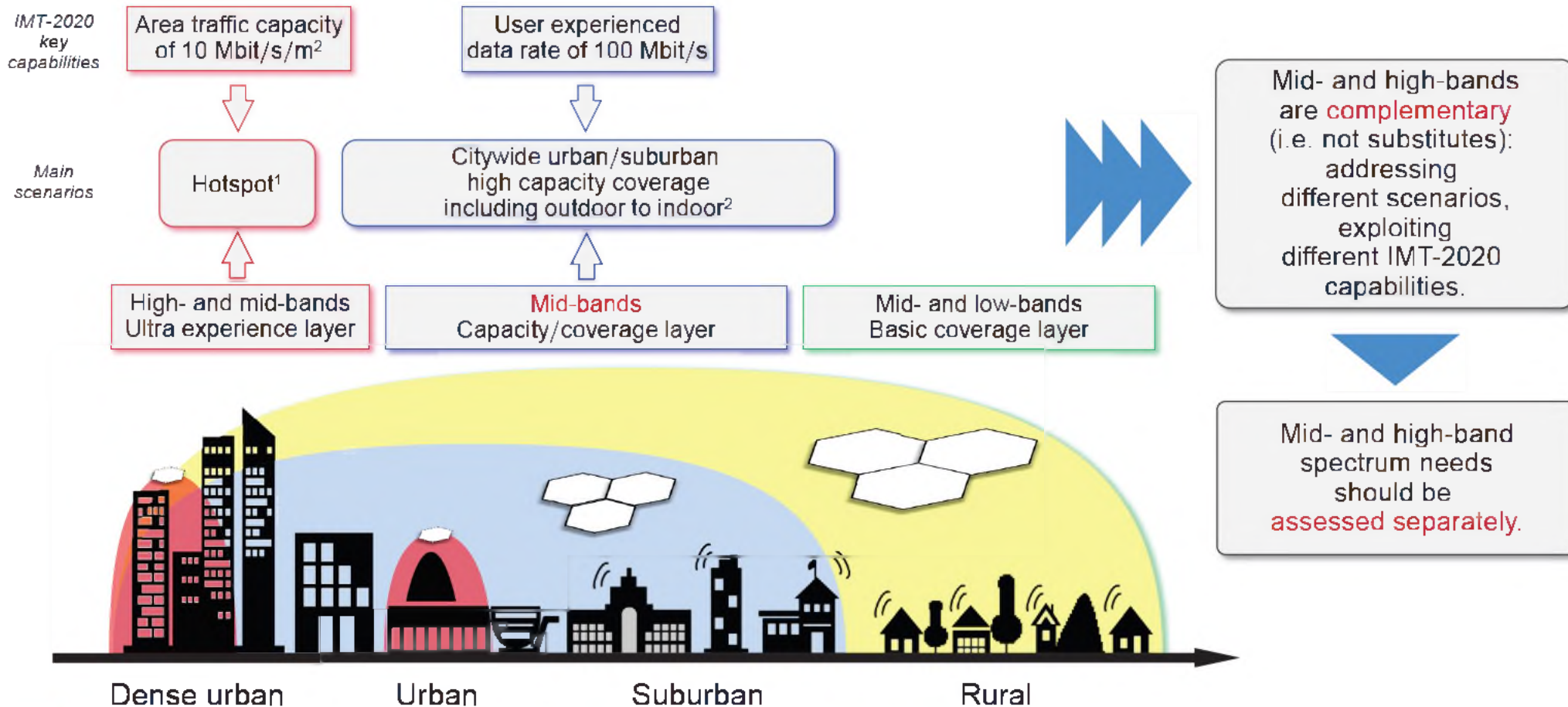
## Commercial Interest



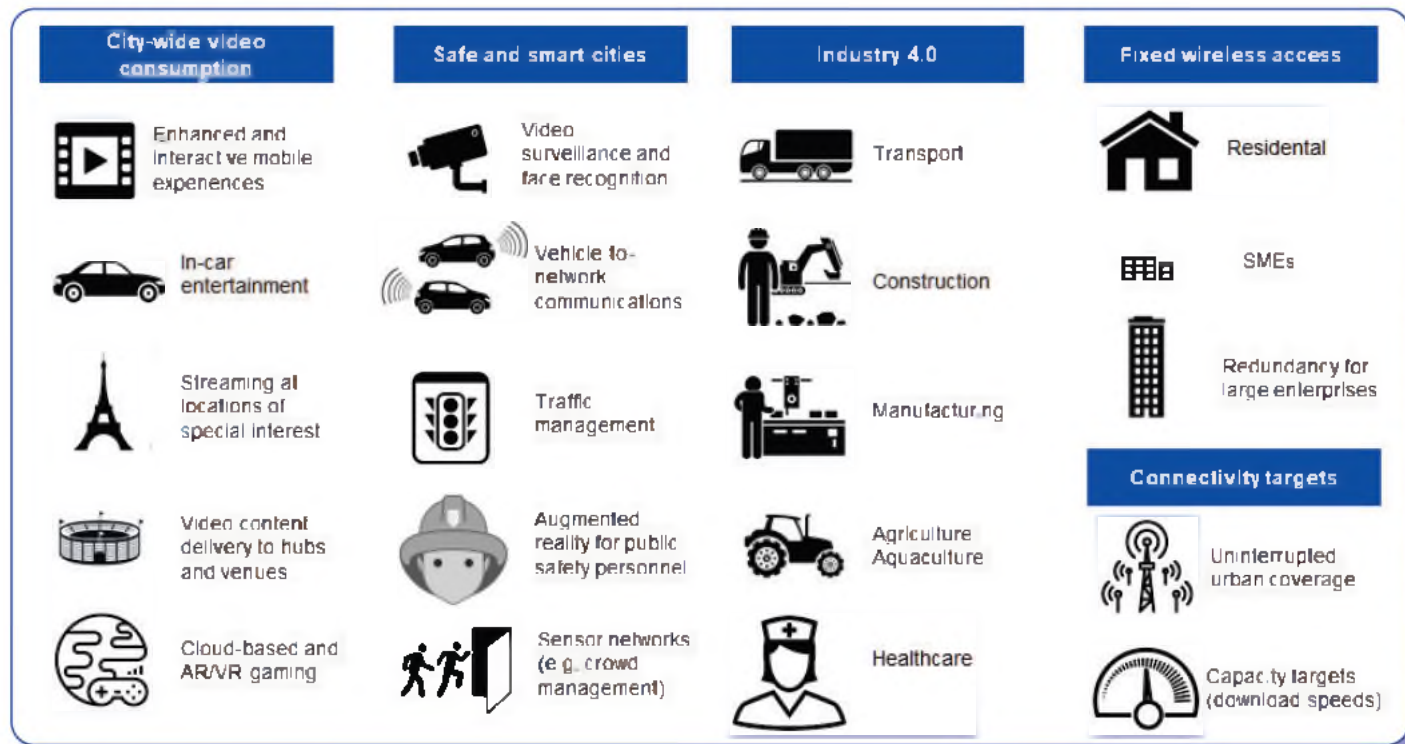
## Outline

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# 5G spectrum for capacity, coverage, and user experience



## Mid-bands: high capacity citywide (urban/suburban) coverage



Source: Analysis Mason, "The 6 GHz opportunity", 2019

Important to assess the needs of the **city of the future** (beyond hotspot requirements) in the **2025-2030** time frame. The spectrum needs of a mobile communication network are the **sum** of the spectrum needs of **each individual** use case supported at any given place and time.

## Webinar: 6 GHz for Europe – January 2021



### IMT spectrum demand

Additional mid-band spectrum needed for mobile operators in 2025-2030 timeframe



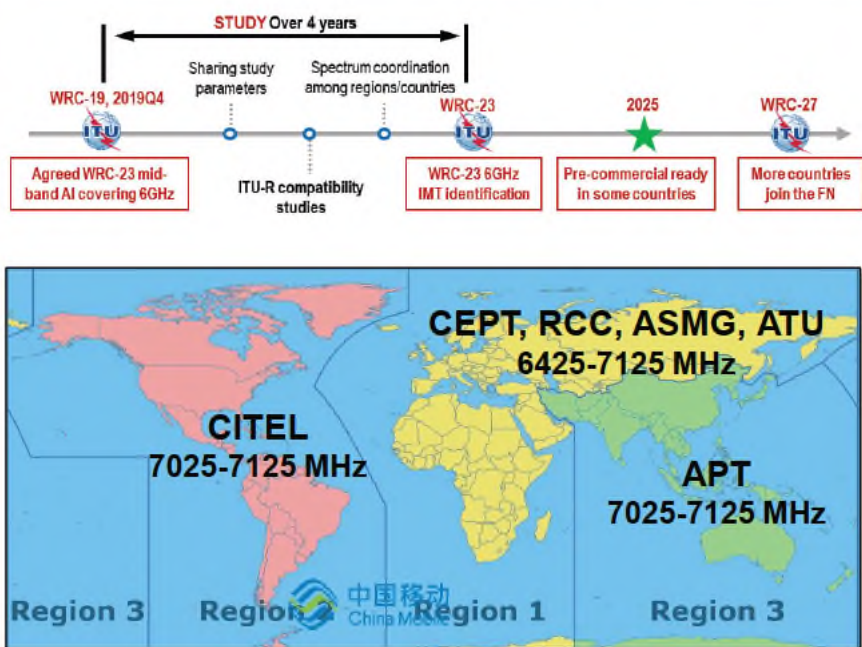
A total of around 2-3 GHz of mid-band spectrum, would enable mobile operators to deliver the ITU-R IMT-2020 requirements in cities in an economically feasible manner

<https://www.gsma.com/gsmadeurope/resources/imt-spectrum-demand/>



# 6 GHz identification at WRC-23 is essential for 5G development in next 10 years

A new agenda item for study of IMT at 6 GHz was set up at WRC-19



Major industry partners have declared 6 GHz as a priority for future IMT spectrum



Set 6425-7125 MHz as a high priority item for WRC-23 (2020)

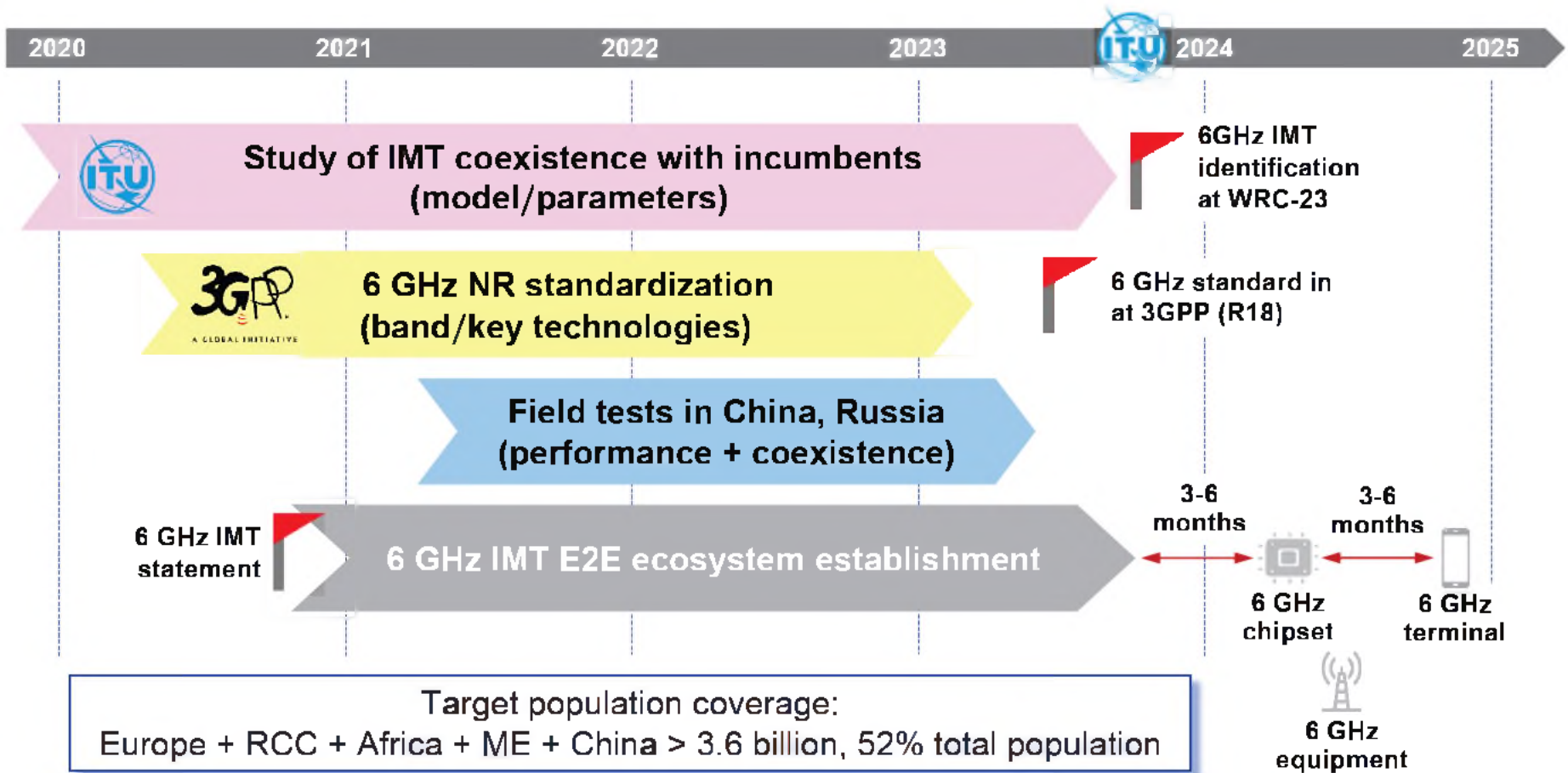


Started 6 GHz NR standardization (2020)

Statement of support for 6 GHz IMT:  
Co-signed by 23 partners (2020)



# 6 GHz expected to be commercially available E2E from 2025



## Recommendations (1)

- ❑ An additional **1000 to 2000 MHz** of **mid-bands** spectrum will be required to meet the IMT-2020 user experienced data rates of **100 Mbit/s** on the downlink and **50 Mbit/s** on the uplink, defined by the ITU-R, for **citywide high capacity** coverage in the **2025-2030** timeframe.
- ❑ The use of such additional **mid-bands** spectrum for **FWA** would reduce by **€42 billion** the cost of achieving European Union's 2025 connectivity target of **100 Mbit/s** broadband for all **households**.

Exhibit 15: Additional mid-bands spectrum needs (MHz) to meet DL and UL requirement

City	Activity factor 10%			Activity factor 15%			Activity factor 20%			Activity factor 25%		
	High bands offload			High bands offload			High bands offload			High bands offload		
	30%	20%	10%	30%	20%	10%	30%	20%	10%	30%	20%	10%
Paris	870	1110	1350	1590	1960	2320	2320	2690	3290	3040	3650	4250
Lyon	50	130	240	340	460	600	640	800	1050	950	1210	1460
Marseille	10	40	110	200	320	460	480	640	810	730	940	1160
Berlin	220	360	490	630	830	1030	1030	1300	1570	1430	1770	2110
Hamburg	160	250	410	540	720	910	910	1160	1410	1280	1600	1910
Munich	50	160	260	370	530	690	690	900	1110	1000	1320	1590
Rome	330	450	640	790	1020	1250	1280	1560	1870	1710	2100	2480
Milan	300	450	590	740	960	1180	1180	1480	1720	1620	1980	2360
Madrid	820	1060	1260	1530	1880	2230	2230	2700	3170	2930	3520	4100
Barcelona	490	660	840	1020	1290	1560	1560	1910	2270	2090	2540	2980
Amsterdam	30	80	170	270	410	550	550	740	930	840	1070	1310

Spectrum rec. < 10 MHz 10 to 500 MHz 500 - 1000 MHz 1000-2000 MHz > 2000 MHz

Source: Coleago, "IMT spectrum demand: Estimating the mid bands spectrum needs in the 2025-2030 timeframe," December 2020

## Recommendations (2)

### RSPG draft opinion on spectrum needs:

“recognises the current demand in the majority of MS for additional spectrum is mainly for the mid-bands”

### RSPG draft opinion on RSPP:

“...the need for clear spectrum policy direction is as valid as ever.”

“RSPG confirms the need for inclusion of policy objectives supporting the development of innovative wireless services based on generic description rather than quantitative.”

“In addition, as has been done recently for 5G, the RSPG can develop long-term spectrum availability plans including needs for harmonisation initiatives for key EU policy areas upon request.”

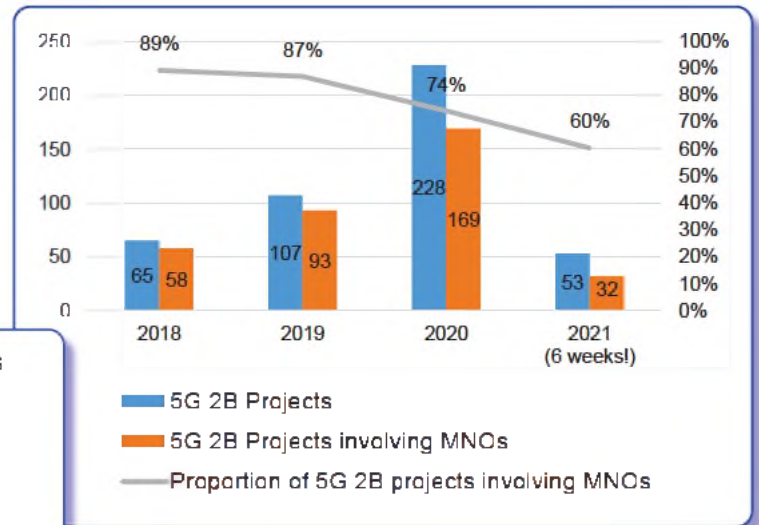
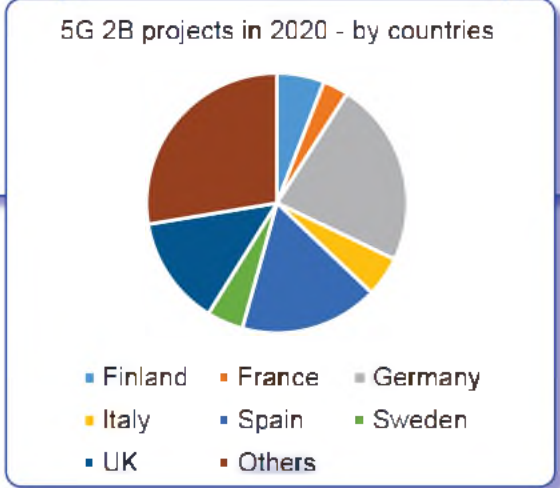
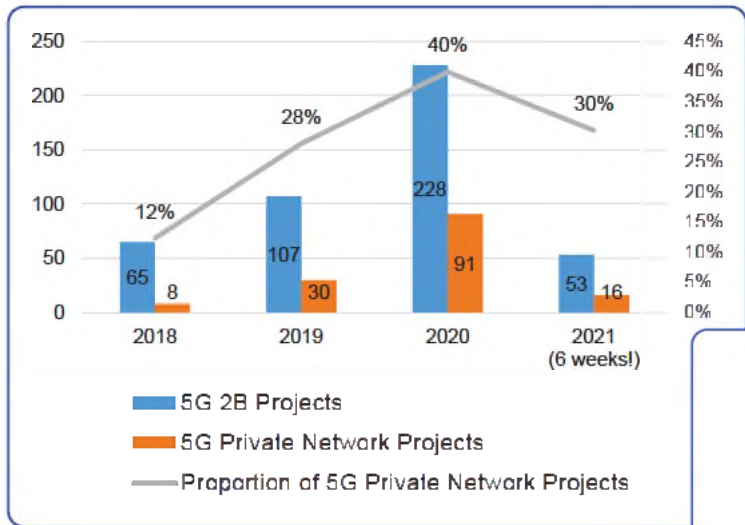
- ☐ The previous **RSPP (2012)** did identify **quantitative** and **ambitious** targets that represented a clear guidance for industry and administrations (“identify at least 1200 MHz of suitable spectrum by 2015”).
- ☐ The **new RSPP** should **equally be ambitious** in defining **quantitative** targets for the **mid-bands** spectrum to be identified in the **2025-2030** time frame, or should at least define clear **next steps** that will lead to the definition of such targets in the near future.
- ☐ Such **clarity** in the **policy direction** will be key for operators to define their longer term network and business strategies.

## Outline

- ☐ 5G deployment status globally
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# 5G 2B projects in Europe

□ We are tracking **453 5G 2B** projects (January 2021) in Europe based on public announcements.



Source – Huawei based on public information

## Commercial Interest



## 5G 2B projects in Germany at 3700-3800 MHz (1/2)



- ❑ 106 local 5G network applications, with 102 granted by BNetzA (as of January 2021).
- ❑ The spectrum assignments can be for direct service provision, related to specific clients, or for internal R&D, or a combination of these.

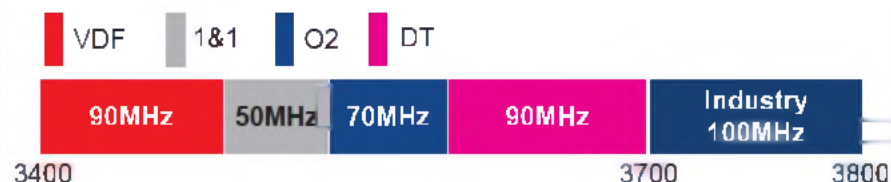
	Apr '20	Sep '20	Oct '20	Nov '20	Dec '20	Jan '21	Feb '21
Total applications		78	86	93	102	106	112
Applications approved	43	74	82	88	97	102	108
Applicants made public		38	47	51	56	59	64
ICT/telecom		47%	49%	49%	45%	44%	44%
Verticals		35%	32%	31%	34%	34%	34%
Research		18%	19%	20%	21%	22%	22%

Source – Huawei based on public information

## 5G 2B projects in Germany at 3700-3800 MHz (2/2)



### 3.7-3.8 GHz local licences available since 2019.11



$$\text{Total fee} = 1000 + R \times t \times 5(6a_1 + a_2)$$

Legend:  $R$  = Bandwidth (MHz),  $t$  = Duration (Y),  $a_1$  = Campus size (km<sup>2</sup>)

	First year	From 2 <sup>nd</sup> year
 100 MHz, 1 km <sup>2</sup>	4000 EUR	3000 EUR
 50 MHz, 20 km <sup>2</sup>	31,000 EUR	30,000 EUR

NOTE: 1.3B EUR auction fees for DT 90 MHz at C-band.

### Risk of interference

Private local network (3.7 – 3.8 GHz)

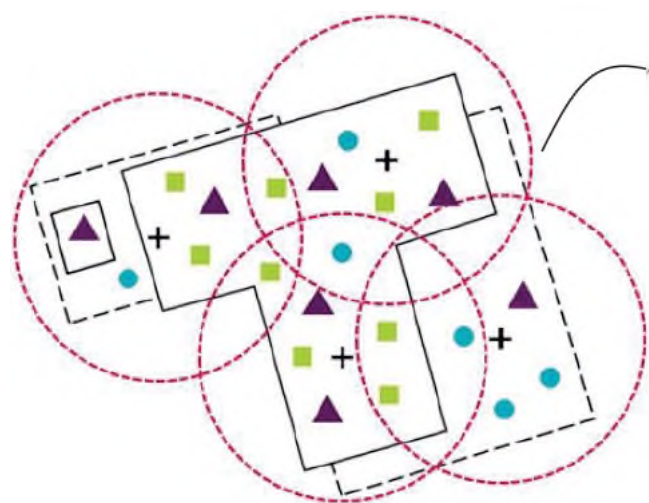


Public macro-cellular network (3.4 – 3.7 GHz)



- ❑ The use of different uplink and downlink traffic patterns in private and public networks lead to different frame structures and **technical complexities** to manage risk of interference.

# 5G 2B projects in UK at 3800-4200 MHz



Licence to deploy  
**as many base stations**  
as required within a  
circle of **50 metre** radius.  
Terminals are licence exempt.

**Annual fee / licence:**  
**£80/(10 MHz)**  
A user can apply for  
**multiple licences**

+ Registered location  
--- 50m radius from registered location  
— Wall of building  
--- Perimeter of outdoor yard area

▲ Base station  
■ Fixed/installed terminal  
● Mobile/nomadic terminal

**9 licensees** as of January 2021:  
(licensing available since December 2019)

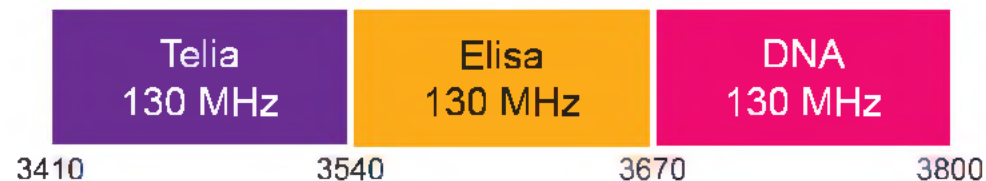
- Quickline Communication Ltd.
- Telent Technology Service Ltd.
- Vodafone Limited
- Netmore IoT Solutions Ltd.
- University of Warwick
- BlueWave Communication
- Toshiba Europe Ltd.
- BCP Council
- Integrated Digital Service Ltd.



## Finland: National licensing of large blocks + leasing obligations

- ❑ No spectrum fragmentation for the very valuable 5G primary band.
- ❑ The “use-it-or-lease-it” obligation ensures that the industrial users will get the connectivity they need.
- ❑ Exploiting and contributing to the 3GPP economies of scale.
- ❑ Allowing to leverage on all MNOs' spectrum assets (low, mid- and high bands).

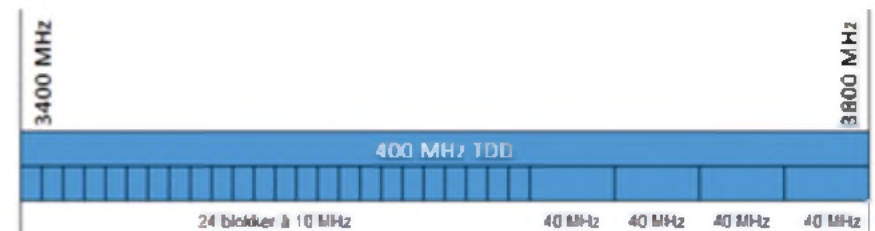
Finland's approach





## Norway: national licensing + access and spectrum rental obligations

- ❑ Consultation deadline: Apr 2021. Auction: Sep 2021.
- ❑ 3400-3800 MHz
  - 4 blocks of 40 MHz, and 24 blocks of 10 MHz
  - Cap: 120 MHz
  - **Obligation** to provide access for **industrial** and business player
  - Licensees required to provide access through the provision of special solutions in the form of **customized services or private networks**, based on reasonable tender requests. The obligation is supplemented by a **rental obligation** where the holders are required to rent out frequencies for a **limited geographical area** for the establishment of a separate 5G solution.
- ❑ 2300 and 3800-4200 MHz to be released in 2023.



## Recommendations (1)

- ❑ The connectivity and spectrum requirements of industrial users should be carefully assessed (for the many different use cases) to formulate evidence-based policies.
- ❑ **Priority:** Provision of services by MNOs through nationwide spectrum licensing of low and mid-bands associated with:
  - Obligations on MNOs for provision of special solutions to industrial use in the form of customized services or private networks through network slicing.
  - Facilitated leasing of spectrum from MNOs by industrial users.
- ❑ **Alternative:** Local licensing could be considered as a second step in case industrial users' connectivity requirements cannot be addressed by MNOs' wide area networks. MNOs should not be excluded from acquiring local licenses.



## Recommendations (2)

### RSPG draft opinion on RSPP:

“RSPP should encourage and incentivise more efficient spectrum use, avoiding fragmented use as much as possible.”

- ❑ Local licensing leads to spectrum **fragmentation** that is **not** easily **reversible**, and should **not** be applied in the **current** and **future 5G primary bands** (i.e., should not compromise availability of large contiguous bandwidths for high performance nationwide networks).
  - Current 5G-NR primary bands: 3400-3800 MHz, 26 GHz.
  - Future candidate 5G-NR primary bands: 2300, 3800-4200, 6425-7125 MHz.

### RSPG draft opinion on spectrum needs:

“Recommends to investigate the possible use of the band 3.8-4.2 GHz for local vertical applications while protecting receiving earth stations and other existing applications and services.”

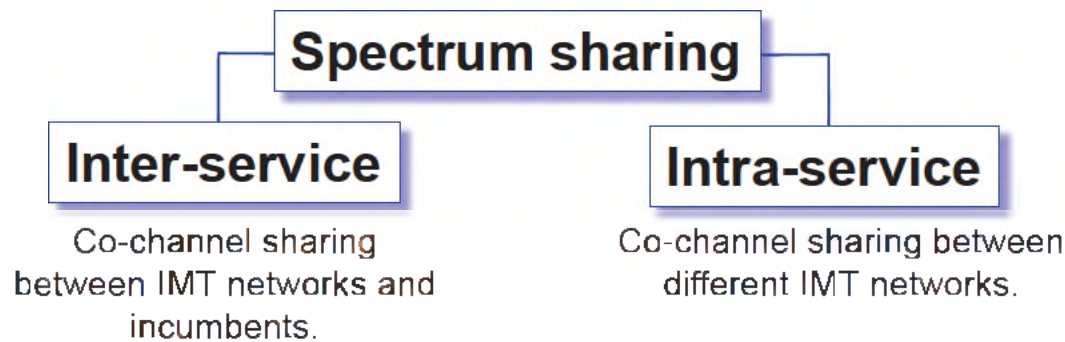
- ❑ If **local licensing** is considered for the **3800-4200 MHz** band:
  - It should be applied only to a **portion** of the available **band** (based on a careful assessment of user requirements).
  - Leaving the possibility for the rest of the band to be used for **nationwide** or **wide-area** assignments (if this is compatible with the need to protect incumbent users).

## Outline

- ☐ 5G deployment status globally
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# Spectrum sharing

- ❑ We note that the issues of *inter-service* and *intra-service* spectrum sharing often get **conflated**, and result in misunderstandings.



- ❑ Broadly speaking, **spectrum sharing** should only be considered where there is a **clear demand** for additional spectrum which otherwise cannot be made available, and where the benefits **outweigh** the costs.



## Recommendations: Inter-service sharing

- ❑ We acknowledge that the growing **demand** for terrestrial mobile broadband connectivity, and the fact that frequency **re-planning** or **clearance** of incumbents to allow IMT deployments may **not** be **possible** in all cases, mean that **increasing** levels of spectrum **sharing** between IMT networks and other services may be **inevitable** going forward.
- ❑ As such, the mobile industry has been very **active** in recent years in establishing **efficient inter-service** spectrum sharing frameworks at a **global level** in order to allow more extensive use of the scarce spectrum resource subject to **least restrictive** technical conditions.



## Recommendations: Intra-service sharing

- ❑ Spectrum sharing in general – and especially **complex** proposals for **intra-service** spectrum sharing<sup>1</sup> – should not be considered as goals in themselves but must bring tangible **net benefits** to users of spectrum.
- ❑ We consider that **existing** spectrum authorisation frameworks based on individual **licensing** and licence **exemption** in **distinct frequencies** respectively, as available today, are **sufficient** to cater for all foreseen intra-service spectrum sharing scenarios for innovative use cases.
- ❑ Where there might be demand for **dynamic/opportunistic** intra-service spectrum sharing, these can already be catered for in **licence exempt** bands. Therefore, we do **not see a need** for additional spectrum **sharing frameworks**<sup>1</sup> to cater for such dynamic/opportunistic use.



Licensing +  
Licence exemption

<sup>1</sup> Some stakeholders are advocates for frameworks where *commercial entities* (e.g., IT/internet companies) take over the role of spectrum management, and operating *independently* of regulators, and having themselves not paid for access to spectrum, grant the right to use the spectrum resource on a dynamic and *opportunistic* basis to users in exchange for a fee. We **do not** support such approaches.