



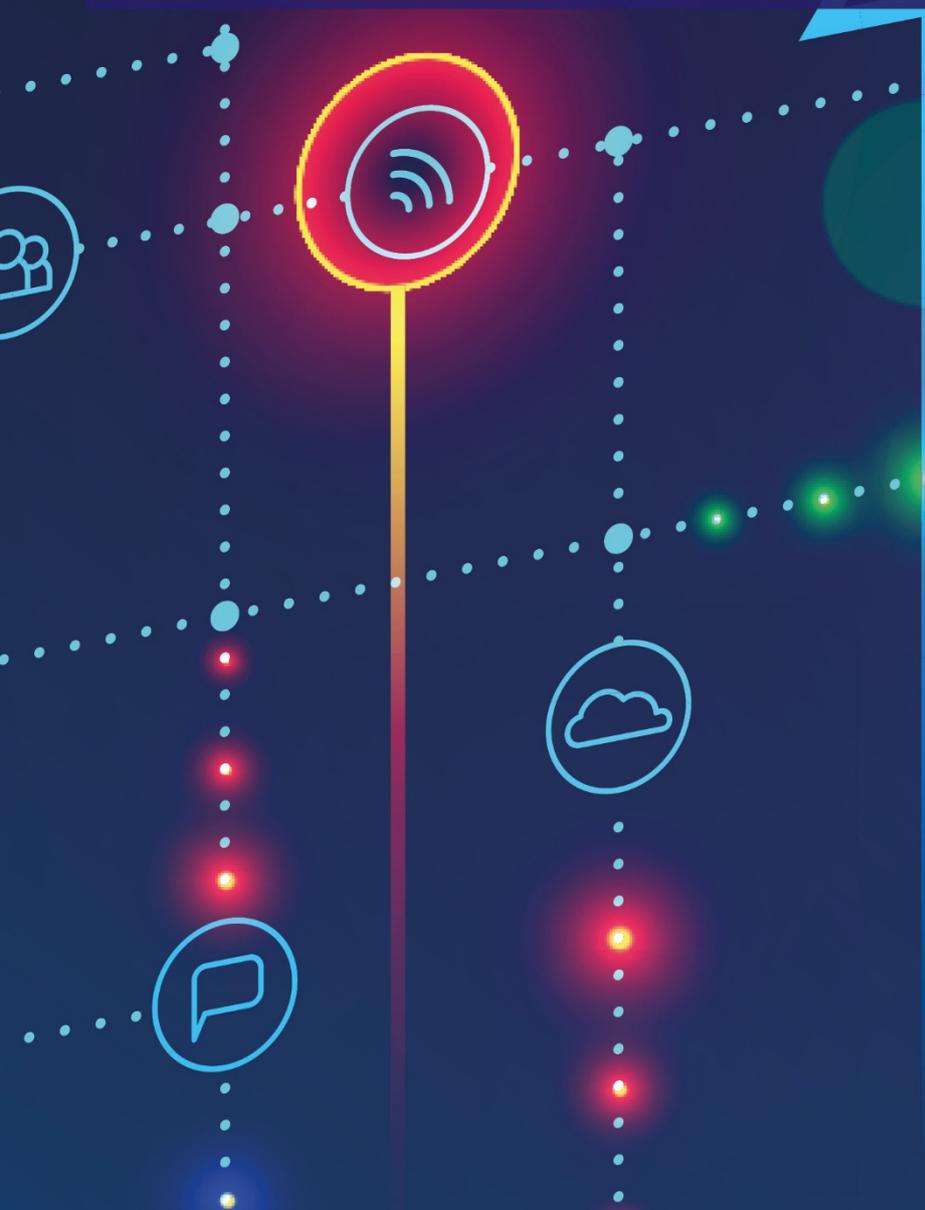
FINAL REPORT FOR CTIA

INTERNATIONAL COMPARISON: LICENSED, UNLICENSED, AND SHARED SPECTRUM, 2017-2020

David Abecassis, Janette Stewart, Chris Nickerson

REF: 2019964-502

JANUARY 2020



Copyright © 2020. Analysys Mason has produced the information contained herein for CTIA.

Analysys Mason Limited
North West Wing, Bush House
Aldwych
London WC2B 4PJ
UK
Tel: +44 (0)20 7395 9000
london@analysismason.com
www.analysismason.com
Registered in England and Wales No. 5177472

Overall findings

Our objective has been to provide a summary of the amount of new spectrum released (or expected to be released) for 5G in selected markets, between 2017 and 2020, including the licensing approaches used. The intention is to highlight the amounts of spectrum being made available in different markets on an exclusively licensed basis for 5G, or on an unlicensed or dynamically shared basis.

This report builds on analysis conducted as part of Analysys Mason’s “Global Race to 5G – Update” report for CTIA,¹ published in April 2019. We have again benchmarked the situation in the US against that in thirteen other countries: Australia, Canada, China, France, Germany, Hong Kong, Italy, Japan, Qatar, South Korea, Spain, Sweden, and the UK.

The chart overleaf is a summary of the main findings from the report.

From this chart, our key conclusions are:

- The US is currently an outlier in terms of the amount of spectrum bands being brought to market on an unlicensed or shared basis, as the chart overleaf illustrates.² Nearly all spectrum in the benchmark countries being made available in this time range has been via exclusive licensing to mobile network operators (MNOs) for wide-area deployment.
- All countries studied, except the US, have made mid-band spectrum available (or will do so by the end of 2020) in the 3.4–5.0GHz range via exclusive wide-area licenses. The US is unique in terms of the approach to licensing of the initially available mid-band spectrum.³ Unlike other markets, initially available mid-band spectrum in the US is not being licensed on an exclusive wide-area basis and is being made available on a dynamically shared/unlicensed basis.⁴
- We understand that a policy debate is ongoing in the U.S. re: the 6GHz band, with unlicensed interests seeking the entire 1200MHz of the band, while commercial wireless providers seek

¹ See <https://www.ctia.org/news/global-race-to-5g-update>

² Several markets are planning significant assignments of spectrum beyond 2020 that are not captured in our chart. For example, South Korea recently announced plans to release a further 320MHz by 2021 such that 600MHz of contiguous mid-band spectrum (3.4–4.0GHz) is available for 5G by that date. And in the EU, the lower 6GHz band (5925–6425MHz) is expected to be harmonized for unlicensed use across all Member States by the end of 2020, with assignment in individual Member States likely to take place in 2021 and beyond.

³ Some countries, namely Germany (3.7–3.8GHz), the UK (3.8–4.2GHz), and Sweden (3.7–3.8GHz,) are making some spectrum available on a first come, first served (FCFS) basis for local use. FCFS is a licensing approach in which a local licensee can apply to the regulator use spectrum in a specific location or area. The first applicant to apply for a specific area is then licensed to use that area; local licensees making subsequent applications can use the same spectrum in neighbouring areas but would not be licensed to use the spectrum in an area that has already been licensed to the first applicant. It is noted that in Sweden, the 3.7–3.8GHz band is not expected to be available for local licensing until after 2020.

⁴ While part of the 3.5GHz band will be available on a licensed basis via PALs, the full 150 megahertz in this band will be available on an opportunistic basis, including the PAL-licensed spectrum, when it is not being used by the licensee. In addition, spectrum use must protect government incumbent systems.

licensed access to the upper portion. Our research shows that EU countries are in the process of harmonizing only the lower part (5925–6425MHz) of the 6GHz band for unlicensed use.⁵

- In the low-band frequencies (<3GHz), all benchmark countries in ITU Regions 1 and 2 (including the US) have already released licensed, exclusive use spectrum for 5G (or are expected to do so by the end of 2020) in either the 600MHz or 700MHz band.⁶ With the US 600MHz auction completed in February 2017, the US was one of the first markets in the world to release new low-band spectrum suitable for 5G.
- In the high-band frequencies (>24GHz), most benchmark countries have made, or will make, available at least 1GHz of spectrum in the 26GHz and/or 28GHz bands on an exclusively licensed basis (including FCFS local licensing) for 5G use, with several countries planning to make available more than this amount, across parts of the band from 24.25–29.5GHz. The US has made more high-band spectrum available, within several different bands (24GHz, 28GHz, 37GHz, 39GHz, and 47GHz). The US and the UK have also made available spectrum in the 64–71GHz band range on an unlicensed basis – more countries are expected to make this band available for mobile use, following the decision taken at WRC-19 to identify this frequency range for use by IMT.

⁵ Technical conditions are not expected to be finalized before the end of 2020. Hence, this additional spectrum in Europe is not shown in our chart. (The UK is an exception: Ofcom recently released a consultation on making the lower 6GHz band available for unlicensed use, suggesting spectrum may be available before the end of 2020).

⁶ In France and Germany, assignments were made prior to 2017, and are therefore not shown in our chart above.

Figure 1: New spectrum released, or scheduled to be released, between 2017 and 2020 [Source: NRAs, Analysys Mason, 2020]

	Key:												
	Exclusively licensed		Unlicensed or dynamic sharing		nnn- <u>nnn</u> MHz/GHz: already assigned		nnn- <u>nnn</u> MHz/GHz: assignment expected by 2020						
US	617-652/663-698MHz		Unassigned EBS spectrum (2495-2690MHz)	3.55-3.7GHz	3.7-3.98GHz		5850-5895 MHz ⁵	5.925-7.125GHz ⁶	24.25-24.45GHz, 24.75-25.25GHz, 27.5-28.35GHz	37.0-37.6GHz	37.6-40GHz	47.2-48.2GHz	64-71GHz
Australia				3.575-3.7GHz									
Canada	617-652/663-698MHz			3.45-3.65GHz					26.5-27.5GHz				
China	700MHz, exact range unknown		2515-2675MHz ¹	3.4-3.6GHz		4.8-4.9GHz							
France				3.49-3.8GHz					26.5-27.5GHz ²				
Germany				3.4-3.7GHz, 3.7-3.8GHz*					24.25-27.5GHz*				
Hong Kong				3.3-3.4GHz ³ , 3.4-3.6GHz		4.84-4.92GHz			24.25-26.55,** 26.55-27.75GHz, 27.75-27.95,** 27.95-28.35GHz*				
Italy	703-733/758-788MHz, 733-748MHz**			3.6-3.8GHz					26.5-27.5GHz				
Japan				3.4-3.48GHz, 3.6-3.8GHz	3.8-4.1GHz	4.5-4.6GHz, 4.6-4.8GHz*			27.0-28.2GHz, 28.2-28.3GHz,* 28.3-29.1GHz,* 29.1-29.5GHz				
Qatar	703-733/758-788MHz			3.4-3.6GHz, 3.6-3.8GHz					25.5-27.5GHz				
S. Korea				3.42-3.7GHz					26.5-28.9GHz				
Spain	700MHz, exact range unknown			3.6-3.8GHz									
Sweden	713-733/768-788MHz, 738-758MHz**	2300-2380MHz		3.4-3.72GHz					24.25-27.5GHz* ³				
UK ⁴	703-733/758-788MHz, 738-758MHz	2350-2390MHz, 2390-2400MHz*		3.41-3.48GHz, 3.50-3.58GHz, 3.68-3.8GHz	3.8-4.2GHz*		5725-5850MHz	5925-6425MHz	24.25-26.5GHz*				66-71GHz

*Local licensing of specific base stations or defined geographic area, coordinated by the NRA on a FCFS basis. **Made available for assignment, but not bought by any operator.

¹ The 2555-2655MHz range is currently licensed to MNOs and used to provide TD-LTE services. ² Trial licences. ³ Indoor use only. ⁴ The UK has also made the DECT guard band (1781.7-1785/1876.7-1880MHz) available for local licensing. ⁵ May be released after 2020; currently at proposal stage. ⁶ May be released after 2020; currently at proposal stage. Exact licensing regime to be decided. Source: NRAs

Summary of spectrum released

This section provides details on new spectrum released (or expected to be released) for 5G between 2017 and 2020 in each of the benchmark countries, according to the latest information published by national regulatory authorities (NRAs) and other publicly available sources.

In line with our “Global Race to 5G” report, we consider low-band (<3GHz), mid-band (3–24GHz), and high-band (>24GHz) spectrum in successive subsections. Key developments since the publication of our “Global Race to 5G” report in April 2019 are marked as “[Update:]”.⁷

Low-band frequencies

Figure 2: New spectrum assigned for 5G in the low-band frequencies [Source: Analysys Mason, 2020]

Country	New spectrum released for 5G since 2017	New spectrum expected to be released for 5G by 2020
US	An auction of 2×35MHz (617–652/663–698MHz) was completed in February 2017	The US is updating the framework for licensing Educational Broadband Service (EBS) spectrum in the 2.6GHz band. ⁸ [Update:] In July 2019, the Federal Communications Commission (FCC) voted to adopt several changes, including removing the educational use requirement for licensees. After a priority filing window for Tribal Nations, any remaining unassigned spectrum will be auctioned for commercial use. We understand that the auction is expected to take place in 2020 ⁹
Australia	None	None
Canada	[Update:] An auction of 2×35MHz (617–652/663–698MHz) was completed in April 2019 ¹⁰	None
China	None ¹¹	None ¹²
France	None ¹³	None ¹⁴

⁷ Sources have not been provided in cases where there has been no update since our earlier report.

⁸ The Educational Broadband Services (EBS) band consists of consists of twenty 5.5MHz or 6.0MHz channels (totalling 112.5MHz) within the 2.6GHz band (2495–2690MHz); see https://selectspectrum.com/EBS_BRS.html. As noted in the “Race to 5G” report, 89MHz in the EBS band is currently licensed to mobile players.

⁹ See <https://www.fcc.gov/document/fcc-transforms-25-ghz-band-5g-services-0>

¹⁰ See <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11499.html>

¹¹ We note that China Broadcasting Network (CBN) has announced plans to use its existing 700MHz spectrum to provide 5G mobile services. See <http://m.c114.com.cn/w1991-1104749.html>

¹² As noted in the “Global Race to 5G” report, a total of 687MHz of low-band IMT spectrum has currently been planned for mobile in China, of which 582MHz has already been awarded. The spectrum yet to be assigned consists of a further 10MHz in the 1800MHz band, 5MHz in the 1900MHz band, 30MHz in the 2100MHz band, 30MHz in the 2.3GHz band, and 30MHz in the 2.6GHz band. We are not aware of an official timeline for the release of this spectrum.

¹³ An auction of 2×30MHz in the 700MHz band (703–733/758–788MHz) was completed in December 2015.

¹⁴ As noted in the “Global Race to 5G” report, ARCEP has consulted on assignment of the 738–753MHz (unpaired) range. This band was vacated by PMSE in June 2019; however, we are not aware of plans for its assignment to mobile by the end of 2020. As also noted in the “Global Race to 5G” report, ARCEP had previously envisaged assigning L-band spectrum for 5G at the same time as spectrum in the 3.4–3.8GHz. However, in June 2019, ARCEP announced that it plans to assign licenses in the L-band by the end of 2022. See <https://en.arcep.fr/news/press-releases/p/n/mobile-networks.html>

Country	New spectrum released for 5G since 2017	New spectrum expected to be released for 5G by 2020
Germany	None ¹⁵	None
Hong Kong	None	The Communications Authority (CA) intends to assign the vacated 'digital dividend' spectrum in the 700MHz (698–806MHz) band to mobile services as soon as possible after the analog switch-off [Update:] In January 2020, the CA indicated that this spectrum is expected to be made available in 2021 at the earliest ¹⁶
Italy	An auction of 2×30MHz (703–733/758–788MHz) was completed in October 2018 15MHz (733–748MHz) of unpaired spectrum was also made available at the auction but was not sold	None
Japan	None	None
Qatar	None	Qatar plans to assign 2×30MHz of spectrum (703–733/758–788MHz) in the 700MHz band for 5G
S. Korea	None	None ¹⁷
Spain	None	Spain expects to auction spectrum in the 700MHz band in early 2020
Sweden	An auction of 2×20MHz (713–733/768–788MHz) was completed in October 2018. 20MHz (738–758MHz) of SDL ¹⁸ spectrum was also made available at the auction but was not sold	The Swedish Post and Telecom Authority (PTS) is planning to award the 2300–2380MHz range to mobile (alongside the 3.4–3.7GHz range). [Update:] In November 2019, PTS announced that the auction would not take place in Q1 2020 as previously planned; instead, it will happen "as early as possible in 2020" ^{19,20}
UK	An auction of the 2350–2390MHz range (for nationwide use) was completed in April 2018 [Update:] In July 2019, the UK Office of Communications (Ofcom) announced new spectrum-sharing arrangements in the DECT guard band (1781.7–1785/1876.7–1880MHz) and the 2390–2400MHz band. Local licenses will be assigned by Ofcom on a FCFS basis ²¹	The UK plans to auction the 703–733/758–788MHz (paired) and 738–758MHz (unpaired) ranges in Q2 2020. Spectrum should be available for use by May/June 2020

¹⁵ An auction of 2×30MHz in the 700MHz band (703–733/758–788MHz) was completed in June 2015.

¹⁶ See https://www.coms-auth.hk/en/media_focus/press_releases/index_id_2060.html

¹⁷ In November 2019, MSIT launched its "5G+ spectrum plan" which aims to "secure the world's largest 5G spectrum supply" by releasing an additional 2640MHz of 5G spectrum by 2026. This includes spectrum in the 700MHz, 800MHz, 2.3GHz, and 2.6GHz bands; however, the first milestone for spectrum assignment is not until 2021. See <https://www.msit.go.kr/web/msipContents/contentsView.do?catId=mssw311&artId=2360371>

¹⁸ SDL = Supplementary Downlink, i.e. spectrum specified by 3GPP to be used for mobile downlink transmissions.

¹⁹ See <https://www.pts.se/sv/nyheter/radio/2019/pts-skjuter-fram-tilldelning-av-frekvenser-i-35-ghz-och-23-ghz-banden/>

²⁰ PTS's spectrum management plan, updated in May 2019, indicates that L-band spectrum is expected to be assigned in 2020 or later, subject to demand. See https://www.pts.se/contentassets/3019229ac3f848b29a59c83f562df91d/inriktningsplan_spektrumhantering_190528.pdf

²¹ See https://www.ofcom.org.uk/__data/assets/pdf_file/0033/157884/enabling-wireless-innovation-through-local-licensing.pdf

Mid-band frequencies

Figure 3: New spectrum assigned for 5G in the mid-band frequencies [Source: Analysys Mason, 2020]

Country ²²	New spectrum already released for 5G	New spectrum expected to be released for 5G by 2020
US	[Update:] In September 2019, the lightly licensed ²³ bottom tier of the Citizens Broadband Radio Service (CBRS) band (covering the full 3550–3700MHz range) became available for initial commercial deployment	The US is making spectrum in the 3550–3700MHz (CBRS) band available through a dynamic sharing arrangement consisting of three tiers. Users in lower tiers must not cause interference to, and must accept interference from, users in higher tiers. This is achieved through a spectrum access system (SAS) and environmental sensing capability. 70MHz (in the 3550–3650MHz range) will be auctioned on a wide-area (county) basis in Tier 2. [Update:] The auction is expected to take place in mid-2020 ²⁴ The FCC is exploring repurposing (parts of) the 3.7–4.2GHz band from satellite to terrestrial use. [Update:] In November 2019, the FCC announced that it plans to auction the bottom 280MHz of the band (3.7–3.98GHz). We understand that the auction is expected to take place by the end of 2020 ²⁵ [Update:] In December 2019, the FCC adopted a consultation which proposes to designate the 5.850–5.895GHz band for unlicensed use ²⁶ In October 2018, the FCC proposed rules to allow unlicensed use in the 5.925–7.125GHz band. ²⁷ The final rules are still to be decided.
Australia	A regional auction of the 3575–3700MHz range was completed in December 2018	None ²⁸
Canada	None	In June 2018, Canada published its “Spectrum Outlook 2018-2022” as well as a specific

²² The 5925–6425MHz range is expected to be harmonized for unlicensed use across all EU Member States by the end of 2020. Assignment in individual Member States is likely to take place from 2021 onwards. See <https://www.ecodocdb.dk/document/10170> and http://apps.cept.org/eccnews/aug-2019/europe_prepares_to_harmonise_the_6_ghz_spectrum_band_for_radio_local_area_networks.html

²³ Tier 3 is often referred to as unlicensed, but users are licensed-by-rule (i.e. to be eligible they must meet the FCC’s technical, financial, character, and citizenship qualifications). See <https://www.fcc.gov/wireless/bureau-divisions/mobility-division/35-ghz-band/35-ghz-band-overview>

²⁴ See <https://www.fcc.gov/document/fcc-seeks-comment-bidding-procedures-pals-35-ghz-auction>

²⁵ See <https://docs.fcc.gov/public/attachments/DOC-354364A1.pdf>

²⁶ See <https://docs.fcc.gov/public/attachments/DOC-361339A1.pdf>

²⁷ In the 5.925–6.425GHz and 6.525–6.875GHz sub-bands, unlicensed devices would only be allowed to transmit under the control of an automated frequency control (AFC) system. In the 6.425–6.525GHz and 6.875–7.125GHz sub-bands, unlicensed devices would be restricted to indoor use and would operate at lower power, without an AFC system. See <https://docs.fcc.gov/public/attachments/DOC-354364A1.pdf>. Some entities are seeking access to the full band for low-power indoor and very low power indoor/outdoor unlicensed operations without use of an AFC.

²⁸ In August 2019, the ACMA published a discussion paper on the 3.7–4.2GHz band. Implementation of review outcomes is scheduled for Q2 2020 onwards. See <https://www.acma.gov.au/consultations/2019-09/planning-3700-4200-mhz-band-consultation-272019>. The ACMA also consulted on options for optimizing arrangements in the 3400–3575MHz band in April 2019. The ACMA’s “FYSO 2019-23”, published in September 2019, states that a decision paper is planned for Q4 2019. See <https://www.acma.gov.au/publications/2019-09/publication/five-year-spectrum-outlook-2019-23>

Country ²²	New spectrum already released for 5G	New spectrum expected to be released for 5G by 2020
		consultation on the 3450–3650MHz band, with an auction for that band planned for late 2020
China	In December 2018, nationwide 5G test licenses were issued in the 2515–2675MHz, 3.4–3.6GHz, and 4.8–4.9GHz ranges to the country's three MNOs. ²⁹ [Update:] In June 2019, the Ministry of Industry and Information Technology (MIIT) awarded commercial 5G licenses in these bands to the three MNOs, ³⁰ as well as to China Broadcasting Network (CBN) in the 4.9–4.96GHz band ³¹	None ³²
France	In December 2017, the Autorité de Régulation des Communications Électroniques et des Postes (ARCEP) made (parts of) the 3410–3460MHz range available for FWA use in certain areas until 2026	[Update:] In November 2019, ARCEP adopted a decision on rules for the auction of the 3.49–3.80GHz range (for nationwide use). The auction is scheduled to take place before the end of 2020 ³³
Germany	[Update:] An auction of the 3.4–3.7GHz range (for nationwide use) was completed in June 2019 ³⁴ [Update:] In November 2019, the Federal Network Agency (Bundesnetzagentur or BNetzA) opened applications for local licenses in the 3.7–3.8GHz range ³⁵	None
Hong Kong	[Update:] An auction of the 3.4–3.6GHz and 4.84–4.92GHz ranges (for nationwide use) was completed in October 2019 ³⁶ [Update:] An auction of the 3.3–3.4GHz range (for indoor use) was completed in November 2019 ³⁶	None ³⁷
Italy	An auction of the 3.6–3.8GHz range (for nationwide use) was completed in October 2018	None
Japan	The 3400–3480MHz range was assigned (for nationwide use) in April 2018	As noted in the “Global Race to 5G” report, the 4.6–4.8GHz range will be further considered for private 5G use

²⁹ The 2555–2655MHz range is currently licensed to MNOs and used to provide TD-LTE services.

³⁰ See <http://www.miit.gov.cn/n1146290/n1146402/n7039597/c7093441/content.html> and <https://static1.squarespace.com/static/5bf2b77d75f9eefcd937cb5c/t/5d1a20eb11a9570001f95d65/1561993455970/5.+Julin+LIU.pdf>

³¹ See <http://m.c114.com.cn/w1991-1104749.html>

³² As noted in the “Global Race to 5G” report, in June 2017, MIIT confirmed that 500MHz of spectrum (within the 3.3–3.6GHz and 4.8–5.0GHz ranges) would be released in China, with the 3.3–3.4GHz range available for indoor use.

³³ See <https://www.arcep.fr/actualites/les-communiqués-de-presse/detail/n/5g-7.html>

³⁴ See https://www.bundesnetzagentur.de/SharedDocs/Pressemitteilungen/EN/2019/20190612_spectrumauktionends.html

³⁵ See https://www.bundesnetzagentur.de/SharedDocs/Pressemitteilungen/DE/2019/20191121_lokaleFreq.html?nn=265778

³⁶ See https://www.ofca.gov.hk/en/industry_focus/radio_spectrum/auctions/index.html

³⁷ In January 2020, the CA published its Spectrum Release Plan for 2020–2022. The CA plans to assign new spectrum for mobile in the 4.80–4.84GHz and 4.92–4.96GHz bands, however this is not scheduled to take place until 2021 at the earliest. See https://www.coms-auth.hk/en/media_focus/press_releases/index_id_2060.html

Country ²²	New spectrum already released for 5G	New spectrum expected to be released for 5G by 2020
	[Update:] The 3.6–4.1GHz and 4.5–4.6GHz ranges were assigned (for nationwide use) in April 2019 ³⁸	[Update:] We understand that the 4.6–4.8GHz range is expected to be made available by the end of 2020
Qatar	100MHz in the 3.4–3.6GHz range has been assigned to each of the two MNOs	A document released by the Communications Regulatory Authority (CRA) in February 2018 indicates that the 3.6–3.8GHz range will be assigned for 5G use in the future, though we are not aware of the exact timings
S. Korea	An auction of the 3.42–3.7GHz range (for nationwide use) was completed in June 2018	None ³⁹
Spain	An auction of 2×20MHz (3460–3480/3560–3580MHz) was completed in March 2016 An auction of the 3.6–3.8GHz range (for nationwide use) was completed in July 2018	None
Sweden	None	PTS is planning to award 300MHz in the 3.40–3.72GHz range to mobile (alongside the 2300–2380MHz range). [Update:] In November 2019, PTS announced that the auction would not take place in Q1 2020 as previously planned; instead, it will happen “as early as possible in 2020” ⁴⁰
UK	In March 2017, Ofcom made the 5725–5850MHz range available for unlicensed use An auction of the 3.41–3.48GHz and 3.50–3.58GHz ranges (for nationwide use) was completed in April 2018 [Update:] In July 2019, Ofcom announced new spectrum-sharing arrangements in the 3.8–4.2GHz band. Local licenses will be assigned by Ofcom on an FCFS basis ⁴¹	The UK anticipates awarding 120MHz of spectrum in the 3680–3800MHz band by Q2 2020; the spectrum is expected to be available in most parts of the UK by mid-2020 [Update:] In January 2020, Ofcom published a consultation on making the lower 6GHz band (5925–6425MHz) available for unlicensed use. Responses are due by March 2020 ⁴²

³⁸ See http://www.soumu.go.jp/menu_news/s-news/01kiban14_02000378.html

³⁹ In November 2019, MSIT launched its “5G+ spectrum plan” which aims to “secure the world’s largest 5G spectrum supply” by releasing an additional 2640MHz of 5G spectrum by 2026. This includes assigning 320MHz in the 3.4–3.42GHz and 3.7–4.0GHz ranges by 2021. See <https://www.msit.go.kr/web/msipContents/contentsView.do?catelId=mssw311&artId=2360371>

⁴⁰ See <https://www.pts.se/sv/nyheter/radio/2019/pts-skjuter-fram-tilldelning-av-frekvenser-i-35-ghz-och-23-ghz-banden/>. PTS is also planning to make local licenses available for 5G in the 3.7–3.8GHz band; however, we are not aware of plans for this to occur before the end of 2020.

⁴¹ See https://www.ofcom.org.uk/__data/assets/pdf_file/0033/157884/enabling-wireless-innovation-through-local-licensing.pdf

⁴² See https://www.ofcom.org.uk/__data/assets/pdf_file/0038/189848/consultation-spectrum-access-wifi.pdf

High band frequencies

Figure 4: New spectrum assigned for 5G in the high-band frequencies [Source: Analysys Mason, 2020]

Country	New spectrum already released for 5G	New spectrum expected to be released for 5G by 2020
US	<p>In July 2016, the FCC adopted new rules to allow unlicensed use of the 66–71GHz band</p> <p>The FCC also made the lower 37GHz band (37.0–37.6GHz) available for use by both federal and non-federal users on a shared basis</p> <p>An auction of the 28GHz band (27.5–28.35GHz), in each county where not already assigned,⁴³ was completed in January 2019</p> <p>[Update:] An auction of the 24GHz band (24.25–24.45GHz, 24.75–25.25GHz) in each partial economic area (PEA) was completed in May 2019⁴⁴</p>	<p>In December 2018, the FCC adopted rules for the auction of spectrum in the upper 37GHz (37.6–38.6GHz), 39GHz (38.6–40.0GHz), and 47GHz (47.2–48.2GHz) bands</p> <p>[Update:] In July 2019, the FCC published rules for the auction. In August 2019, the FCC announced that all 39GHz incumbents had committed to relinquish their 39GHz licenses, meaning that the maximum possible number of generic license blocks will be available in every PEA.⁴⁵ Qualified bidders were announced in October 2019, with the auction beginning in 2019⁴⁶</p>
Australia	None	[Update:] None ⁴⁷
Canada	None	ISED aims to release the 26GHz (26.5–27.5GHz) band for 5G by 2020
China	None	<p>MIIT has stated that it intends to make available 2GHz of spectrum per operator in the 24.25–43.5GHz range</p> <p>In June 2017, MIIT published a consultation on mm-wave bands for 5G, including the 24.75–27.5GHz and 37–42.5GHz bands</p> <p>[Update:] In June 2019, MIIT stated that it would propose a plan for 5G mm-wave spectrum by December 2019.⁴⁸ However, as of January 2020, we are not aware of details of the proposed plan</p>
France	<p>In January 2019, ARCEP issued an invitation to apply for 5G trial licenses in the 26.5–27.5GHz band</p> <p>[Update:] In October 2019, ARCEP announced that eleven applicants had been accepted. Licensees must build an operational 5G trial network by January 1, 2021 at the latest; this network must be made available to third parties to conduct their</p>	None

⁴³ The 28GHz band was not already assigned in 1536 counties (corresponding to roughly 24% of spectrum in the band, on a MHz per pop basis). Two 425MHz blocks were auctioned in each of these counties; 2965 of the 3072 licenses were sold.

⁴⁴ Seven 100MHz blocks were auctioned in each PEA (in the upper 24GHz segment (24.75–25.25GHz), four 100MHz blocks and one 75MHz block were offered in one PEA and only four blocks in three other PEAs). 2904 of the 2909 licenses were sold. See <https://www.fcc.gov/auction/102>

⁴⁵ That is, ten 100MHz blocks in the upper 37GHz band, fourteen 100MHz blocks in the 39GHz band, and ten 100MHz blocks in the 47GHz band will be available in each PEA.

⁴⁶ See <https://www.fcc.gov/auction/103>

⁴⁷ As noted in the “Global Race to 5G” report, Australia ran a consultation on the future use of the 26GHz (24.25–27.5GHz) band at the end of 2018. The consultation scheduled an auction for Q3/4 2020. However, in October 2019, the Australian government announced that it expects to hold the auction in early 2021. See <https://www.minister.communications.gov.au/minister/paul-fletcher/news/opening-more-5g-spectrum>

⁴⁸ See http://www.xinhuanet.com/english/2019-06/29/c_138184382.htm

Country	New spectrum already released for 5G	New spectrum expected to be released for 5G by 2020
	own trials. The test licenses are valid for up to three years ⁴⁹	
Germany	None	At the end of 2018, BNetzA completed a consultation on a co-ordinated FCFS licensing arrangement (for individual base stations) in the 24.25–27.5GHz range BNetzA has said that it aims to release this band “as early as possible so that usage can start in 2020” [Update:] BNetzA is currently consulting on a draft basic framework for the 24.25–27.5GHz range; submissions are due in February 2020 ⁵⁰
Hong Kong	The CA set aside 4.1GHz of spectrum across the 26/28GHz bands for the provision of wireless broadband services: 3.7GHz (24.25–27.95GHz) for exclusive nationwide licenses and 400MHz (27.95–28.35GHz) for local licenses [Update:] In March 2019, the CA announced that 1.2GHz (26.55–27.75GHz) of the available 3.7GHz had been (administratively) assigned ^{51, 52} [Update:] In July 2019, the CA opened applications for local licenses (to be assigned on an FCFS basis) ⁵³	None
Italy	An auction of the 26.5–27.5GHz range (for nationwide use) was completed in October 2018	None
Japan	[Update:] The 27.0–28.2GHz and 29.1–29.5GHz ranges were assigned (for nationwide use) in April 2019 ⁵⁴	As noted in the “Global Race to 5G” report, the 28.2–29.1GHz range will be further considered for private 5G use [Update:] We understand that the 28.2–28.3GHz range is already open for local 5G license applications, while the 28.3–29.1GHz range is expected to be made available by the end of 2020 ⁵⁵
Qatar	None	In February 2018, CRA announced that it would assign two 400MHz blocks to Vodafone and Ooredoo in the 26.5–27.5GHz range in 2018. CRA also said that the spectrum for assignment would expand to 25.5–27.5GHz by January 2019 and then to 24.5–27.5GHz by January 2021. However,

⁴⁹ See <https://en.arcep.fr/news/press-releases/p/n/5g-6.html>

⁵⁰ See https://www.bundesnetzagentur.de/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Frequenzen/OeffentlicheNetze/LokaleNetze/lokaleNetze-node.html

⁵¹ See https://www.ofca.gov.hk/en/media_focus/press_releases/index_id_1891.html

⁵² The CA are planning to make the remaining 2.5GHz available in a second round of administrative assignment (to take place in the first half of 2021 at the earliest). See https://www.coms-auth.hk/filemanager/en/content_613/spectrum_plan2020_en.pdf

⁵³ See https://www.ofca.gov.hk/en/media_focus/press_releases/index_id_1953.html

⁵⁴ See http://www.soumu.go.jp/menu_news/s-news/01kiban14_02000378.html

⁵⁵ See <https://www.japantimes.co.jp/news/2019/12/24/business/tech/japan-open-for-local-5g-licenses/#.Xia-ycj7RPY>

Country	New spectrum already released for 5G	New spectrum expected to be released for 5G by 2020
		as of January 2020, we are not aware of confirmation of any mm-wave assignment
S. Korea	An auction of the 26.5–28.9GHz range (for nationwide use) was completed in June 2018	None ⁵⁶
Spain	None	None
Sweden	None	[Update:] In December 2019, PTS published a consultation on plans for the 24.25–27.5GHz band. The consultation proposes that the band is available for indoor 5G use from 2020 and outdoor use from 2025/2026 ⁵⁷
UK	[Update:] In July 2019, Ofcom announced that it had added the 24.25–26.5GHz range to its spectrum sharing framework for indoor use. Local licenses will be assigned by Ofcom on an FCFS basis ⁵⁸ In November 2018, Ofcom adopted new rules to allow unlicensed use of the 66–71GHz band ⁵⁹	None

⁵⁶ In November 2019, MSIT launched its “5G+ spectrum plan” which aims to “secure the world’s largest 5G spectrum supply” by releasing an additional 2640MHz of 5G spectrum by 2026. This includes assigning 2000MHz in the 24GHz band (1400MHz by 2021 and a further 600MHz by 2026). See <https://www.msit.go.kr/web/msipContents/contentsView.do?catelId=mssw311&artId=2360371>

⁵⁷ See <https://pts.se/sv/nyheter/radio/2019/samrad-av-forstudie-om-pts-inriktning-for-26-ghz-bandet/>

⁵⁸ See https://www.ofcom.org.uk/__data/assets/pdf_file/0033/157884/enabling-wireless-innovation-through-local-licensing.pdf

⁵⁹ See <https://www.ofcom.org.uk/consultations-and-statements/category-3/implementing-decisions-57-71-ghz-band>