

WIRELESS INVESTOR

## Upcoming global spectrum auctions, 2021 onward

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Both mobile operators and regulators experienced a consequential year in 2020 as the COVID-19 pandemic forced the cancellation of several much-awaited spectrum auctions. Kagan curated a list of rescheduled and upcoming auctions worldwide, split into three broad categories: low-band, mid-band, and high-band or millimeter-wave spectrum.

*To view the complete list of upcoming spectrum auctions, download the attached spreadsheet.*

### Low-band spectrum (below 1 GHz)

Auctions for low-band spectrum below 1 GHz are set to be held in 32 markets worldwide in the upcoming years, mostly in the 700 MHz band. Markets in the Asia-Pacific region originally planned to release 700 MHz last year to comply with the 2020 deadline for adopting the APT700 standard for 4G. European markets were similarly bound by a 2020 deadline for the band, but for 5G as stipulated in the 5G Auction Plan of the European Union.

The COVID-19 pandemic crushed the timeline for compliance for both plans, which is why several tenders for the 700 MHz band remain slated for 2021. Since the band can be used for both 4G and 5G, some markets in Asia-Pacific and Latin America and the Caribbean opted to tag their 700 MHz auctions either for both technologies or as technology neutral.

India was one of the most prominent markets that were originally set to release low-frequency spectrum last year. The local regulator earmarked lots in the 700 MHz, 800 MHz and 900 MHz bands to help alleviate the market's spectrum deficiency. The regulator eventually pushed back the tender to the first quarter of 2021 after heeding the calls of financially distressed operators that complained about the expensive auction fees.

Malaysia, on the other hand, awarded licenses in the 700 MHz band in May 2020 only to revoke them the following month after complaints from local operators. Malaysia is targeting to auction lots in the band some time this year.

The 700 MHz band has already been set aside for the Red Compartida wholesale network in Mexico, so the regulator shifted the market's low-frequency 5G band to 600 MHz. Mexico and Hong Kong are notable for being the only markets so far to set an auction for the 600 MHz band for 5G use. The same band is used in the U.S. by GCI LLC, T-Mobile US Inc. and United States Cellular Corp. for their 5G networks.

## Upcoming low-band spectrum auctions

Market	Band (MHz)	Target date	License	Market	Band (MHz)	Target date	License
<b>Africa</b>				<b>Europe</b>			
South Africa	700, 800	2021	Mobile	Belgium	700	2021-2022	Mobile (5G)
				Croatia	700	2021	Mobile (5G)
<b>Asia-Pacific</b>				Estonia	700	TBA	Mobile (5G)
Australia	850, 900	2021 Q4	Mobile broadband	Germany	450	2021 Q1	Mobile, fixed
Hong Kong	600, 700	2021 Q4	Mobile (indoor)	Ireland	700	2021 Q1	Technology neutral
	850	2021	Mobile	Kosovo	700	2022	Technology neutral
India	700, 800, 900	2021 Q1	Technology neutral		800-900	TBA	Technology neutral
Malaysia	700	2021-2022	Mobile broadband	Latvia	700	TBA	Mobile (5G)
Myanmar	700	2022	Mobile (4G, 5G)	Lithuania	700	2021 Q1	Technology neutral
Pakistan	900	2021	Mobile	Malta	700	2021	Mobile
Vietnam	700	2021-2022	Mobile (4G, 5G)	Montenegro	700	2021	Mobile (5G)
<b>Latin America</b>				Norway	700, 900	2021	Mobile (including 5G)
Brazil	700	2021 Q1	Technology neutral	Portugal	700, 900	2021 Q1	Technology neutral
Chile	700	2021 Q1	Mobile (5G)	Romania	700, 800	2021 Q2	Mobile (5G)
Ecuador	700	2021	Mobile (5G)	Slovenia	700	2021 Q1	Mobile (5G)
El Salvador	700	2021	Mobile (4G, 5G)	Spain	700	2021 Q1	Mobile (5G)
Guatemala	600, 700	2021	Mobile (4G)	Ukraine	700	2021 Q4	Mobile (5G)
Honduras	700	2021	Mobile	United Kingdom	700-800	2021 Q1	Mobile broadband
Mexico	600	2021	Mobile (5G)				
	800	2021 Q2	Mobile, trunked radio				

Data compiled January 2021.

TBA = to be announced

Sources: Industry data; Kagan estimates

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## Mid-band spectrum (between 1 GHz and 6 GHz)

Most of the derailed auctions in 2020 were supposed to release mid-band spectrum for 5G, specifically in the 3.5 GHz band because of its good balance of network coverage and capacity.

Europe, where 3.5 GHz 5G deployments are the most popular, saw a wave of auction postponements to late 2020 or early 2021 in Austria, Belgium, Czech Republic, France and Portugal among others. Hungary was able to finish its 700 MHz, 2.1 GHz and 3.5 GHz tender in March before pandemic-related restrictions swept the region.

Operators whose 5G plans were hinged on the release of 3.5 GHz spectrum were caught off guard last year by the postponement of auctions in several markets. Some operators, such as those in Brazil, became resourceful. In the absence of 3.5 GHz allocations, some embraced Dynamic Spectrum Sharing, or DSS, for 5G. This entailed the use of low- and mid-band spectrum such as 700 MHz, 1.8 GHz and 2.6 GHz originally used for earlier technologies as substitute bands for 5G.

DSS 5G and the expiration of old spectrum licenses are factors in the increase in the number of markets planning to auction mid-band spectrum aside from 3.5 GHz. At least 35 markets worldwide have plans of auctioning mid-band spectrum in upcoming years.

The U.S. recently held two mid-band auctions: the CBRS auction (3.5 GHz to 3.7 GHz) concluded in August 2020 and the highly anticipated C-band auction (3.7 GHz to 4.2 GHz) that is yet to be concluded. An auction of the 2.6 GHz band is in the consultation phase. Canada is also planning to auction the 3.5 GHz band this year.

## Upcoming mid-band spectrum auctions

Market	Band (GHz)	Target date	License	Market	Band (GHz)	Target date	License
<b>Africa</b>				<b>Europe</b>			
South Africa	2.3, 2.6, 3.5	2021 Q1	Mobile	Belgium	3.5	2021-2022	Mobile (5G)
				Croatia	3.5	2021	Mobile (5G)
<b>Asia-Pacific</b>				Denmark	1.5, 2.1, 2.3, 3.5	2021 Q1	Technology neutral
Bangladesh	2.6, 3.5	2021	Technology neutral	Estonia	3.5	TBA	Mobile (5G)
Hong Kong	2.6	2022	Mobile	Kosovo	1.8, 2.1, 2.6	TBA	Technology neutral
	4.9	2021	Mobile		3.5	2022	Technology neutral
India	1.8, 2.1, 2.3, 2.5	2021 Q1	Technology neutral	Lithuania	3.5	2021 Q1	Technology neutral
Indonesia	2.3	2021	Mobile (5G)	Montenegro	3.5	2021	Mobile (5G)
Malaysia	2.6	2025	Mobile (5G)	Netherlands	3.4, 3.7	2026	Mobile (localized 5G)
Myanmar	1.5	2023	Mobile		3.5	2022	Mobile (localized 5G)
	2.3	2022	Mobile (4G, 5G)	Norway	1.5	2022	Mobile (including 5G)
	2.6	2021-2023	Mobile (4G, 5G)		2.3, 2.6, 3.5	2021	Mobile (including 5G)
	3.5	2022-2025	Mobile (4G, 5G)	Poland	3.5	2021 Q1	Mobile (5G)
New Zealand	3.5	2022	Mobile (5G)		3.7	2021 Q1	Mobile (localized 5G)
Pakistan	1.8, 2.1	2021	Mobile	Portugal	1.8, 2.1, 2.6, 3.5	2021 Q1	Technology neutral
Thailand	3.5	2021	Mobile	Romania	1.5, 2.6, 3.5	2021	Mobile (5G)
				Slovakia	1.8	TBA	Mobile (including 5G)
<b>Latin America</b>				Slovenia	1.5, 2.1	2021 Q1	Mobile
Argentina	1.8, 2.1	TBA	Technology neutral		2.3	2021 Q1	Mobile (localized)
Brazil	2.3, 3.5	2021 Q1	Technology neutral		3.5	2021 Q1	Mobile (5G)
Chile	AWS, 3.5	2021 Q1	Mobile (5G)	Sweden	2.1, 2.6	2023	Mobile broadband, mobile (5G)
Colombia	2.3	2022	Technology neutral				
	3.5	2021 Q4	Technology neutral	<b>North America</b>			
Ecuador	AWS, 2.5, 3.5	2021	Mobile (5G)	Canada	3.5	2021 Q2	Technology neutral
Honduras	3.5	2021	Mobile	United States	2.6	TBA	Technology neutral
Mexico	1.9, 2.6, AWS	2021 Q2	Mobile				
Mexico	3.3	2021	Mobile				
Peru	AWS, 2.3	2020 Q2	Mobile (4G, 5G)				

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## High-band spectrum (millimeter-wave bands above 24 GHz)

Only 16 markets so far have confirmed plans of auctioning millimeter-wave, or mmWave spectrum, mostly in the International Telecommunication Union's officially sanctioned 26 GHz band.

MmWave bands still have a smaller following than low- and mid-band spectrum despite the International Telecommunication Union's approval of their use for mobile services in November 2019. Apart from being new and having a less-developed ecosystem, mmWave bands pose significant cost issues related to tower densification and power consumption that discourages some operators from using them.

Consultations in some markets such as Chile, Cyprus and Poland yielded little to no demand for millimeter-wave spectrum from operators, causing regulators to scrap proposed auctions for these bands. This mirrors Hong Kong's experience in March 2019, wherein the local regulator skipped the planned auction process and assigned lots in the 26 GHz and 28 GHz bands to operators for free due to lack of demand.

North America seems to be the only region where millimeter-wave spectrum is highly coveted. The U.S. successfully auctioned licenses in the 37 GHz, 39 GHz and 47 GHz last year after successful allocations of the 24 GHz and 28 GHz bands in previous years. Canada likewise designated the 26 GHz, 28 GHz, 37 GHz-40 GHz and 64 GHz-71 GHz bands as high priority bands that are set to be auctioned starting this year.

Upcoming mmWave spectrum auctions							
Market	Band (GHz)	Target date	License	Market	Band (GHz)	Target date	License
<b>Asia-Pacific</b>				<b>Africa</b>			
Australia	26	2021 Q2	Mobile broadband	Nigeria	26, 37-43	2021 Q4	Mobile (5G)
Malaysia	26	2021-2022	Mobile (5G)	<b>Europe</b>			
	28	2021-2022	Mobile (localized 5G)				
Vietnam	26	2021	Mobile (5G)	Croatia	26	2021	Mobile (5G)
<b>Latin America</b>				Denmark	26	2021 Q1	Technology neutral
				Kosovo	26	2022	Technology neutral
Brazil	26	2021 Q1	Mobile (5G)	Lithuania	26	TBA	Technology neutral
Chile	28	2021 Q1	Mobile (5G)	Montenegro	26	2021	Mobile (5G)
<b>North America</b>				Netherlands	26	2026	Mobile (localized 5G)
				Norway	26	2021	Mobile (including 5G)
Canada	26, 28	2021	Technology neutral	Romania	26	2021	Mobile (5G)
	37-40, 64-71	2021	Technology neutral	Slovenia	26	2021 Q1	Mobile (5G)
					28, 32	2021-2022	Mobile (5G)

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