NGMN White Paper

Spectrum licensing and other regulatory issues for 5G

by NGMN Alliance

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Project:	**Spectrum Group**
Editor / Submitter:	C. Cheeseman (BT), S. Apetrei (Orange)
Contributors:	AT&T, Bell Canada, BT, China Mobile, Chunghwa Telecom, HKT, NTT DoCoMo, Orange, Telecom Italia, Telefonica, Telus, Turkcell, Sprint, Vodafone, Huawei, Nokia.
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1 Introduction

This White Paper builds on the original NGMN 5G White Paper of 2015[1] and the NGMN Spectrum White Paper of 2017[2]. It addresses in more detail the spectrum and regulatory issues in relation to implementation of 5G networks.

As explained in the previous White Papers, the 5G implementations will require a range of new spectrum bands, and re-use of bands already used by earlier generations of mobile technology, in order to deliver the full range of capabilities. In this paper we focus on some of the more detailed licensing issues that concern how the spectrum may be assigned. This is important as it can facilitate and encourage investment and network roll-outs, to bring the benefits of 5G to the widest and earliest extent possible, with appropriate service coverage, quality and features.

A further NGMN White Paper is envisaged in 2018 providing final NGMN views on matters relating to the ITU World Radiocommunication Conference 2019 (WRC-19).

2 Spectrum Access Models (Licensed, Licence-Exempt)

Importance of exclusive licences
NGMN has previously highlighted the importance to mobile network operators of dedicated licensed spectrum and believes this approach should remain the cornerstone of spectrum policy. This requirement stems from the desire to provide assured network quality and reliability for consumers. This was the case for previous generation technologies and continues to apply for 5G.

Considering the bands below 6 GHz, exclusive individual licences should continue as the foundation for mobile networks that are deployed, in order to give contiguous coverage within a country or region, with licence-exempt spectrum in this range delivering additional connectivity in hot spots (e.g. 2.4 GHz and 5 GHz WiFi or LTE-LAA today, and potentially new 5G technologies in future).

When awarding licences to support deployment of 5G capabilities, National Administrations should strike a balance between maximising the use of spectrum and promoting investments. For example, licence conditions could enable spectrum trading or leasing on voluntary basis and thus support commercial arrangements and market mechanisms to facilitate optimal use of spectrum. NGMN therefore advocates consideration of market and commercial incentives to spectrum sharing and to avoid regulatory barriers or requirements that would not support this process.

Complementary role of licence-exempt bands
NGMN recognises the important complementary role of licence-exempt spectrum to deliver the overall 5G vision, noting this is typically suited to lower power short-range connections to mobile devices, and potentially also in future for small cells backhaul.

The NGMN alliance recognises the efforts to explore additional licence-exempt spectrum in the 5 GHz range, which could be of interest for 5G technologies in future. NGMN advocates technology and service neutral regulation of such licence-exempt spectrum.

[1] NGMN 5G White Paper, March 2015,
https://www.ngmn.org/fileadmin/ngmn/content/downloads/Technical/2015/NGMN_5G_White_Paper_V1_0.pdf
[2] NGMN Spectrum White Paper, February 2017,
https://www.ngmn.org/uploads/media/1701031_NGMN_5G_SPECTRUM_WHITE_PAPER_V1.0.pdf

New scenarios with mmWave bands
Some important 5G capabilities, notably very high peak data rates, may be delivered using newly available higher (mmWave) frequency bands where much wider channel bandwidths may be available compared to lower (below 6 GHz) frequency bands. These very high data rate deployments are anticipated to be available in certain localized areas rather than as contiguous coverage throughout an entire country or region. This is a consequence of the technical characteristics of the mmWave bands and the economics of network deployments. Consequently wide area coverage obligations would definitely not be appropriate for licences in the mmWave frequency bands.

Dedicated spectrum may not be needed for specific use cases
It is worth noting that it may not be necessary to dedicate spectrum in some use cases where a particular application needs to have assured quality of service as this can be handled at a network level (e.g. with the help of the "network slicing" concept).

3 Spectrum Sharing Options

For 5G networks the possibility for spectrum sharing can be envisaged on a number of levels.

5G sharing with other radio services
NGMN notes that spectrum sharing can enable greater value to be derived from the use of spectrum. Whilst it is preferable to clear spectrum for 5G (or for sharing to be a transitional measure), where this is not possible sharing may be feasible, especially in higher frequency bands. In the case of sharing of 5G networks with other radio services, the sharing could be managed by coordination of base stations where the mobile terminals are "listen before talk". This scenario may arise for example where mmWave mobile systems are introduced in a band where there may be some legacy fixed links in operation, or where a band is to be shared , perhaps in a transition period, between backhaul and mobile applications.

Sharing between 5G operators
For sharing between 5G operators a number of possibilities exist, ranging from shared network components (e.g. base stations, backhaul, antennas) to shared licensed spectrum, as is already the case today with earlier generations of mobile technology. NGMN notes that various methods of spectrum sharing between operators have been discussed by various national regulators in the past, including with databases and engineering codes of practice. Commercial arrangement between operators provides a potential approach to facilitating sharing, as discussed in section 2 above.

4 National / Regional / Local Assignments

National licences enable operators to deliver national coverage and support international roaming. As mentioned, contiguous national coverage is not anticipated in the case of mmWave bands where the spectrum may be more suited to very high data rate capabilities in more local scenarios such as indoor, urban and sub-urban hotspots, campus complexes, office parks or stadia. Nevertheless, national licences are still important at mmWave frequencies to enable operators to deploy coverage at relevant hot spot locations or fixed wireless access as an alternative to fibre optics deployment, noting that licence conditions could still facilitate spectrum sharing under commercial arrangements in any areas where it is unused, if there is interest to do so.

5 Spectrum Licences to Support 5G

Required bands
A number of applications are envisaged within the 5G umbrella under the three main themes of enhanced mobile broadband, critical communications and massive machine type communications.

NGMN generally favours technology and service neutral spectrum assignments rather than specific frequency bands for specific 5G applications or capabilities.

Operators may typically require access to a range of frequency bands to optimally deliver 5G services, requiring access to new bands and re-farming of existing mobile bands according to their particular situation. A discussion of the spectrum bands that may be suitable for 5G was included in the NGMN Spectrum White Paper issued in February 2017[2]. Further guidance in relation to the additional new bands that are to be considered at the ITU WRC-19 conference are to be addressed in a further NGMN Spectrum White paper that is anticipated in 2018.

Required bandwidths
For existing bands below 3GHz, existing 4G technologies use individual channels of up to 20MHz and multiple channels and aggregated carriers are often used.

New 5G technologies are undergoing standardisation. NGMN notes that carrier channel bandwidths up to 100 MHz wide have been discussed in 3GPP for 5G new radio (5G NR) in some potential initial frequency bands below 6GHz and carrier channel bandwidths up to 400MHz wide for some initial mmWave bands[3]. Higher total bandwidths are envisaged with carrier aggregation (under study).

The ability to achieve the ITU IMT-2020 targets and future vision will require bandwidths up to or exceeding 1GHz[4].

Licence conditions to promote operator investments
The licence rights and obligations for spectrum to be used for 5G are of critical importance to the successful implementation of 5G networks and capabilities. Important considerations include:

- The rights and obligations attached to licences should be clear at the outset and should be carefully considered in terms of whether they will promote investment and be commercially viable.
- Long licence durations (e.g. 25 years or indefinite) can help give confidence to commit the required extensive investments in 5G mobile networks, as would presumption of automatic licence renewal for existing networks in successful commercial operation(where licences are not already indefinite).
- A technology and service neutral approach will ensure that the latest and most appropriate technologies can be deployed.
- Tradable licences to help enable spectrum to be made available to those that can generate best use and may provide a means to help resolve any inefficiencies in initial assignments.
- For higher (mmWave) bands, regulatory coverage requirements should be markedly eased or removed as their usage will not be intended for wide area coverage.

[3] For example, see 3GPP RAN4 document R4-1704397. - http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_82Bis/Docs/R4-1704397.zip
[4] See Sec 4.13 of Report ITU-R M.2410-0 - Minimum requirements related to technical performance for IMT-2020 radio interface(s) https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2410-2017-PDF-E.pdf

- The mobile traffic is increasing dramatically. Therefore, operators need to densely deploy small cells to alleviate the traffic congestion. In addition, considering the spectrum characteristic of the mmWave bands, the deployment of mmWave bands are expected to be available in small local area which is appropriate for small cells installation. Thus, regulators should remove/relax deployment barriers for the installation of small cells to encourage operators to invest 5G.