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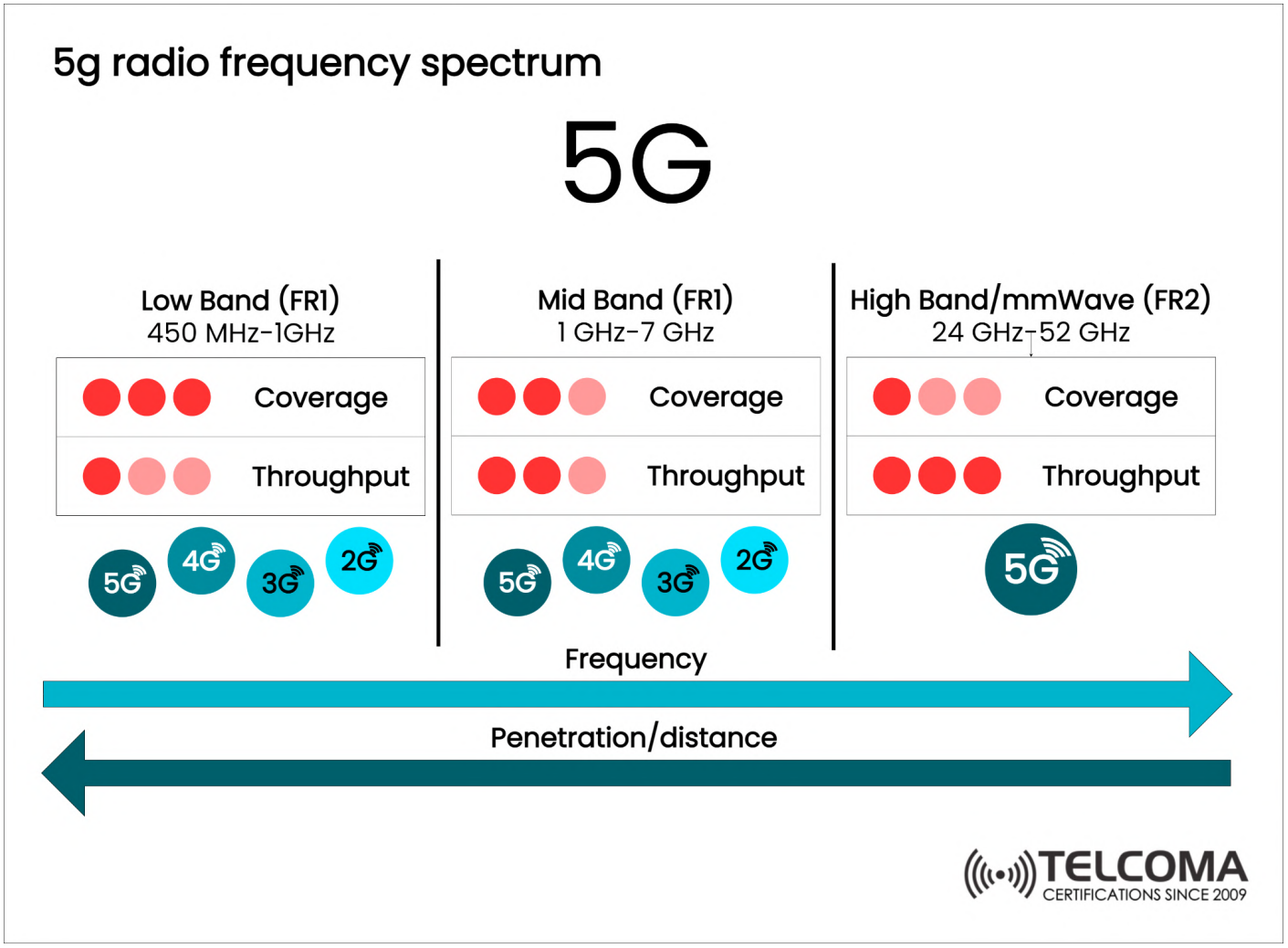
TELCOMA Global Whitepaper

5G Frequency Bands

5G frequency bands

Introduction

The 5G Spectrum is a range of radio frequencies in the sub-6GHz range and the millimeter wave (mmWave) frequency range that is 24.25 GHz and above. The 5G spectrum refers to the radio frequencies that carry data from user equipment (UE) to cellular base stations to the data's endpoint. LTE networks that use frequencies in the sub-6GHz range will be sharing the space with 5G traffic. The lower frequency bands will be used for less densely populated areas because data can travel further, through slower on these frequencies.

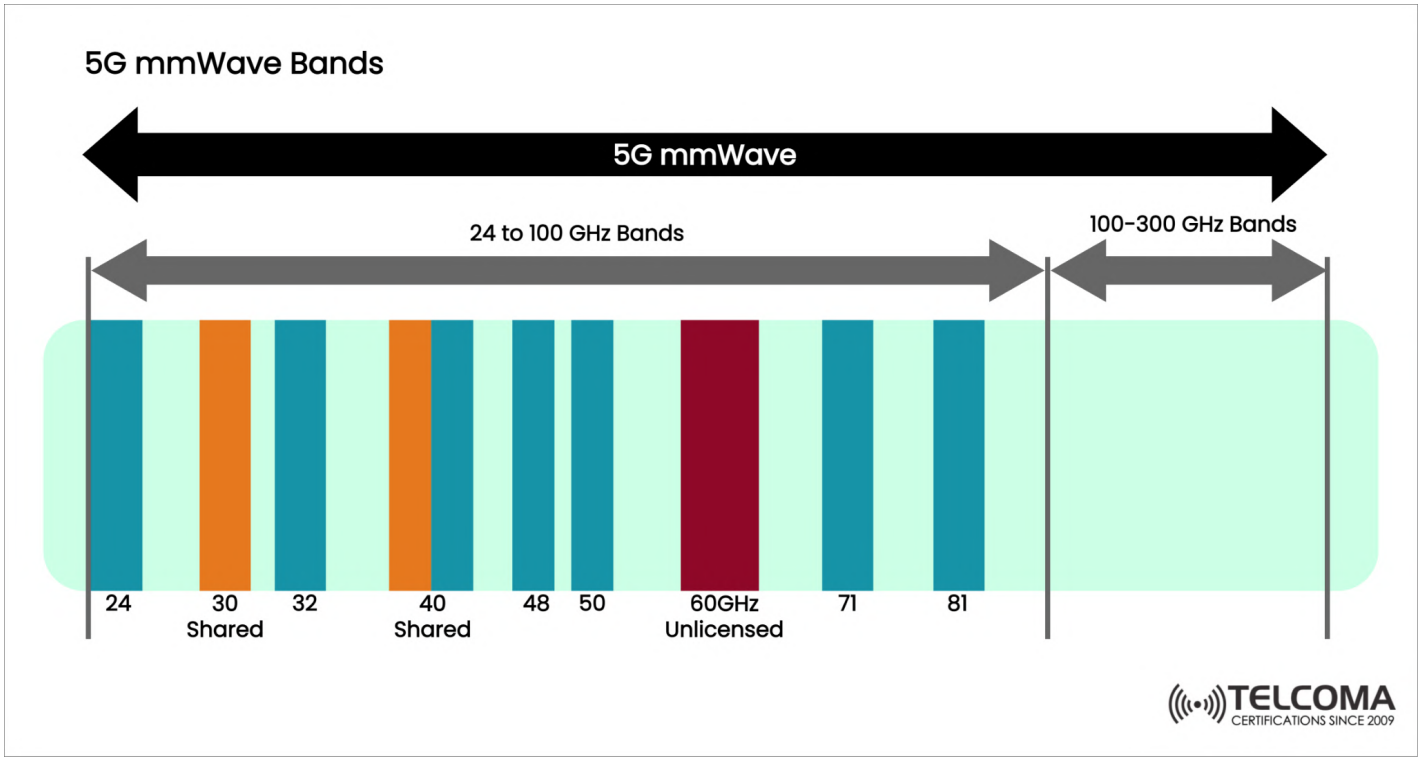


Low and Mid bands for coverage and capacity

Low-bands (e.g sub-1GHz) supports widespread coverage, including indoors, across urban, suburban, and rural areas, while the mid-band spectrum offers a mix of coverage and capacity benefits. The majority of the commercial 5G networks are relying on the spectrum in the range of 3.5 GHz (3.3 GHz- 4.2 GHz). The low-band spectrum offers good coverage because of the relationship between frequency and distance. Low-band spectrum in any spectrum that is lower than 1GHz. In the 5G world, the low-band spectrum will make it possible for various operators to provide a wide range of coverage. The Mid-band spectrum provides coverage and capacity. Spectrum in the 1 GHz - 6GHz range in the mid-band spectrum is considered ideal for 5G because it can carry large amounts of data over a distance.

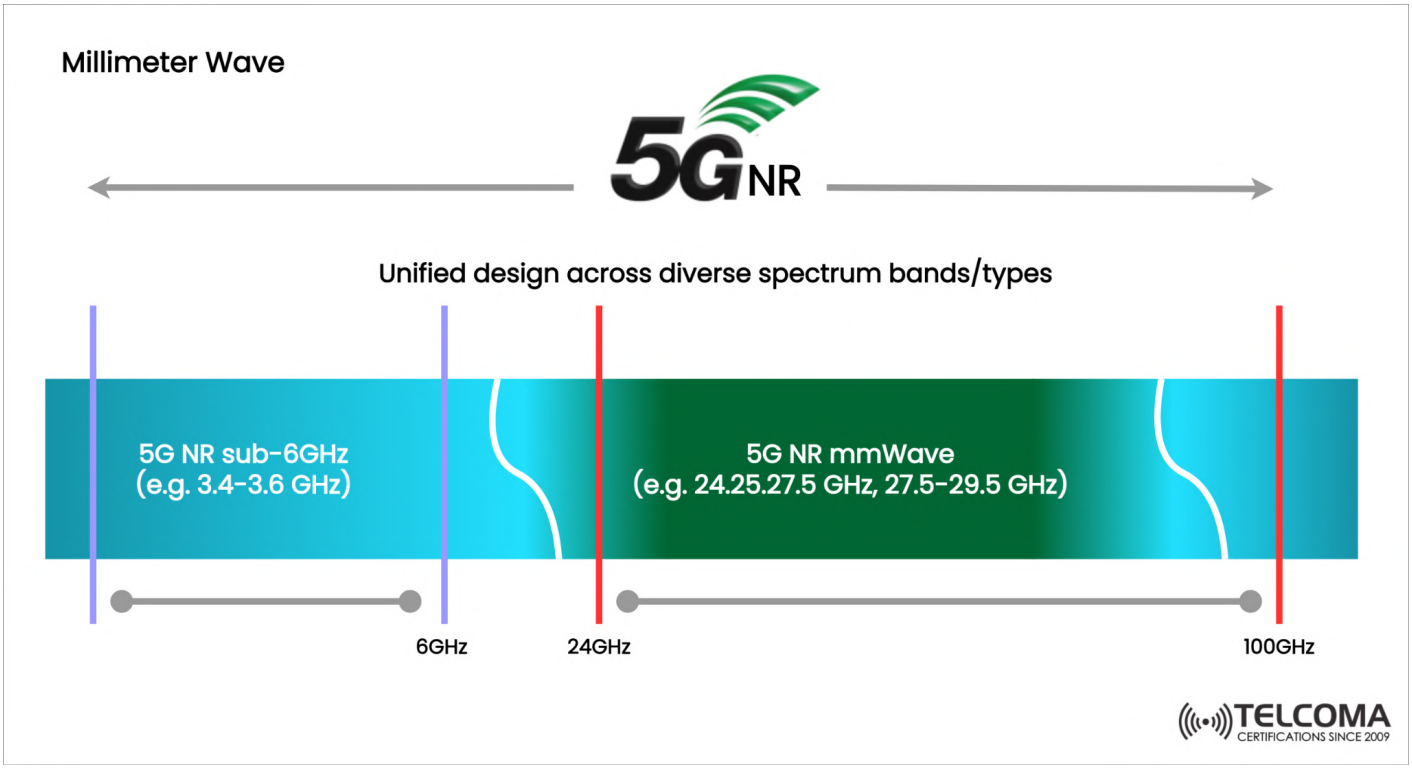
5G Spectrum in the millimeter waves

mm-Wave spectrum is also known as the High band spectrum that offers super-fast speeds over a short distance. This spectrum band is 24 GHz and higher. Operators should support mmWave spectrum in the 26GHz, 40 GHz, 50 GHz, and 66 GHz bands for mobile services. This spectrum is limited because mm waves can't travel much distance. It can offer a speed of 1gbps - 3gbps or higher.



5G NR Frequency bands

New Radio supports a spectrum that has a varied frequency range and the spectrum is categorized as a low band (below 1 GHz), mid-band (1-6 GHz), and high band (Above 24 GHz). The high band is also named as mmWave band. It uses two frequency ranges FR1 and FR2. FR1 includes 6 GHz frequency bands and below. FR2 supports bands in the mm-wave range which includes 24.25 - 52.6 GHz. The mmWave bands are helpful to enable 5G UWB (Ultra-wideband).5G NR supports five types of sub-carrier spacing of 15 kHz, 30 kHz, 60 kHz, 120 kHz, and 240 kHz in the FR 1 (Frequency range 1) and FR2 (Frequency range 2).



5G Spectrum Key points

- The frequency bands for 5G networks come in two sets: FR1 (450 MHz - 6 GHz), FR2 (24.25 GHz - 52.6 GHz)
- To share frequencies used by LTE and 5G networks, frequency and time division duplexing can be used.
- Lower frequency spectrum bands will not be available for auction because of the existing licenses.
- Higher frequency bands are available for auction because they are not currently licensed.

Large quantities of the new radio spectrum, also known as New Radio frequency bands, have been allocated to the 5G technology to fulfill all the requirements of 5G. U.S FCC (Federal Communications Commission) has freed up vast amounts of bandwidth for 5G use cases.

Higher frequency bands in different countries

- Europe: 3400-3800 MHz
- China: 3300-2600 MHz
- China: 4400-4500 MHz
- China: 4800-4990 MHz
- Japan: 3600-4200 MHz
- Japan: 4400-4900 MHz
- Korea: 3400-3700 MHz
- USA: 3100-3550 MHz
- USA: 3700-4200 MHz

mmWave frequency bands in different countries

- Europe: 24.25-27.5 GHz for commercial deployment from 2020
- China: focusing on 24.25-27.5 and 37-43.5 GHz studies
- Japan: 27.5-28.28 GHz
- Korea: 26.5-29.5 GHz
- USA: 27.5-28.35 GHz and 37-40 GHz

Lower 5G frequency bands

The bands 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1.5 GHz, 2.1 GHz, 2.3 GHz, and 2.6 GHz are considered for traditional coverage applications and new specific usages such as the Internet of things (IoT), Industry Automation, and business-critical use cases. Spectrum refarming will be required for most of the spectrum bands, hence the time required to have them allocated to 5G will be much longer than the higher bands.

How much spectrum does 5G need?

NR specifications include traditional as well as new frequency bands. It supports channel bandwidth ranging from 5 MHz to 100 MHz for bands below 6 GHz and channel sizes from 50 MHz to 400 MHz in bands above 24 GHz. 5G supports carrier aggregation to enable very high speeds which makes it possible to have faster, lower latency, and greener 5G services.