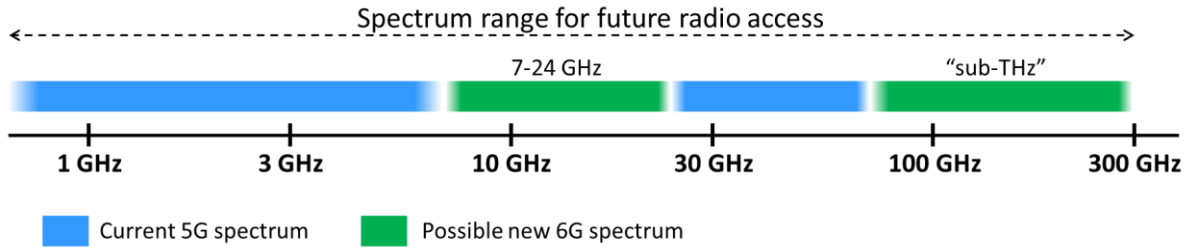
GSA views on THz spectrum

UK Spectrum Policy Forum
Workshop on THz frequencies

20 April 2022

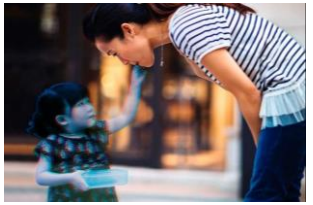
Foreword

- Sub-THz and THz spectrum represent a new frontier in wireless communications.
- In this context, GSA refers to the 92-300 GHz spectrum as “sub-THz” and the spectrum above 300 GHz as “THz”.
- Even though a significant amount of research is ongoing in these very high frequency bands with 6G as a target, it is important to note that 6G is envisioned to utilize a wide range of frequency bands spanning sub-1 GHz to sub-1 THz.



Use cases of the sub-THz and THz spectrum

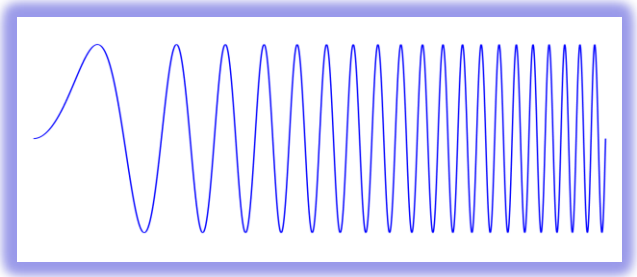
- Some of the potential use cases in the sub-THz and THz spectrum include:
  - Immersive experience with holography beyond conventional XR
  - Multi-sensory communication with telepresence
  - High resolution mapping and digital twinning
  - Positioning and sensing for robots and cobots
  - High-speed communication links
- While it is still very early to provide an accurate view of the channel bandwidths required, from a high level ‘ball-park’ view, it can be estimated that a contiguous amount of spectrum needed to support a peak data rate of 1 Tbit/s would be in the order of tens of GHz per network.



Important aspects of sub-THz and THz spectrum

Concentration of demand

- It is very likely that the use of the sub-THz range will start before that of the THz range, in part due to hardware developments and availability.
- As a result, there will most likely be an initial concentration of demand in the 92-300 GHz.
- Several research innovations such as enhanced beam forming, ultra-massive MIMO antennas, Reconfigurable Intelligent Surfaces, Embedded (AI/ML) and improvements in energy efficiency may become technology enablers for THz communications.

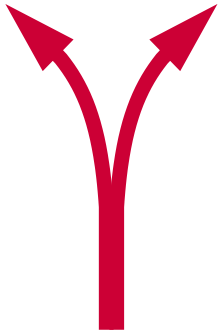


Harmonisation vs. fragmentation

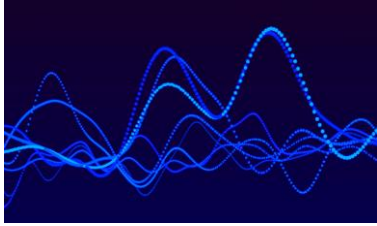
GSA considers that

a) fragmentation, particularly in new and innovative frequency ranges such as the sub-THz and THz ranges, can lead to innovation silos, to a slow-down in the growth of the technology, to a stifling of adoption and to ecosystem challenges.

b) global harmonization in these ranges is highly desirable in order to bring this nascent technology to maturity. This includes harmonised frequency assignments as well as authorisation models and technical conditions.



Propagation aspects



GSA considers that

a) even though signals attenuate relatively faster in these very high frequency ranges, harmful interference cannot be precluded and should be analysed.

b) the possibility of scattered signals interfering with other users in the vicinity, especially in dense deployments, cannot be ruled out even with directed narrow beams.

Some of the initial research in sub-THz spectrum indicates that communication distances of 50-100 m can be achieved. The goal of research activities is to reach a range of 100-200 m with the sub-THz/THz spectrum in the future.

Authorisation regimes

GSA considers that

a) spectrum management in the sub-THz and THz ranges should enable operation without compromising performance requirements of 6G applications, including security and reliability.

b) To guarantee QoS which in turn leads to certainty for investments, individual licencing will be required for some applications and portions of spectrum.

c) the most efficient use of sub-THz and THz spectrum can be achieved by considering diverse approaches such as individual licensing, effective and least-restrictive implementation of inter-service co-existence and sharing, and license-exemption, depending on the use cases and their technical performance requirements for coverage, capacity, throughput, latency, security, etc.

International consensus

There is a global aspect to consider in relation to sub-THz and THz spectrum due to their important use for space-based applications which are inherently global by their nature.

GSA considers that

a) sharing among terrestrial and passive space applications in 92-300 GHz would be a key consideration to enable sufficient contiguous spectrum for terrestrial applications in this range. In this context, Resolution ITU-R 731 is of relevance.

b) international consensus is thus crucial for the evolution of technologies in these frequencies.

Technical standards

- GSA considers that 3GPP specifications as defined today support a diverse range of use cases including mobile broadband, IoT, automotive, fixed wireless access and non-terrestrial networks, and aims to ensure that all these use cases can interoperate.
- GSA expects that ITU-R and regional/national regulations will continue to be the basis for ensuring co-existence among services.
- Around 2030 is targeted for 6G standards and initial deployments.

Summary

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- Realisation of 6G applications in sub-THz and THz frequencies requires tens of GHz/network.
- Hardware development and availability will most likely concentrate initial demand to the lower part of sub-THz spectrum.
- Global harmonisation needed to avoid fragmentation which could lead to ecosystem challenges.
- Individual licencing is essential for QoS and certainty of investments for some applications and services. The need for diverse authorisation regimes should be carefully assessed, in order to secure QoS and certainty of investments, while enabling diverse use cases.
- Sharing with incumbents and international consensus is crucial for the evolution of technology in these frequencies.

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