

Elisa appreciates the opportunity to comment on RSPG draft document (dated on 14 June 2023): The development of 6G and possible implications for spectrum needs and guidance on the rollout of future wireless broadband networks.

Elisa wants to raise some specific remarks regarding the opinion section, and especially the need for additional frequencies for 6G networks as stated in the title of the document ("The development of 6G and possible implications for spectrum needs"). According to Elisa's point of view, it would be very important that new IMT-spectrum for additional 6G frequencies within 7-15 GHz shall be studied in WRC-27 so that new frequencies would be aligned with timing of 3GPP 6G specifications and first products.

In further work and In the Opinion section of the report, it would be necessary to clearly highlight the need for new 6G additional frequency bands. According to preliminary evaluations, the need for additional frequency band for the 6G network for one mobile network operator would be at least 500 MHz.

In order to implement 6G services with stable quality and nationwide coverage (as with the technologies of previous generations), new additional frequencies for 6G networks especially from the mid band frequency range (i.e., from frequency band 7-15 GHz) are needed. In our opinion, it is not at all reasonable or even commercially possible to start building 6G networks and offering 6G services with extremely high frequencies (meaning frequencies of several tens of GHz) due to fact that geographical coverage becomes extremely limited. This would result in 6G coverage being available only locally and most probably only in line-of-sight situations clearly limiting the potential of 6G services.

The solution must not solely rely on network densification or shared use of existing 5G frequencies among 6G. First of all, at some point densification is no longer economically possible due to relatively high investments and operating costs for base stations covering only small geographical areas. In addition, densifying the base station network grid is strongly associated with challenges related to site permitting and acquisitions. Secondly, in the current and possible new 5G frequency bands (upper 6.5 GHz or U6GHz), there is not enough frequency band available per operator for anticipated 6G requirements. From Elisa's point of view, these frequencies will be heavily used in 5G - at least before 6G starts to take over the traffic with the new frequencies. Possible new millimeter frequency ranges (e.g., 40 GHz) have sufficient frequency capacity for the needs of 6G, but due to weaker propagation characteristics, they are anticipated to be available only for certain deployment scenarios or use cases. Finally, additional and significant shortcoming in existing frequency bands is related to the limitations of the transmission direction (uplink). In TDD technologies, generally adopted and implemented frame structures are favoring in the download direction resulting in considerably lower rates for uplink direction. Envisioned 6G use cases (and already 5.5G use cases) as XR will require more uplink rates and capacity, and new frequencies in the frame of 6G would definitely ease this challenge.

If enough new mid-range frequency band is not assigned to 6G networks, the risk is that 6G networks with sufficient frequency band can only be built in a fairly spot-like fashion in urban environments. In this case, the benefits brought by 6G technology would remain helplessly unreachable and would be available only to limited amount of users.

---

Title: Head of Mobile Access Technology

First name: Jarno

Last name: Niemelä

Name of organization: Elisa

City: Helsinki

Country: Finland