Advances on 5G, research directions and role of optical technologies - An industry view

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SUMMARY

One important aspect of 5G, compared to previous generations, is the prominent role of a diverse set of usage scenarios with applications above and beyond the traditional high-speed connection. Even though enhanced mobile broadband (eMBB) is still an important use case for mobile operators around the world, emergence of other usage scenarios such as those classified under massive machine type communications (mMTC) and ultra-reliable/low-latency communications (URLLC) enabled by 5G NR has opened the door for a myriad of non-traditional applications.
In this context 5G is targeting unprecedented improvements over the previous generations of mobile networks such as a 1000-times increase in system capacity, 100-times improvement in energy efficiency, down to milliseconds end-to-end network latency and massive machine type connectivity for numerous devices.

Notwithstanding 5G is in its deployment phase industry is already researching what is coming beyond 5G with a further new set of challenges to satisfy the envisaged applications that are going to require even more bandwidth, extremely precise positioning, real-time and up-link centric broadband, integration of communication and sensing.

In order to implement this vision, millimeter-wave spectrum, new solutions and new network topology will be necessary posing challenges to the research not only for the wireless domain but also for optical technologies, expected to play a key role for innovative base stations architectures and above all in the backhaul to transport and route the enormous quantity of data.

Envisioned 5G to 6G communication architecture scenario

5G to 6G key requirements driving evolution of mobile access and wireless x-haul to millimeter-wave and sub-millimeter ranges

Research directions for optical technologies in the backhaul and innovative base station architectures
Analysis of the most important requirements of 5G to drive optical technologies

- Free Space Optical links both in Near InfraRed and Mid InfraRed ranges
- RoF or MWoF technologies
- Microwave Photonics for sub-TeraHz signal generation