

## SESSION 3.6 - 5G, FROM TECHNOLOGY TO ITS ENABLED APPLICATIONS

### **Invited speech - EMF EXPOSURE EVALUATIONS FOR FUTURE NETWORKS BASED ON TDD AND MASSIVE MIMO: NEW INTERNATIONAL REGULATIONS**

Future networks will allow to reach high level of connectivity and capacity in order to respond to the growing traffic needs of the next years. It means that, future fifth generation of mobile network (5G) will rely not only on the expansion of existing fourth (4G) Long Term Evolution (LTE) network, but thanks to the introduction of new radio access in the millimetre wave bands will allow to meet these new requirements. Specifically, future networks will be characterized by a very large installations deployment in terms of macro/micro/femto cells. In addition, 5G New radio (NR) is characterized by advanced antenna technologies such as massive MIMO (Multiple Input, Multiple Output) and beamforming techniques, for which the beam is steered in the directions where it is needed, rather than to constantly transmit energy in a wide sector. It suggests that, an exposure evaluation based on traditional conservative approach where theoretical maximum power is transmitted in each possible direction for a long time period is unrealistic.

By these considerations, it appears that the RF EMF (Radio Frequency Electromagnetic Field) compliance assessments with the regulatory requirements for human exposure for the installation permission needs to be revised accordingly. As a measure for harmonization of the member States the European Commission indicated in the “5G Action Plan” the importance of all European Countries to align their policies and legislations for EMF exposure, according to the International Commission on Non-ionizing Radiation Protection (ICNIRP), in order to promote an efficient 5G roll-out. In particular, in order to promote a collaborative interaction of all countries for 5G development, the International Telecommunication Union (ITU) within the framework ITU Regional Initiative for Europe on Development of Broadband Access and Adoption of Broadband, promoted European Country Case Studies to evaluate the impact of national legislation to the introduction of future 5G mobile network. By evaluations, it emerged that countries characterized by more restrictive limitations with respect to the ICNIRP guidelines could experiment difficulty to introduce broadband wireless networks. This situation already experimented in 3G-4G migration, could become more critical for the future network deployment, such as 5G.

For this reason, in order to cope with the new challenges posed by the innovative 5G radio access networks, the International Electrotechnical Commission (IEC), in the TC106 “Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure” has developed an improvement of exposure assessment methodologies including 5G frequencies in the Standard IEC 62232 Ed.2 where the actual maximum power instead of the nominal one, defined as the 95th percentile of the measured values, has been considered. This approach takes into account the long-term behavior of spatial multiplexing capabilities of Massive MIMO antennas, as well as radio resource utilization and TDD transmission intervals.

As a consequence, the Italian Electro technical Committee [CEI], established the importance to introduce in the technical guides CEI 211-7E and CEI 211-10 (needed to evaluate EMF according to the Italian Regulations), new updates by considering novel EMF metrics. As Massive MIMO and TDD will be the main components of future 5G networks, the statistical model is likely to be the most appropriate for the EMF compliance assessment of future networks, and thus the regulations will be updated accordingly.

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