

Figure 3. Peak spatial average absorbed power density with and without smart contact lens at 60 GHz

S09-7 [09:30]

**EXPOAUTO – An international research project on cumulative exposure of people of different ages to radiofrequency electromagnetic fields from new technologies in automotive services and connected objects**

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**Presented by: Gabriella Tognola**

The paper presents the objectives, the architecture, and the partnership of the international Project EXPOAUTO ‘Cumulative real smart car exposure to radiofrequency electromagnetic fields in people of different ages from new technologies in automotive services and connected objects’ financed by the French National Research Program for Environmental and Occupational Health of Anses (2020/2 RF/05).

**Abstract**

The automotive sector is evolving toward the concept of ‘intelligent’ mobility where cars are smart inter-connected ‘ecosystems’ that can sense the environment (e.g., detect blind spots during parking through

radars placed on the car body) and communicate with other cars, the infrastructure, the network, and pedestrians for sharing and obtaining information via mobile broadband (3-4-5G), Wi-Fi or satellite technology, and with Internet of Things (IoT) devices. The situation is that passengers in a car and people in the car nearby (e.g. pedestrians) are exposed to a variety of RF generated by the technologies used in automotive connectivity that are operated from a few GHz (e.g., for applications using WiFi protocol) to many GHz, up to 79 GHz as for radars used in almost all modern cars for parking aid and collision warning [1-3].

EXPOAUTO is a multi-centric research project that involves three teams, namely in Italy (CNR, coordinator), France (TPT), and Belgium (IMEC).

EXPOAUTO aims to: 1) Identify and characterize technologies and protocols used in the 'car ecosystem', including IoT technology deployed with 5G; 2) Experimentally measure electromagnetic fields emitted by real devices in connected cars with in-lab and on-road testing along the existing 'smart highway track' in Belgium, France, and Italy; 3) Determine the cumulative exposure (RF power absorbed in different organs) in passengers and pedestrians, by type of technology and use in realistic use case scenarios.

As shown in Fig.1, EXPOAUTO is articulated in four interconnected Workpackages, as described below:

- WP1-Identification of technologies in smart car ecosystems: i) to identify all the potential wireless transmissions in the 'car ecosystem', accounting also for personal mobility and infotainment; ii) to investigate how these technologies are employed in typical use-case scenarios in car ecosystems.
- WP2-Experimental measurements of RF EMF emitted by real devices in connected cars in-lab and on-roads: i) in-lab measurement of power levels and duty cycles (throughputs for car connections) for the car technologies and configurations identified in WP1 [4-5]; ii) on-road testing along smart highways and urban environments equipped with wireless communication and sensor technologies in Belgium, France, and Italy, also for characterize the influence of smart road infrastructure on the actual output power [6].
- WP3-Estimation of RF power absorption in humans of different ages, from neonates to adults and pregnant women: i) to analyse the frequency used and location of the sources of interest and their possible coupling to humans; ii) to determine for organs of interest (e.g. brain, whole body, genital organs) the relationship between power emitted (or incident power density) and power absorbed [7-8].
- WP4- Assessment of cumulative exposure of the novel 'car ecosystem' for different technologies and people at different ages in real-life situations: i) design of surrogate models of complex use-case scenarios of the 'car ecosystem' and calculation of the dose of exposure using advanced techniques, such as Stochastic Dosimetry and Machine Learning [9-10]; ii) development and evaluation of the EXPOAUTO cumulative exposure index in real exposure scenarios of the 'car ecosystem'.

More details will be given and discussed during the presentation, including brief reports on the updated outcomes of the Project.

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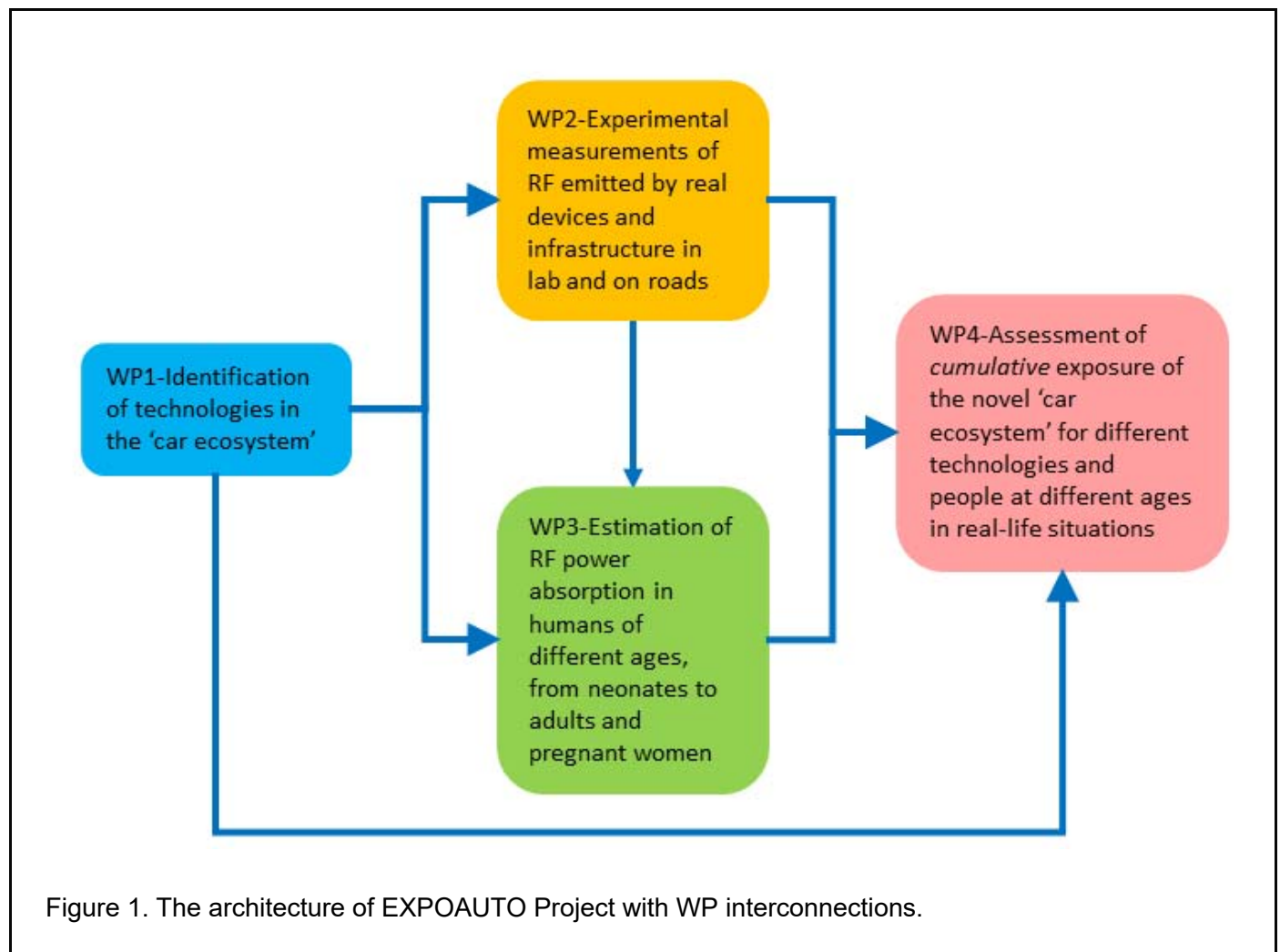
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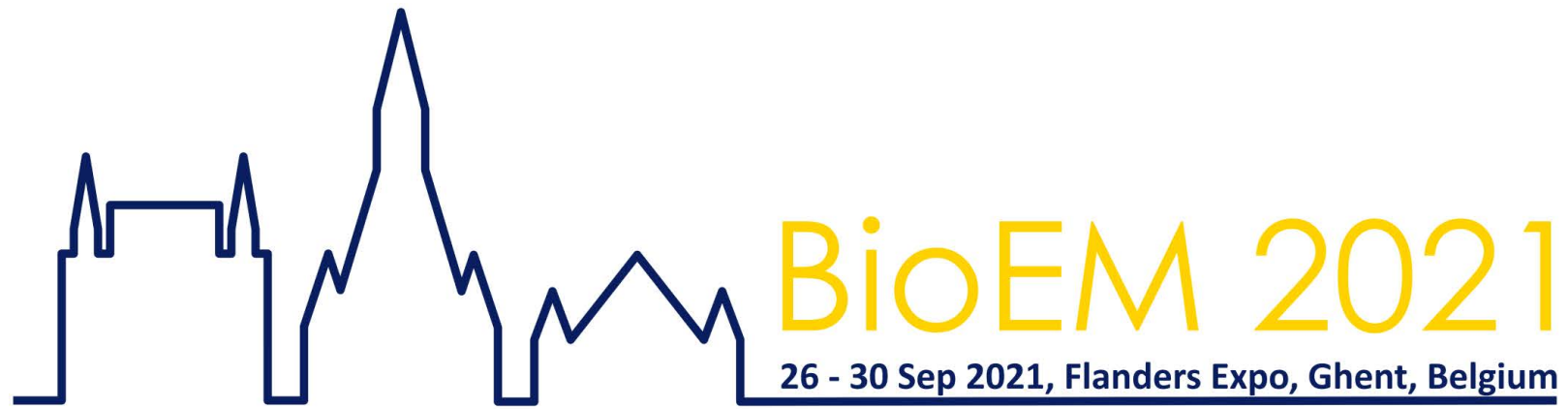
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## Figures





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