ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING

CNR - Sub-THz Electromagnetics for Space Applications and 6G

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Context of the research activity	This research activity is focused on mm-wave and subTHz smart radio environments for terrestrial applications, future satellite links for non-terrestrial networks and observation/sensing systems operating from 30 to 850 GHz. Both antenna systems and metasurfaces will be considered in terms of modeling, design, experimental characterization (device and channel), and advanced manufacturing (silicon and metal micromachining, additive manufacturing).
Objectives	The frequency spectrum above 100 GHz will unlock new possibilities in terms of both resource sharing and performance for modern communication and sensing applications (6G and beyond). Smart radio environments will exploit a large number of antennas and intelligent reflective surfaces to achieve greater capacity and reliability. Seamless integration to non-terrestrial networks (UAVs, High Altitude Platforms, Satellites) will require fast and reliable links that to do not interfere with present systems. In such a complex scenario, the optimum resource allocation will require both a comprehensive knowledge of the available channels and high-performance devices. The Istituto di Elettronica ed Ingegneria dell'Informazione e delle Telecomunicazioni (IEIIT) of Consiglio Nazionale delle Ricerche (TO) has a long heritage in the design and characterization of microwave and millimeter-wave subsystems for both space and terrestrial application, developed and exploited in several projects with Thales Alenia Space, OHB, TIM, and many other partners. The candidate will be enrolled as a researcher in the team that is exploring the capabilities of the subTHz spectrum be means of the new research infrastructure denominated TeraHertz Advanced Manufacturing (TERAM) and the new facilities that will be acquired within the projects of Piano Nazionale di Ripresa e Resilienza (PNRR) denominated SoBigData, RESTART and Earth-Mars-Moon. Both indoor and outdoor channel measurements will be performed up to 750 GHz using innovative scanning techniques to assess the capabilities of reflective surfaces in real scenarios. These activities will be performed in collaboration with an interdisciplinary team of researchers on signal

	processing and artificial intelligence to identify both models and performance at system level. As far as devices are concerned, present designs of antenna systems at subTHz frequency are very lossy, generally single-polarized and with poor repeatability. Silicon-micromachined devices have good performance but they are very fragile for integration in satellite systems and ground stations. In this research, we will define new device configurations to overcome the fragility aspects. We will also study metal-only passive devices for the subTHz regime that can be manufactured with the modern micromachining techniques with very high accuracy and surface quality. This will provide both high-performance and robustness for the relevant operative conditions.

Skills and competencies for the development of the activity	Knowledge on applied electromagnetics with reference to antenna technologies (arrays, feed systems) at microwave/millimeter-waves. Experience on simulation tools and lab equipment. Knowledge on Matlab for data post-processing. General knowledge on communication and sensing. Good attitude to team working.