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Title:State of the art in 60-GHz integrated circuits and systems for wireless communications

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Abstract:This tutorial presents an overview of the technological advances in millimeter-wave (mm-wave) circuit components, antennas, and propagation that will soon allow 60-GHz transceivers to provide multigigabit per second (multi-Gb/s) wireless communication data transfers in the consumer marketplace. Our goal is to help engineers understand the convergence of communications, circuits, and antennas, as the emerging world of subterahertz and terahertz wireless communications will require understanding at the intersections of these areas. This paper covers trends and recent accomplishments in a wide range of circuits and systems topics that must be understood to create massively broadband wireless communication systems of the future. In this paper, we present some evolving applications of massively broadband wireless communications, and use tables and graphs to show research progress from the literature on various radio system components, including on-chip and in-package antennas, radio-frequency (RF) power amplifiers (PAs), low-noise amplifiers (LNAs), voltage-controlled oscillators (VCOs), mixers, and analog-to-digital converters (ADCs). We focus primarily on silicon-based technologies, as these provide the best means of implementing very low-cost, highly integrated 60-GHz mm-wave circuits. In addition, the paper illuminates characterization techniques that are required to competently design and fabricate mm-wave devices in silicon, and illustrates effects of the 60-GHz RF propagation channel for both in-building and outdoor use. The paper concludes with an overview of the standardization and commercialization efforts for 60-GHz multi-Gb/s devices, and presents a novel way to compare the data rate versus power efficiency for future broadband devices. © 2011 IEEE.