Abstracts

Millimeter-wave remote self-heterodyne system for extremely stable and low-cost broad-band signal transmission

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We have developed a millimeter-wave remote self-heterodyne transmission system that enables extremely stable and low-cost broad-band transmission in the millimeter-wave band. The system was applied to a 60-GHz-band transmission system for the first time. The transmitter of the developed system transmits RF modulated signals and a local oscillation signal simultaneously, and the receiver detects these signals by using a square-law-type detection technique, thus creating a very stable and low phase-noise millimeter-wave transmission link without the use of an expensive and more advanced frequency-stabilization technology. Since the receiver no longer requires a millimeter-wave oscillator for frequency conversion, the devices used in this system can be miniaturized and the cost of the system can be reduced. This paper discusses the performance of the developed system in terms of its phase-noise degradation and carrier-to-noise power ratio (CNR). We also discuss the optimal transmitter design to obtain the maximum CNR. Using our miniaturized monolithic millimeter-wave integrated-circuit-based 60-GHz-band experimental system, we demonstrate that our millimeter-wave transmission link is completely free of phase-noise and frequency-offset degradation due to the use of a millimeterwave local oscillator. We show that equal transmission-power distribution between the RF signal and local carrier gives the maximum CNR under the transmission-power-limited conditions. Also, we demonstrate that QPSK-modulated satellite broadcast multichannel video signals with a 300-MHz bandwidth, in total, can be successfully transferred over a distance of 8 m.

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