Abstracts

Novel Design Approach for X-Band GaAs Monolithic Analog 1/4 Frequency Divider

K. Honjo and M. Madihian. "Novel Design Approach for X-Band GaAs Monolithic Analog 1/4 Frequency Divider." 1986 Transactions on Microwave Theory and Techniques 34.4 (Apr. 1986 [T-MTT]): 436-441.

A novel analog frequency divider which can generate a 1/4 frequency component is proposed. The frequency divider consists of a dual-gate FET and a two-stage capacitor-resistor coupled amplifier. This circuit configuration also enables achieving a small-size GaAs MMIC analog frequency divider. In this analog frequency divider, the input signal f/sub 0/ is mixed with signal component f/sub 0//x caused by noise or transients in a feedback loop. Then, a (1 -- 1/x)f/sub 0/ IF component is induced and is again mixed with the input signal. This process delivers the f/sub 0//x component regeneratively. Resultant continuous signal components f/sub 0//x and (1-1/x)f/sub 0/ have a harmonic relation when the system reaches a steady state. The f/sub 0//x component can be mainly obtained at an output port of the frequency divider. The operation band was simulated using a SPICE II computer program. The designed bandwidth and conversion gain for the 1/4 frequency divider are 8.5-10.6 GHz and -3 dB, respectively. Based on the simulation, a GaAs monolithic analog 1/4 frequency divider was made and tested. The developed 1/4 frequency divider provides a 8.5-10.2-GHz operation bandwidth and --5±1-dB conversion gain. The designed and experimental values are in good agreement. The frequency division band can be shifted to higher frequency (10.65-11.2 GHz) by adopting the external matching circuit at the GaAs chip output port. The proposed analog frequency divider circuit can be applied not only for 1/4 frequency division, but also for 1/n frequency division (interger n > 2).

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