A design of 28.5GHz META-VCO based-on meta-material using CMOS Process

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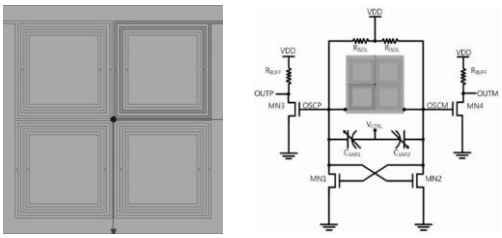
I. INTRODUCTION

A CMOS META-VCO (Voltage Controlled Oscillator) is designed using 180nm CMOS technology with the frequency of 28.5GHz for 5G mobile communication system. The proposed CMOS VCO operates at 28.4GHz ~ 28.6GHz according to the control voltage. The phase noises are -160.3dBc/Hz and -169.4dBc/Hz at 1MHz and 10MHz offset respectively.

II. VCO design

A. *Meta-structure for the proposed VCO*

Meta-material is used to have special electrical properties that can't be found in nature. In this paper, we use the SRR(Split Ring Resonator) structure by controlling the geomatrical variables of the SRR structure to obtain the LC resonance characteristics. Figure 1 (a) show the proposed meta-structure resonator array.



(a) (b)

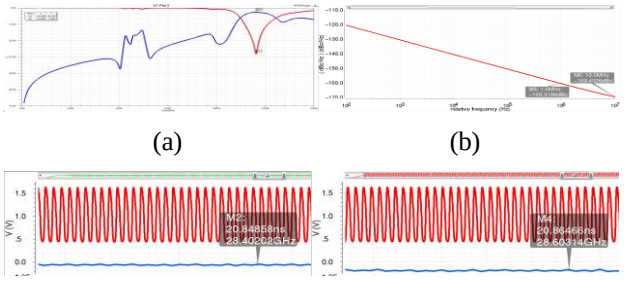
Figure 1. (a) MATE resonator structure using SRR array
(b) META-VCO circuit

B. *META-VCO design*

Figure 1 (b) show the META-VCO circuit adapting the meta-material designed using HFSS. The META-VCO is composed of meta-material for the inductor role, NMOS cross coupled pair having negative resistance, and two varactors. It was designed to control the oscillation frequency according to V_{CTRL}.

III. CHIP SIMULATION RESULTS

Figure 2 shows the META-VCO simulation result and HFSS simulation result. The META-VCO has the operating range of 28.4 ~ 28.8GHz by controlling V_{CTRL}. The phase noises are -160.3dBc/Hz and -169.4dBc/Hz at 1MHz and 10MHz offset frequency. Figure 2 (a) shows the resonance frequency characteristic using HFSS. S_{11} is -35dB and S_{21} is -3.3dB. Figure 3 shows the photo graphy of the fabricated chip.



(a) (b)

(c) (d)

Figure 2. (a) S_{11} and S_{21} Simulation
(b) Phase noise simulation (c) VCO output (V_{CTRL}=0V)
(d) VCO output (V_{CTRL}=1.8V)

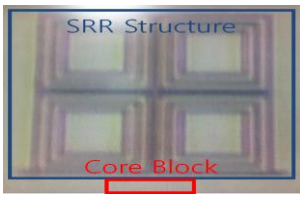


Figure 3. Chip top view

The test results are not shown so we analysis the reasons. Frist, there was a problem with the design of the SRR structure. Secondly, parasitic elements could not be considered.

Ⅳ. ACKNOWLEDGEMENT

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