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Smart Media
KOREAN INSTITUTE OF SMART MEDIA

Poster Session Ⅱ
14:20-15:20, Friday, December 12, 2014
Session Chair : Sung Bum Pan (Chosun Univ.)

P16 Harmonic Suppressed Power Amplifier Using Defected Ground Structure
Junhyung Jeong, Seungwook Lee, Yongchae Jeong (Chonbuk National Univ.)

P17 Design of Greenhouse skylight automation application using Sensor
Soonyong Kim, Wonmo Yang, Hyun Yoe (Sunchon National Univ.)

P18 Packet Priority based Transmission Control Mechanism at WMSN
Dong Ok Cho, Jin-Gwang Koh, Sung-Keun Lee (Sunchon National Univ.)
Hyun-Ho Choi (Suncheon Jeil College)

P19 The Hardware Design of High Performance Adaptive Loop Filter for HEVC Encoder
Seungyong Shin, Seungyong Park, Kwangki Ryoo (Hanbat National Univ.)

P20 Design of Agile Smart Home Automation
Hyeonggi Kim, Youngho Kim, Soogyum Kim, Daehee Kim, Dai Oh (Mokpo National Univ.),
SooLyul Oh, Youngho Lee (Mokpo National Univ.),
Gwangjin Kim (ZENT Co,. Ltd.)

P21 Development of Agricultural Dehumidifier Automation System using Smart phone
Yun Kim, Young-Jae Lee, Eung-Kon Kim (Sunchon National Univ.)
Kyoung-Wook Park (Chonnam National Univ.)

P22 Designing Cross Media Content for Chinese character Education Utilizing Animation
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P23 Top-view Based on the Detection of Obstacles Around the Vehicle Research
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P24 Object Segmentation from Surveillance Video Sequence using Spatial-Temporal Color Information
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P25 An Automatic Camera Control Method for Object Recognition System
Sung-Pil Ryu, Nae-Joung Kwak, Jae-Hyeong Ahn (Chungbuk National Univ.)

P26 The study on new silver generation's understanding of smart ecosystem and the method to establish the ecosystem
Su Kyung Ban, Il Seub Shin (Honnam Univ.)

P27 ZigBee Channel Characteristic and Link Quality Measurement Under Wi-Fi Interference
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P28 A Survey on Learning-based Face Hallucination Methods for Single-frame Facial Image
Sang-Woong Lee (Chosun Univ.), Jeong-Seon Park (Chonnam National Univ.)

P29 National Infrastructure Automatic Management Technology Based on IoT
Myoungbae Seo, Nam-Gon Kim (Korea Institute of Civil Engineering and Building Technology)

P30 SmartBlocker: A Botnet Detection Mechanism for Smartphone
Ujin Choe, Gwangil Jeon (Korea Polytechnic Univ.) Jiyeon Park (LG Electronics),
Jinman Jung, Junyoung Heo (Hannam Univ.) Seongje Cho (Dankook Univ.)

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Harmonic Supppressed Power Amplifier Using Defected Ground Structure

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Abstract

This paper describes the performances improvement of power amplifier (PA) by suppressing unwanted signals with defected ground structure (DGS) transmission line (TL). Due to the excellent frequency band rejection characteristics, DGS TL can be greatly applied in improving performances of PA such as harmonics suppression, output power, and power added efficiency. A single spiral-type DGS TL could suppress 2nd to 5th order harmonics. The experimentally a maximum output power of 29.2 dBm and PAE of 35% are achieved with a proposed topology in the operating center frequency of 880 MHz.

Keywords-Defected ground structure*, harmonic suppression, *power amplifier.

I. Introduction

RF power amplifiers (PAs) are widely used in wireless and radio communication systems. However, PA is a nonlinear device and can exhibit unwanted signals at the output of PA that cause PA degradations in the maximum output power and efficiency.

Defected ground structure (DGS) is realized by etching specific periodic or non-periodic pattern in a ground plane of planar transmission line [1], which perturbs the shield current distribution in the ground plane. This perturbation is changed by physical sizes of transmission line, which can raise the phase constant and slow-wave effect. Therefore, the DGS on the transmission line (TL) produces band rejection characteristics in a certain frequency band. The DGS can be used to remove the existing unwanted signals and can lead the performance improvement of PA and reduce the circuit size because of band rejection and slow effect of DGS.

Several structures of the DGS have been adopted in previous for the performances improvment [2]-[3]. In these works, the DGS at bias line have been used that can suppress only 2nd and 3rd order harmonics. In references [4] and [5], the DGS circuit is combined with output matching of the PA in order to suppress harmonics. Even though these works could suppress harmonics, but the circuit size is not compact as well. In [6], the output matching network is realized with several dumball shaped DGS in order to suppress harmonics.

In this work, the matching network (MN) integrated with a single spiral DGS is presented to suppress harmonics up to 5th order harmonics. This proposed PA with DGS output MN is compact and show excellent out-of-band suppression.

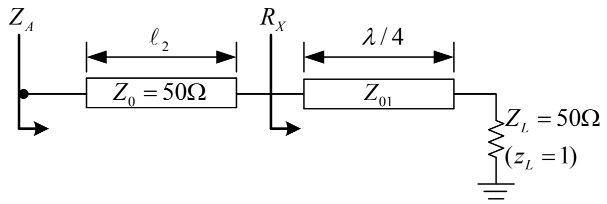

Fig. 1. Conventinal output matching schematic.

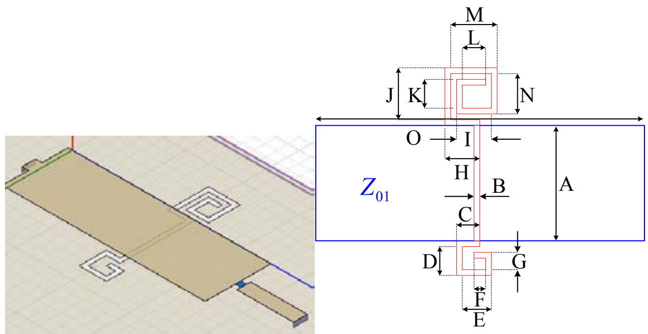

Fig. 2. Proposed schemetic of the spiral DGS line.

II. Design of DGS Power Amplifier

A. Conventional Matching Network Design

Fig. 1 shows the schematic of conventional output MN consists of two transmission lines with characteristic impedance Z_{01} and Z_0, respectively. The first $\lambda/4$ TL transforms 50 Ω load to resistance R_X. Then, the second 50 Ω transmission line with length ℓ_2 changes the resistance R_X to the impedance required $Z_A=R_X+jX$.

B. DGS Matching Network Design

Fig. 2 shows the proposed microstrip line DGS MN. The physical dimensions of a single spiral-type DGS TL are tabulated in Table I. The designed circuit is performed on a digital cellular downlink band. Fig. 3 shows the measured *S*-parameters of the conventional and proposed DGS output MN. Whereas the conventional MN can suppress only the 2nd and 4th order harmonics due to $\lambda/4$ TLs characteristics. The measured results shows rejections of 2nd and 4th order harmonics higher than 18 dB and 19 dB, respectively. Similarly, 3rd and 5th order harmonics rejections with the DGS MN are better than 25 dB.

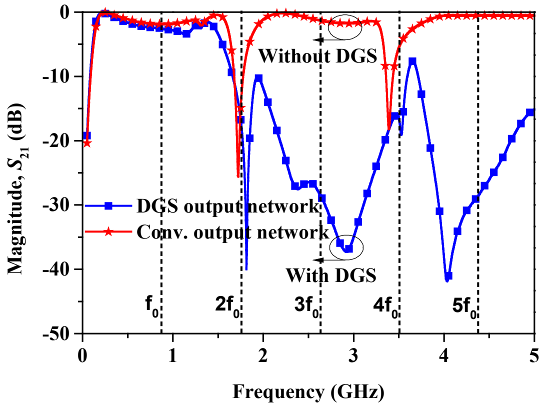

Fig. 3. Measured S-parameter results of the conventional and proposed DGS output matching network.

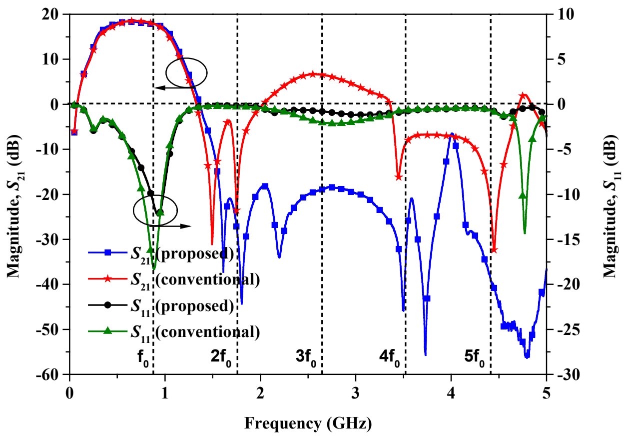

Fig. 4. Measured small-signal gains and return loss of the conventional and proposed DGS power amplifiers.

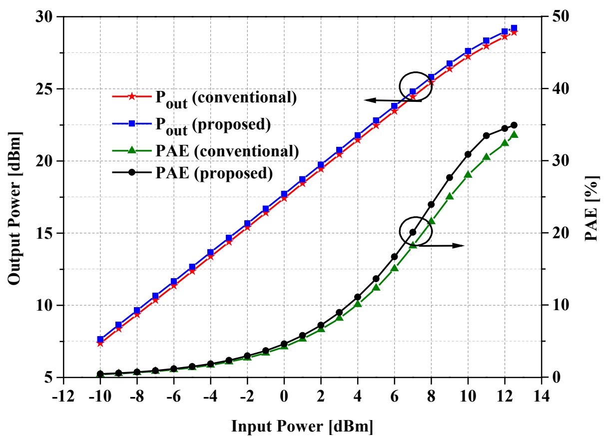

Fig. 5. Measured output power and power added efficiency of conventional and proposed power amplifiers.

TABLE I
DIMENSIONS FOR SPIRAL DGS OF MATCHING NETWORK (DIMENSION ARE IN MILLIMETTERS) REFER TO FIG. 2.

A/B/C/D/E/F/G/H/I/J/K/L/M/N/O
11.6/0.8/3.2/4/4/1.6/2.4/4/3.2/6.4/3.2/1.6/4.8/4.8/35

III. Experimental Results

To show the validity of the proposed spiral-type DGS MN, two PAs (conventional and proposed) are fabricated at the operating center frequency 880 MHz using TQP7M9103 of Triquent. PAs are implemented with the bias conditions of V_{ds} =5 V and I_{ds}=235 mA. Whereas the measured small signal gain and return loss of the conventional PA are 17.9 dB and -18.2 dB, those of the proposed PA are 17.9 dB and -11 dB as shown in Fig. 4. The proposed PA shows wide out-ot-band suppresion characteristics. Fig. 5 shows the measurement output power (P_{out}) and power added efficiency (PAE) of the conventional and proposed PAs. From the measurements, P_{1dB} and PAE in the conventional PA are achieved as 28.9 dBm and 33.6%, while those of the proposed PA shows 29.2 dBm and 35%, respectively. P_{out} and PAE of the proposed PA are improved by 0.3 dB and 1.4%, respectively, than the conventional.

IV. Conclusion

This paper presents a design of load network using spiral-type defected ground structure combined with output matching microstrip line to improve the performances of the power amplifier. When the defected ground structure is employed at the output matching network, it have shown that the possibility of the rejection of 2nd, 3rd, 4th, and 5th order harmonics. The measured harmonics rejection of the proposed structure is better than conventional matching network. Moreover, the length of the proposed matching network is compact than the conventional.

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