4-way Power Divider Using Common DGS and Stacked-substrate Structure

Jongsik Lim[1], **Junhyung Jeong**[2], **Phirun Kim**[2], **Yongchae Jeong**[2], **Sang-Min Han**[1], **and Dal Ahn**[1]

[1]Soonchunhyang University, Republic of Korea
[2]Chonbuk National University, Republic of Korea

Abstract— A miniaturized 4-way Wilkinson power divider designed with common defected ground structure (DGS) and stacked-substrate structure is proposed. Fig. 1 shows that the stacked multi-layer structure is composed of 4 dielectriclayers, 3 pattern-layers for transmission lines, and 2 common ground planes in which the common DGS patterns are realized. The signal lines of transmission lines are connected by signal via-holes which penetrate the dielectric layers as depicted in Fig. 1. The beginning of design is to arrange the layout of the normal 4-way divider using stripline and microstrip lines as shown in Fig. 2. This can be simply folded for size-reduction. It is well known that periodic perturbation structures such as DGS and photonic bandgap patterns play a role of size-reduction due to their additional equivalent inductive- and capacitive-elements when they are adopted into transmission lines. In addition, a common DGS located in the common ground plane of double-sided transmission line structures has been proposed previously. So if common DGS patterns are combined to the folded divider, the final size may be quite smaller than that of normal 4-way divider (Fig. 3). It is noted that output port 2 and port 3 are on the upside, while port 4 and port 5 bottom side. So the connecting part between input layer and two output layers should be designed very carefully after taking the identical electrical length and symmetry into consideration (Fig. 4). Fig. 5 shows the S-parameters of the designed size-reduced 4-way divider. It is shown that the power division ($-6.26\,\mathrm{dB}$ and $-6.58\,\mathrm{dB}$), matching ($-12.97 \sim -21.07\,\mathrm{dB}$) and isolation ($-13.76 \sim -29.25\,\mathrm{dB}$) are so good even after the size has become only 1/3 of normal 4-way divider. It is expected the proposed size-reduction using common DGS and stacked-substrate structure are well applicable to multi-layered LTCC and RFIC for microwave and wireless applications.

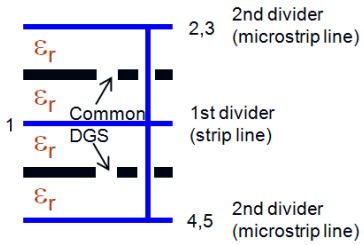

Figure 1.

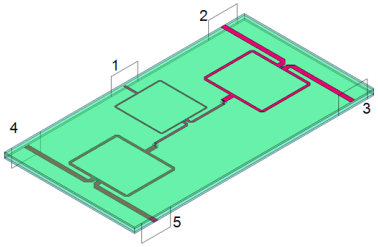

Figure 2.

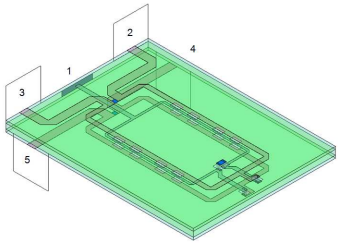

Figure 3.

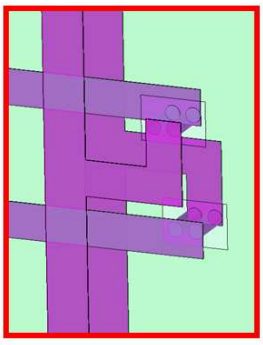

Figure 4.

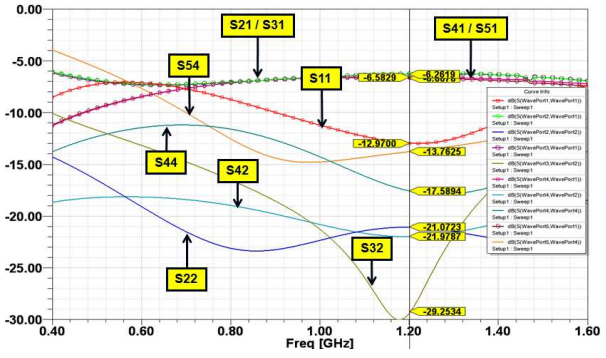

Figure 5.

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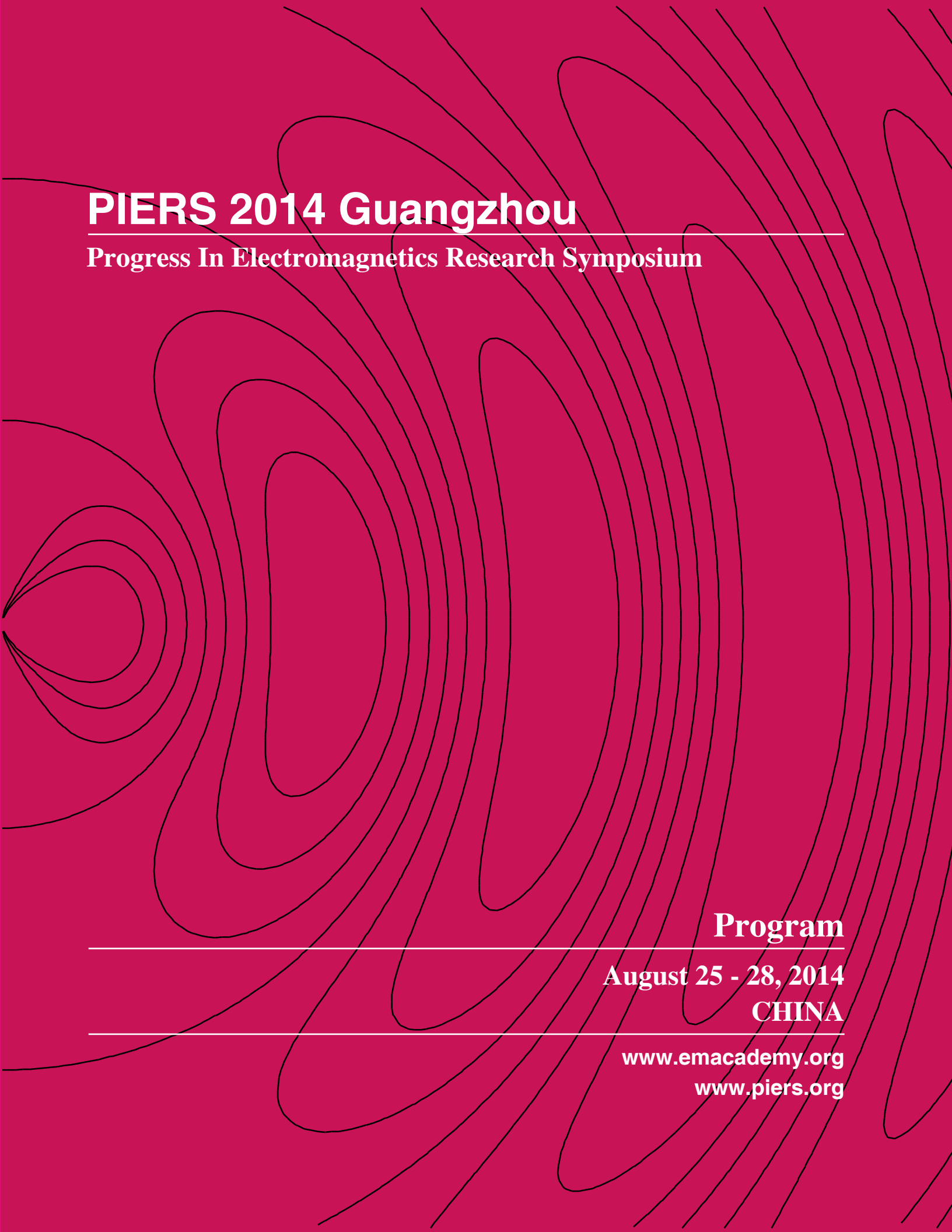

Program

August 25 - 28, 2014

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13:20 HBT PA MMIC for WCDMA/LTE Applications
invited
Bumman Kim (*Pohang University of Science and Technology (POSTECH), Korea*); *Yunsung Cho* (*Pohang University of Science and Technology, Korea*); *Jooseung Kim* (*Pohang University of Science and Technology, Korea*); *Kyunghoon Moon* (*Pohang University of Science and Technology, Korea*);

13:40 4-way Power Divider Using Common DGS and
invited Stacked-substrate Structure
Jongsik Lim (*Soonchunhyang University, Republic of Korea*); *Junhyung Jeong* (*Chonbuk National University, Republic of Korea*); *Phirun Kim* (*Chonbuk National University, Republic of Korea*); *Yongchae Jeong* (*Chonbuk National University, South Korea*); *Sang-Min Han* (*Soonchunhyang University, Korea*); *Dal Ahn* (*Soonchunhyang University, Korea*);

14:00 Multilayer Thick-film and Next Generation
invited Millimetre-wave Embedded Components and System Integration
Kamal Kumar Samanta (*Milmega/Teseq Ltd., UK*);

14:20 Microwave and Millimeter Wave 2D and 3D Integra-
invited tion
Tauno Vaha-Heikkila (*VTT Technical Research Centre of Finland, Finland*);

14:40 Hybrid and Monolithic Planarization and Integration
keynote of Non-planar Metallo-dielectric Waveguides for High-density Electromagnetic Circuits and Systems
Ke Wu (*Montreal University, Canada*);

15:20 **Coffee Break**

15:40 Multilayered Integration of Microwave Components
invited by Substrate Integrated Waveguide Technology
Maurizio Bozzi (*University of Pavia, Italy*); *Riccardo Moro* (*University of Pavia, Italy*); *Stefano Moscato* (*University of Pavia, Italy*); *Luca Perregrini* (*University of Pavia, Italy*);

16:00 Recent Developments in Microwave and Millimeter-
invited wave Integrated Circuits (MMICs) and Systems
Xin Jiang (*Southeast University, China*); *Wei Hong* (*Southeast University, China*); *Jixin Chen* (*Southeast University, China*); *Debin Hou* (*Southeast University, China*); *Zhe Chen* (*Southeast University, China*);

16:20 CMOS Terahertz Synthesized Left-handed Transmis-
invited sion Lines
Hsien-Shun Wu (*Tianjin University, China*); *Ching-Kuang C. Tzuang* (*National Taiwan University, Taiwan*);

Session 2P_13b
SC4: Reconfigurable Antennas

Tuesday PM, August 26, 2014
Room 13
Organized by Yingjie Jay Guo, Ying Liu
Chaired by Ying Liu

16:40 Magnetically Tunable Dual-polarized Dual-band SIW Slot Antenna
Li-Rong Tan (*Nanjing University, China*); *Rui-Xin Wu* (*Nanjing University, China*);

17:00 Dual-polarized Unit-cell of Continuous Reflective Phase-shift for Reconfigurable Reflectarrays
Ming-Tao Zhang (*Xidian University, China*); *Steven Gao* (*University of Kent, UK*); *Jixiang Wan* (*Xi'an Institute of Space Radio Technology, China*); *Buning Tian* (*Xi'an Institute of Space Radio Technology, China*); *Chunbang Wu* (*Xi'an Institute of Space Radio Technology, China*);

17:20 A Reconfigurable Folded Antenna for Mobile Phone Applications
Liu Hu (*Xidian University, China*); *Ying Liu* (*Xidian University, China*); *Cao Yu* (*Xidian University, China*); *Shuxi Gong* (*Xidian University, China*);

17:40 Pattern Reconfigurable Printed Antennas with High Gain and Broadband
Xue-Xia Yang (*Shanghai University, China*); *Zhongliang Lu* (*Shanghai University, China*); *Guannan Tan* (*Shanghai University, China*); *Yong Jin Zhou* (*Shanghai University, China*);

18:00 A Thin Planar Antenna Based on Gradient Metasurface
Bo Chen (*Xi'an Jiaotong University, China*); *Hongyu Shi* (*Xi'an Jiaotong University, China*); *Anxue Zhang* (*Xi'an Jiaotong University, China*); *Juan Chen* (*Xi'an Jiaotong University, China*);

18:20 Wideband RCS Reduction of Microstrip Antenna by Frequency Reconfigurable Electromagnetic Band Gap
Ying Liu (*Xidian University, China*); *Y.-W. Hao* (*Xidian University, China*); *Yongtao Jia* (*Xidian University, China*); *S.-X. Gong* (*Xidian University, China*);

18:40 Frequency Reconfigurable Narrow-frame Antenna for WWAN/LTE Smartphone Applications
Zhong-Xiang Chen (*University of Electronic Science and Technology of China, China*); *Yong-Ling Ban* (*University of Electronic Science and Technology of China, China*);

Session 2P13a
FocusSession.SC4: Recent Progresses in Monolithic and Multilayer/Planar Integrated Circuits and Components