1st International Conference on Industrial Electrical and Electronics (ICIEE)

"The opportunities, challenges, and future impacts of industry 4.0"
Anyer, Banten, Indonesia, September 4-5th, 2018

The 1st International Conference on Industrial Electrical and Electronics (ICIEE) aims to bring together leading academic scientists, researchers and research scholars to exchange and share their experiences and research results on all aspects of Industry 4.0 and Internet of Things. It also provides a premier interdisciplinary platform for researchers, practitioners and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered and solutions adopted in the fields of Industry 4.0 and Internet of Things.

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Keynote Speakers 1

Prof. Dr. Rosni Abdullah
(Universiti Sains Malaysia, Malaysia)

The opportunities and challenges of industry 4.0

Abstract
The Internet of Things (IoT) has not only revolutionised business processes, but has strong potential to profoundly impact the life of many citizens. Many sectors such as healthcare, transportation and manufacturing among others, are starting or have started to adopt IoT by connecting devices and creating innovation in the respective sectors. One sector that will particularly benefit is the industrial sector. In Industry 4.0, the connected ecosystem of the IoT, will provide manufacturers and consumers increased automation, improved communication and monitoring, along with self-diagnosis and new levels of analysis to improve productivity. This talk will introduce the framework of IoT in the context of industry 4.0 and explore the opportunities and challenges that lay ahead.

Keynote Speakers 2

Prof.Dr.Yilmaz Uygun, M.Sc. (Dept. Mathematics & Logistics, Jacob Univ. Bremen, Germany)

Human Resources Requirements for Industry 4.0

Abstract
Industry 4.0 is currently changing industrialized countries´ economies. Previously uncoupled items will connect to each other to develop self-controlled production systems by using the latest software and hardware in information and communication technology. This rapidly increasing technologies not only have the potential to substitute repetitive jobs but also pose a threat to more sophisticated ones. Against the backdrop of this, important questions arise which will be addressed with this speech; such as the type of jobs that are affected, the qualifications and skill sets that are needed in Industry 4.0. Other specific queries that appear are; type machines/robots that will be dominant, the policy taken in the factory, new communication of work (e.g., man-machine interaction) and the operating procedure for the machines. All of these terms should be addressed and mapped based on the locus of the industries which vary depending on their technological maturity level. Afterwards, set of cognitive readiness competencies should be prepared. Finally, the relevant vocational educations, trainings and certifications can be derived from those set of competencies.

Keynote Speakers 3

Prof. Poki Chen (National Taiwan University of Science and Technology, Taiwan)

Abstract
Industrial production is one of the key competitions among global players. After Industry 4.0 introduced by German government, most of the international big players invest tons of money to offer their production system more flexibility, faster adaptationforboth individualizedand customized products through digitalization and new technologies. For implementation, Industry 4.0 needs decentralized control and advanced connectivity to collect and exchange real-time information for production processesoptimization.Expected as the newest industrial revolution, it opens a huge market for both software and hardware engineers. To generate big enough data for optimizing the production automation, it needs a lot of sensors to identify, locate, track and monitor the equipment and the products. To connect all the machines, products and factories, a market booming for sensors not only can be expected but also is already undergoing.In this speech, feasible solutions for Industry 4.0 from micro-scale MEMS (Micro Electro Mechanical System)accelerometers, humidity, pressure,acoustic,gas sensors all the way to nano-scale image, illumination, position and temperature sensors will be highlighted to point out the possible ways for both research and commercialization.

Preface

We would like to welcome all participants from academicians, government, and industry to attend the International Conference on Industrial, Electrical and Electronics (ICIEE 2018) in Aston Beach Hotel, Anyer, Indonesia. ICIEE 2018 is organized by Department of Electrical Engineering, the Universitas Sultan Ageng Tirtayasa, supported by FORTEI (Electrical Engineering Higher Education Forum of Indonesia).

This conference is a great event in the field of Industrial, Electrical and Electronics. World Class Speakers are scheduled to deliver speech on hot topics in industry 4.0 so as it can be beneficial to all delegates. The committee noted that 143 abstracts submitted to the conference systems. However, after go through a peer-review process by the program (editorial) committee and international boards, the final accepted papers are 76.

On behalf of the organizing committee, the editors would like to express our sincere gratitude and appreciation to all participants for coming down to Anyer Beach to share and present your research findings. We are also indebted to all the international reviewers for helping us in reviewing all the papers for ensuring high quality of all the accepted papers. I would like to thanks all sponsorships for their valuable supports. We believe that the conference will be a key stage to improve our research and show great development to the world in the field of industrial, electrical, electronics and information technology

I would also like to extend my thanks to all the organizing committee for working very hard to make this conference as today and record my personal apology for any shortcomings. Any recommendations and suggestions for improvement are very much appreciated and most welcome.

The ICIEE 2018 is one step to reach our vision towards an excellent department in 2020. I believe this international event is able to encourage our spirit to move on a better condition as well as expand our collaboration and networking.

Editor of ICIEE

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Design Of Array and Circular Polarization Microstrip Antenna For LTE Communication

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Abstract. This paper proposes a high gain microstrip antenna with circular polarization for LTE applications at a working frequency of 2300 MHz. Gain of antenna is optimized by using an array method with 4 elements arranged in plannar using feed line of 50 Ohm, 100 Ohm and 70.7 Ohm. The proposed antenna designed using FR-4 substrate with (Ɛr) = 4.3, substrate thickness (h) of 1.6 mm and loss tangent (tan δ) of 0.0265. Gain of antenna can be optimized by increasing the number of elements in the array of the antenna. Circular polarization can be obtained by cutting the edge of a rectangular patch antenna with an angle of 45^0 . From the simulation results obtained reflection coefficient value of -20.02 dB and VSWR of 1.22 at the working frequency of 2300 MHz. The gain of proposed microstrip antenna is 10.56 dB with an impedance bandwidth value of 714 MHz (1925 - 2639 MHz). The proposed antenna obtained a circular polarization with axial ratio of 1.745 dB at working frequency of 2300 MHz. Array method with four elements increased the gain of antena until 45.07% compared to the single element antenna.

1 Introduction

At present time, the development of mobile telecommunication technology and communication system is growing very rapidly, especially the development in the mobile and wireless telecommunications. The society needs for communication and high transfer data rates are getting higher along with the entry of 4G Long Term Evolution technology. The stability of the connection and the speed of data transfer becomes very important to make the telecom provider optimize the network in order to meet customer needsthere are several telecommunication systems that have been developed, for example is DCS at frequency band (1710 MHz -1885 MHz), PCS (1907 MHz -1912.5MHz), UMTS (1920 MHz – 2170 MHz),WLAN 2.4 GHz and LTE 2.3 GHz [1]. The band frequency of 2300 MHz - 2400 MHz is used for broadband communication system such as Long Term Evolution and Wireless Fidelity in accordance with the Regulation of the Minister of

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Communication and Information of the Republic of Indonesia Number 28 / PER / M.KOMINFO / 09/2014 [2].

In modern telecommunication devices such as modem usually use an internal antenna that has a small gain so that the reception of signal is not optimal. To solve that problem can be used an external antenna but sometimes the dimension of external antenna is big enough so that it becomes ineffective in its application. In addition, the type of external antenna sold in the market also has a vertical polarization (dipole) while the transmitting antenna used in the BTS (Base Transmission Station) has a horizontal polarization causing a loss on the receiver side due to its cross polarization between the receiving antenna and the transmitter. To overcome this problem microstrip antennas can be developed with circular polarization to reduce the loss caused by cross polarization of the transmitting and receiving antennas. In addition, microstrip antennas has advantages such as small and compact dimensions so the application is more effective beside that microstrio antenna can delovoped to produce circular polarization. It provides both linear and circular polarization. However, microstrip antenna has disadvantages such as low level gain, narrow bandwidth, low efficiency, and low directivity [3]. The circular polarization (CP) is a special case of elliptical polarization and it is realized when antenna configuration excites two equal amplitude, time and space orthogonal resonant modes [4]. Polarization loss may result due to the misalignment in the signal and the receiving antenna. To solve this problem we can used microstrip antenna with circular polarization [5].

To obtain microstrip antenna that has a circular polarization can be used several methods such as fractal [6], truncated corner [7] and proximity coupling [8]. In this research, the truncated corner method is used by cutting the upper and lower edges of the rectangular shape antenna, the selection of this method is because the initial dimension of the designed microstrip antenna is rectangular so that the use of truncated method is much easier and more effective in designing, the truncated corner method also reduces the dimensions of the antenna into smaller ones resulting in a more compact dimension. Beside that to increase the gain of the antenna can be done by using array method [9-12]. In a previous study [13-15] obtained a circular polarization using the truncated corner method.

In this research, the microstrip antenna is designed using truncated corner method to produce axial ratio ≤ 3 dB. After that, gain of the microstrip antenna can be optimized by using an array method using 4 elements. The selection of the trucanted corners method caused by the dimensions used in the initial design is rectangular which is easier and more effective in designing to produce circular polarization. The type of array used is the plannar array because it is more effective to optimizing the gain value of the antenna. The type of substrate used in the design of the antenna is FR-4 Epoxy with (εr) = 4.3, substrate thickness (h) of 1.6 mm and loss tangent (tan) of 0.0265. The design and simulation process of the proposed antenna uses AWR Microwave Office.

2 Design of Antenna

Circular polarization microstrip antenna is designed using double layer substrate of FR-4 Epoxy with relative permittivity (εr) of 4.3, substrate thickness (h) of 1.6 mm and loss tangent (tan δ) of 0.0265. The first stage is to design a rectangular antenna with microstrip line feeder of 50 Ohm that works at working frequency of 2300 MHz for LTE applications. To determine the dimensions of W and L of the initial design antenna we can use the equations below (1), (2), (3) and (4)[16]. The width dimension of the microstrip line feeder of 50 Ohm (Wf) is obtained using equations (6) and (7)[17]. The design of the rectangular microstrip antenna can be seen in Figure 1.

$$W = \frac{C}{2f\sqrt{\frac{\varepsilon r+1}{2}}} \quad (1)$$

$$L = L_{eff} - 2\Delta L \quad (2)$$

$$L_{eff} = \frac{C}{2f\sqrt{\varepsilon_{reff}}} \quad (3)$$

$$\varepsilon_{reff} = \frac{\varepsilon r+1}{2} + \frac{\varepsilon r-1}{2}\left[1 + 12\frac{h}{W}\right]^{-\frac{1}{2}} \quad (4)$$

$$B = \frac{60\pi^2}{Z_0\sqrt{\varepsilon_{eff}}} \quad (5)$$

$$Wf = \frac{2h}{\pi}\left\{B - 1 + \frac{\varepsilon_r-1}{2\varepsilon_r}\left[\ln(B-1) + 0.39 - \frac{0.61}{\varepsilon_r}\right]\right\} \quad (6)$$

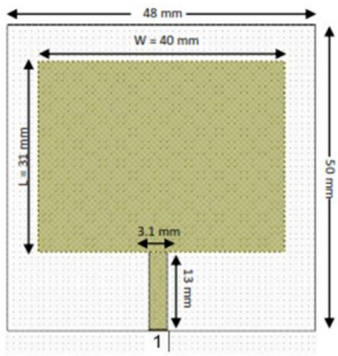

Fig.1 Design of Rectangular Microstrip Antenna

The second stage is to design truncated corner of microstrip antenna with cutting angle of 45^0 at the diagonal position. The main purposes of cutting the patch side of an antenna is to produce a circular polarization with a 3 dB axial ratio. Circular polarization occurs due to interference with the current flowing in the patch affecting the polarization of the antenna. The dimensions of the cut width on the patch antenna can be determined using equation (7) [18]. The design of the truncated corner of microstrip antenna design can be seen in Figure 2.

$$\Delta L = {}^{1}/_{4} \times L \quad (7)$$

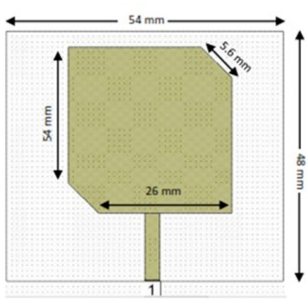

Fig.2 Design of Truncated Microstrip Antenna

The final stage is designing the microstrip antenna using the array method to optimized the gain of antenna by using four patch with feed line of Z_1=50 Ohm, Z_2=70.7 Ohm and Z_3=100 Ohm. Dimension and width of feed line (Wf) of 50 Ohm, 70.7 Ohm and 100 Ohm can be determined using formula (6) and (7) while to determine the distance between patches in the array method is given by (8) [19].

$$d = \frac{\lambda}{2} \tag{8}$$

The design of truncated mirostrip antenna using array with 4 element can be seen in Figure 3.

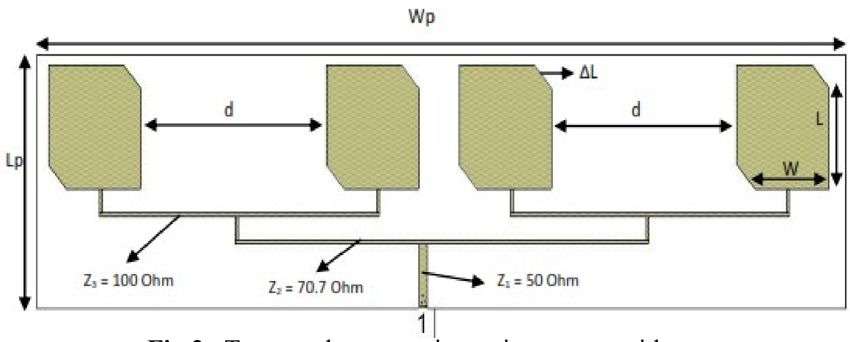

Fig 3. Truncated corner microstrip antenna with array

From Figure 3 above can be seen the dimension of array microstrip antenna with W=26 mm , L = 26 mm, d = 64 mm and ΔL = 5.6 mm. The dimension of the enclosure is Wp = 280 mm and Lp = 65 mm while the width of feeder channel Z_1, Z_2 and Z_3 are 3.1 mm, 1.6 mm and 1 mm.

3 Result and Discussion

After the design process, the next stage performs the simulation process of the design antenna using AWR Microwave Office. The observed parameters are reflection coefficient, VSWR, axial ratio and gain of the antenna. The simulation results of these parameters can be seen in the Figure 4, Figure 5, and Figure 6.

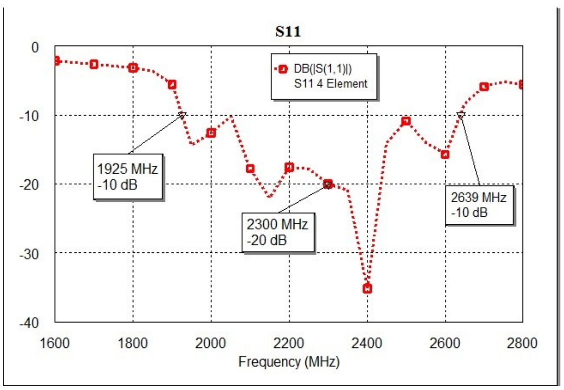

Fig 4. Simulation result of reflection coefficient

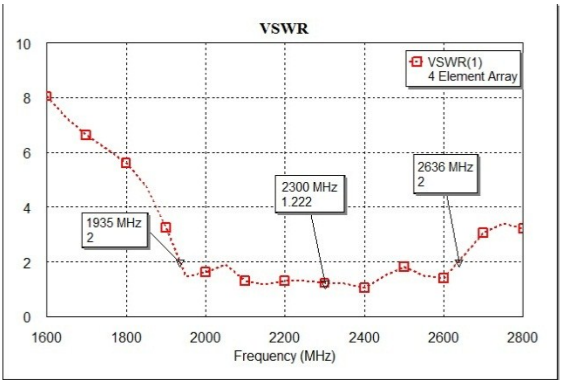

Fig 5. Simulation result of VSWR

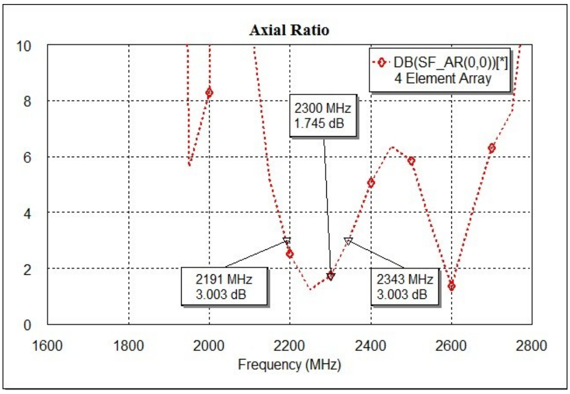

Fig 6. Simulation result of Axial Ratio

From Figure 4 and Figure 5 it can be seen that the proposed antenna has a reflection coefficient of -20 dB and VSWR of 1.22 at a working frequency of 2300 MHz. This is in accordance with the minimum standards set for the reflection coefficient ≤ -10 dB and VSWR ≤ 2 so it can be said that the antenna already has a good reflection coefficient and VSWR. The bandwidth obtained from the proposed antenna is 714 MHz (1925 - 2639 MHz).

From Figure 6 it can be seen that the axial ratio obtained from the proposed antenna is 1.745 dB at a working frequency of 2300 MHz. This proves that the proposed antenna has a circular polarization with an axial ratio of ≤ 3 dB at a predetermined working frequency of 2300 MHz. The bandwidth of the axial ratio obtained from the proposed antenna is 152 MHz (2191 - 2343 MHz) The gain of antena can be optimized by increasing the number of elements in the array of the antenna. The simulation results of gain from optimization process of the proposed antenna are shown in Figure 7.

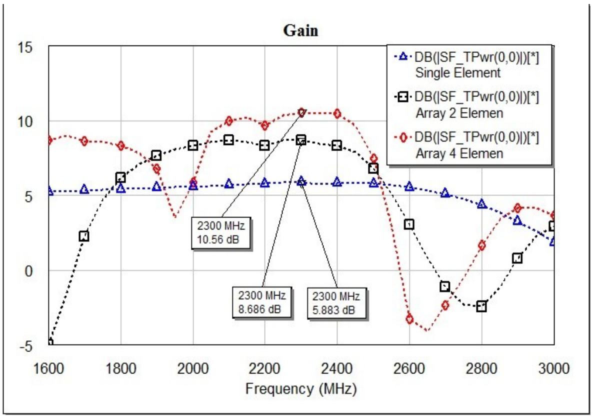

Fig 7. Simulation result of Gain

From Figure 7 it can be seen that the gain increase occurs as the number of elements increases. The gain obtained from the proposed antenna is 10.56 dB at a working frequency of 2300 MHz using 4 elements. The comparison of the overall optimization process of gain on the proposed antenna can be seen in table 1 below.

Table 1. Comparison Gain of Microstrip Antenna

Condition	**Parameter**	
	Gain	***Frequency***
Single Element	5.883 dB	2300 MHz
Array 2 Element	8.685 dB	2300 MHz
Array 4 Element	10.56 dB	2300 MHz

From table 1 above it can be seen that the gain enhancement of the array antenna is directly proportional to the number of elements. The gain obtained from the single element antenna is 5.883 dB, while in the 2 element array it increases to 8.685 dB and in the 4 element array increases to 10.56 dB at working frequency of 2300 MHz. This result proves that the array method on the proposed antenna successfully increases the gain value up to 45.07% compared to the single element antenna. The result of the simulation of the radiation pattern on the proposed antenna can be seen in Figure 6 below.

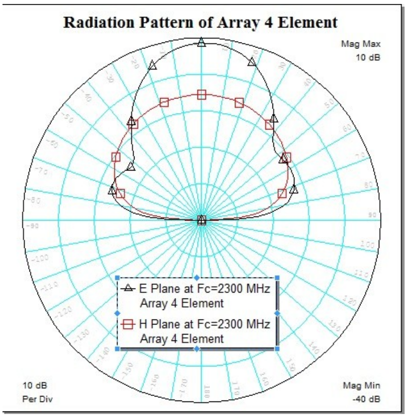

Fig 8. Radiation Pattern of Proposed Antenna

From Figure 8 it can be seen that the radiation pattern generated from the proposed antenna is broadside with the best transmit angle at 0^0. The effect of using arrays is produces a side lobe on the radiation pattern of the proposed antenna.

From the overall results it can be seen that the truncated corner method succeeded in producing circular polarization of antennas with axial ratio ≤ 3dB. In addition, the array method with 4 elements succeeded in increasing gain of antenna from 5.883 dB until 10.56 dB, increasing 47.80% compared to single element antenna.

4 Conclusion

A new design of high gain and circular polarization of microstrip antenna is eventually well proposed. The circular polarization is obtained by cutting the edges of the patch antenna while to increase the gain value is obtained by increasing the number of elements on the antenna. From the simulation results obtained the reflection coefficient of -20 dB, VSWR of 1.22 and axial ratio of 1.72 dB at 2300 MHz working frequency. The gain of the proposed antenna is 10.56 dB or an increase of 40.78% compared to the single elemet antenna.

The authors wish to express their gratitude to the LPPM of Universitas Kristen Krida Wacana for their support through Grant of Internal Researh fiscal of year 2018.

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