Retraction

Retraction: Elliptically Bended Coupler with Arbitrary Power Division (J. Phys.: Conf. Ser. 1916 012111)

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This article (and all articles in the proceedings volume relating to the same conference) has been retracted by IOP Publishing following an extensive investigation in line with the COPE guidelines. This investigation has uncovered evidence of systematic manipulation of the publication process and considerable citation manipulation.

IOP Publishing respectfully requests that readers consider all work within this volume potentially unreliable, as the volume has not been through a credible peer review process.

IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751v1
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Elliptically Bended Coupler with Arbitrary Power Division

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Abstract. In this paper, we propose a 1.8 GHz microwave coupler with arbitrary power division. It consists of a wideband unequal power division hybrid coupler with higher-order harmonic filtering that covers all GSM (0.8 GHz – 1.9 GHz) and WiFi (2.4 GHz) bands. The architecture consists of a 4 port unequal power division, which is usually of the 0° and 180° coupler types.

Keywords: Hybrid coupler, unequal power division, harmonic filtering.

1. Introduction

The couplers are vital components in many of the microwave circuits. Among that the hybrid coupler is an interdigitated microstrip coupler that plays a fundamental role in the application of coupler array systems, amplifiers, phase shifters, and mixers [1]. When a 4-port coupler receives an input microwave signal, the output is received in ports 2 and 4. Since no output is obtained in port 3, it can be used as an isolated port. As a consequence, this coupler will serve as a combiner and divider [2]. For power combining and division in radio frequency applications, a wide range of couplers is needed. These directional couplers face a number of challenges, including directivity and excessive signal suppression.

By adjusting line impedance as defined in the desired power division ratio, the 3 dB hybrid coupler can be converted to an arbitrary power division coupler. Many of the practical modules need a reduction in mass and volume, which is why the hybrid coupler is being considered. The power division is not arbitrary in many of the designs, it also has higher-order harmonics. The size is also not compact. In this paper, a microwave coupler with miniaturized size and higher-order harmonic filtering is implemented for arbitrary power division [3-5].
2. Design:

On one side of the substrate, the ellipse-based bend rat race coupler has a radiating portion and on the other, a partial ground plane. The coupler was made from an FR-4 lossy substrate with a relative permittivity of $\varepsilon_r$ 4.4, the relative permeability of $\mu_r$ 1, and a loss tangent of 0.02. An FR-4 substrate with a thickness of 0.8mm was used to build the coupler. The radiating patch, ground plane, and microstrip transmission line are all made of copper with a thickness of 0.035mm. Between the end of the microstrip line and the ground plane, a tiny $50\Omega$ connector is used. Computer Simulation Technology (CST) software is used to simulate the proposed coupler.

![Figure 1: Hybrid coupler](image1)

Figure 1. Hybrid coupler

Figure 1 shows a traditional hybrid coupler with a termination impedance of $50\Omega$ and a line impedance of $70.7\Omega$. The resonant frequency of 1.8GHz necessitates a wide area of about 7cm*7cm for this coupler, despite its simplicity. There are also unnecessary higher frequency signals generated during the implementation of this design [6].

![Figure 2. Ellipse based bend hybrid coupler](image2)

Figure 2. Ellipse based bend hybrid coupler

A circle of inner radius 11.2mm and outer radius 12mm has been created with 4 ports. It has ellipse-based bends[7] between port 2 and port 4 as shown in Figure 2.
3. Results and Discussion:

The proposed ellipse-based bend hybrid coupler has an impedance bandwidth that covers GSM and WiFi bands. The final dimension of the ellipse-based bend hybrid coupler is selected where the parameters like return loss, power coupling and isolation are measured for the proposed coupler.

The operating range of the proposed coupler is 1.8GHz.

![Figure 3. S parameter](image)

The return loss is used to determine how well the systems are matched. When the return loss is high, the match is fine. The return loss ($S_{44}$) achieved at the operating frequency is >25 dB as shown in Figure 3.

The power coupling ($S_{42}$, $S_{43}$) at the operating frequency is 3.9 and 3.7 respectively as pictured in Figure 3.

The separation between the input and isolated ports differs from the isolation between the two output ports. The isolation ($S_{41}$) achieved at the operating frequency is >25 dB as shown in Figure 3.

![Figure 4. VSWR](image)
VSWR is the key opener for any system using the transmission lines, which is often used to calculate the level of the standing wave. As shown in Figure 4, the VSWR achieved at the frequency of operation is 1.68 and is held below 2.

![Figure 5. Z parameter](image)

The Z matrix impedance defines the system’s electrical behaviour. The incoming and outgoing voltages and currents of a network are calculated using these Z matrices. The Z matrix impedance obtained at the operating frequency is 38Ω and is represented in Figure 5.

4. Conclusion:

The proposed ellipse-based bend hybrid coupler works well in both WiFi and GSM bands. It has a smaller size and has a greater return loss. This proposed coupler allows for efficient arbitrary power division. This ellipse-based bend hybrid coupler also has the added benefit of being able to filter higher-order harmonics without the use of lumped components.

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