



Teguh Firmansyah <teguhfirmansyah@untirta.ac.id>

---

## QiR 2019 submission 123 update

1 pesan

---

**QiR 2019** <qir2019@easychair.org>

3 Juli 2019 pukul 23.46

Kepada: Teguh Firmansyah <teguhfirmansyah@untirta.ac.id>

Dear authors,

we acknowledge that we received new files for your QiR 2019 submission. The information about this update is shown below.

Number: 123

Authors: Teguh Firmansyah, Gunawan Wibisono and Eko Rahardjo

Title: Compact UWB Bandpass Filter based on Crossed Dumbbell-Stub with Notch Band using Defected Microstrip Structure

Uploaded by: Teguh Firmansyah <teguhfirmansyah@untirta.ac.id>

Updates:

paper, version 2 (1041630 bytes)

To access the new version of your submission you should log in to the QiR 2019 EasyChair page.



Teguh Firmansyah &lt;teguhfiransyah@untirta.ac.id&gt;

## [QiR 2019] review comments for paper 123

1 pesan

QiR 2019 &lt;qir2019@easychair.org&gt;

23 Juni 2019 pukul 07.14

Kepada: Teguh Firmansyah &lt;teguhfiransyah@untirta.ac.id&gt;

Dear author(s),

In this email, we send you the comments and suggestions from the reviewers.

As per our previous email, please keep in mind that in order for your paper to be published in any of our listed publications, you will need to revise your paper in accordance to the comments and suggestions from the reviewers. Full paper should also be submitted according to the templates for its corresponding symposium as provided in the conference website (<http://qir.eng.ui.ac.id/paper-submission/>).

We look forward to receiving your revised Conference Paper.

Regards,  
QiR 2019 committee

SUBMISSION: 123

TITLE: Compact UWB Bandpass Filter based on Crossed Dumbbell-Stub with Notch Band using Defected Microstrip Structure

----- REVIEW 1 -----

SUBMISSION: 123

TITLE: Compact UWB Bandpass Filter based on Crossed Dumbbell-Stub with Notch Band using Defected Microstrip Structure

AUTHORS: Teguh Firmansyah, Gunawan Wibisono and Eko Rahardjo

----- Structure -----

SCORE: 2 (Fair; Paper is well organized but still needs improvement)

----- English -----

SCORE: 2 (Fair; There are a few grammatical errors)

----- Novelty -----

SCORE: 2 (Fair; Novelty is sufficient and high impact)

----- Research background -----

SCORE: 2 (Fair; The rationals for the paper is well grounded based on sufficient citations)

----- Analysis -----

SCORE: 4 (Good; Discussion of the results is comprehensive. Results are not overgeneralized.)

----- Referencing -----

SCORE: 4 (Good; The supporting references is strongly reliable and organized)

----- Overall review/comment -----

why does the model in Fig.2 for even-mode just include the dumbbell on the top side,  
not also the bottom side?

----- REVIEW 2 -----

SUBMISSION: 123

TITLE: Compact UWB Bandpass Filter based on Crossed Dumbbell-Stub with Notch Band using Defected Microstrip Structure

AUTHORS: Teguh Firmansyah, Gunawan Wibisono and Eko Rahardjo

----- Structure -----

SCORE: 4 (Good; Paper is well organized and easy to follow)

----- English -----

SCORE: 2 (Fair; There are a few grammatical errors)

----- Novelty -----

SCORE: 4 (Good; High novelty and high impact)

----- Research background -----

SCORE: 4 (Good; The rationals for the paper is well grounded based on the most updated citations)

----- Analysis -----

SCORE: 4 (Good; Discussion of the results is comprehensive. Results are not overgeneralized.)

----- Referencing -----

SCORE: 4 (Good; The supporting references is strongly reliable and organized)

----- Overall review/comment -----

Well written and well organized paper. I have some suggestions :

1. Could you explain why the simulated and measured S11 of UWB in Fig 9 (the blue ones) have slightly different characteristics?
2. I found some grammatical errors in your paper, please revise it carefully.
3. Please see the paper format for camera ready paper.

# Compact UWB Bandpass Filter based on Crossed Dumbbell-Stub with Notch Band using Defected Microstrip Structure

Teguh Firmansyah  
 Department of Electrical Engineering  
 Universitas Indonesia  
 Depok, Indonesia  
 teguh.firmansyah81@ui.ac.id

Gunawan Wibisono\*)  
 Department of Electrical Engineering  
 Universitas Indonesia  
 Depok, Indonesia  
 gunawan@eng.ui.ac.id

Eko Tjipto Rahardjo  
 Department of Electrical Engineering  
 Universitas Indonesia  
 Depok, Indonesia  
 eko@eng.ui.ac.id

**Abstract**—A compact ultra-wideband (UWB) bandpass filter based on cross dumbbell stub with notch band structures is proposed and implemented. This bandpass filter (BPF) structure consists of directly feed line input/output. As the novelty, the cross dumbbell stub resonator was used and it was placed at the middle of the filter structure. By using this structure, the BPF not only has a compact size but also it has a wide-passband response. To remove unnecessary radio frequency (RF) signal, the rejection (notch) band was also proposed by using a novel technique which uses U-shaped defected microstrip structure (DMS). Moreover, the DMS is constructed at the center between crossed dumbbell resonators. This notch band structure has highly independent and it can be adjusted by modifying the U-shaped structure. Therefore, the specific frequency of the notch band can be selected independently without expanded number of resonator or stub. Furthermore, this BPF is fabricated on 2D - Duroid/RT 5880 substrate with permittivity ( $\epsilon_r$ ) of 2.2, thickness ( $h$ ) of 1.57 mm, and loss tangent ( $\tan \delta$ ) of 0.0009. **Furthermore, the measured results show that the UWB-BPF has 3-dB passband from 3.0 – 12.2 GHz, with notch band at 6.7 GHz and the notch band has attenuation -22 dB. The design structure was verified by a good agreement between simulated and measured result.** Overall, the proposed filter design has excellent performance in term of insertion loss, high independent notch-band, compact size, and implementable structures.

**Keywords**— BPF, defected microstrip structure, crossed-dumbbell, notch, UWB.

## I. INTRODUCTION

The ultra-wideband (UWB) wireless technology has great attention after the Federal Communications Commission (FCC) declare that the range of frequency 3.1–10.6 GHz can be used for a commercial purpose [1][2]. The critical subsystem of UWB wireless transceiver is UWB bandpass filter (BPF). High performance of UWB-BPF is needed to reduce noise and interference of radio signals simultaneously. The performance of UWB-BPF can be determined by a good value of insertion loss ( $S_{21}$ ), compact size, and implementable structures. There are various approaches have been proposed to obtain an excellent performance of UWB-BPF.

The UWB-BPF using modified composite-right/left-handed (CRLH) unit cell is proposed by [3] and to control transmission zeros a cross coupling is used. As the result, this UWB-BPF has good insertion loss ( $S_{21}$ ) and compact size, but the BPF structure is complex. Furthermore, the cross-coupling with  $\lambda/4$  short circuit-stub resonator was used by

[4]. As a result, the proposed UWB-BPF has a compact size and high selectivity.

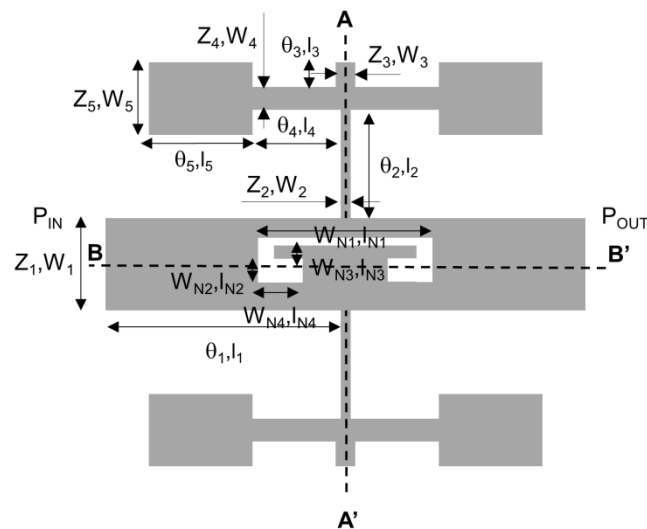


Fig. 1. The proposed UWB-BPF based on Crossed Dumbbell-Stub

The high selectivity response is produced by transmission zeros which are generated by coupling between input and output impedance. Furthermore, a stub-step impedance resonator (SIR) is proposed by [5]. The stub-SIR is connected at its center of filter structure symmetrically. This filter has frequency of 3.1–10.6 GHz. Furthermore, [6] proposed two rectangular stub resonators and single-stage parallel-coupled line and. The rectangular stub resonators create transmission zeros to extend stopband. Moreover, the short-circuited stubs with via-less resonator were investigated by [7]. The resonator structure was investigated by extracting all parasitic elements such as junction and discontinuity to generate UWB BPF. Moreover, Ref [8] presented four resonant modes based on multiple-mode resonator (MMR) with half-mode substrate integrated waveguide (HMSIW) structure. This resonator structure has successfully designed by this resonator structure. However, it has drawback such as complex resonator structure.

Furthermore, the utilizing short-circuited stubs with less-vias resonator structure was proposed by [9]. This paper has advantages such as via less resonator. Another attractive method is proposed by [10]. This paper is investigated UWB-BPF based on one-cell composite right- and left-handed-transmission line (CRLH-TL) resonator with optimized using particle swarm optimization (PSO) process.

However, the UWB-BPF design has drawback such as a complex structure and low selectivity.

In order to remove unnecessary radio frequency (RF) signal, some research proposes the notch band with various resonator structure. Asymmetric open loop resonator with defected ground structures (DGS) was investigated by [11] to produce UWB BPF with notch band. Furthermore, to reduce filter size, the interdigital hairpin resonator unit with three fingers are proposed by [12]. Moreover, the multiple-mode resonators (MMR) and SIR are combined by [13] to increase bandwidth. Another resonator structure to generate UWB BPF with notch band such as complementary split ring resonators (CSRR) [14], embedded SIR [15], radial stub loaded resonator [16], modified non-uniform resonator [17], meander H-shaped slot [18] and multilayer LCP technology [19]. All these methods propose a design UWB-BPF with notch band with good performance of  $S_{21}$ . However, the notch band is not independent. Besides that, majority the notch band structure has an impact to extend the filter size.

As novelty, this paper is proposed a compact UWB BPF based on crossed dumbbell-stub with notch band using defected microstrip structure as shown in Fig.1. The contribution of this paper such as: 1) The proposed resonator structure is based on cross dumbbell stub resonator structure, this structure can generate ultrawide pass band, 2) the notch band could be adjusted independently, 3) the notch band resonator is based on U-shaped defected microstrip structure (DMS), so the additional resonator is not required, and 4) the proposed UWB-BPF has excellent performance in term of insertion loss, compact size, and implementable structures.

This paper is organized as follows: Section 2 briefly describes the design of the proposed compact UWB bandpass filter based on crossed dumbbell-stub with notch band using defected microstrip structure, Section 3 presents the simulated and experimental results, and finally, Section 4 concludes this paper.

## II. DESIGN OF CROSSED DUMBBELL-STUB RESONATOR WITH NOTCH BAND USING DEFECTED MICROSTRIP STRUCTURE

### A. Crossed Dumbbell-Stub Resonator

To generate ultra-wide pass band, the crossed dumbbell stub resonator is proposed, as shown in Fig 1. The crossed dumbbell stub resonator is constructed by dual-dumbbell stub and it is placed at the middle of the filter structure. The  $W_1, W_2, W_3, W_4,$  and  $W_5$  represent the width of the resonator. The  $l_1, l_2, l_3, l_4,$  and  $l_5$  represent the length of the resonator. Furthermore, the resonator structure consists of five transmission lines having different characteristic impedances  $Z_N$  ( $N = 1,2,3,4,5$ ) with corresponding electrical lengths  $\theta_N$  ( $N = 5, 1,2,3$ ), respectively.

Since the resonator is symmetrical to the  $A-A'$  plane and  $B-B'$  plane, the resonant frequencies for even-mode and odd mode can be determined from impedance condition  $Z_{IN} = \infty$  or admittance condition  $Y_{IN} = 0$  [20][21][22]. Equivalent circuit model for the even-mode of UWB-BPF is shown in Fig. 2(a) and equivalent circuit model for the odd-mode of UWB-BPF is shown in Fig 2(b).

Analyzing the input impedance of even-mode  $Z_{IN-even mode}$  can be derived:

$$Z_{INA} = -jZ_5 \cot \theta_5 \quad (1)$$

$$Z_{INB} = Z_4 \frac{Z_{INA} + jZ_4 \tan \theta_4}{Z_4 + jZ_{INA} \tan \theta_4} \quad (2)$$

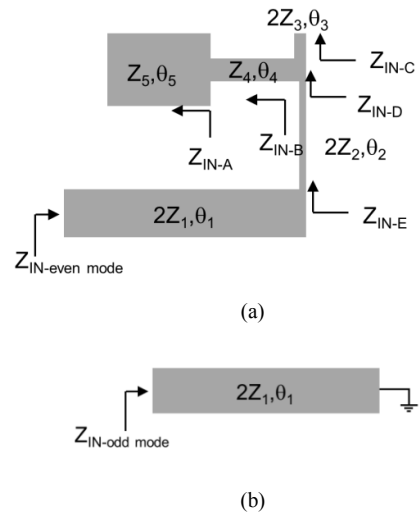


Fig. 2. (a) Equivalent circuit model for the even-mode of UWB-BPF, and (b) Equivalent circuit model for the odd-mode of UWB-BPF.

$$Z_{INC} = -j2Z_3 \cot \theta_3 \quad (3)$$

$$\frac{1}{Z_{IND}} = \frac{1}{Z_{INB}} + \frac{1}{Z_{INC}} \quad (4)$$

$$Z_{INE} = 2Z_2 \frac{Z_{IND} + j2Z_2 \tan \theta_2}{2Z_2 + jZ_{IND} \tan \theta_2} \quad (5)$$

$$Z_{IN-even mode} = 2Z_1 \frac{Z_{INE} + j2Z_1 \tan \theta_1}{2Z_1 + jZ_{INE} \tan \theta_1} \quad (6)$$

Equation (6) can also be expressed as:

$$Z_{IN-even mode} = \frac{2Z_1 A + j4Z_1^2 B \tan \theta_1}{2Z_1 B + jA \tan \theta_1} \quad (7)$$

with:

$$A = 2Z_2 Z_{IND} + j4Z_2^2 \tan \theta_2 \quad (8)$$

$$B = 2Z_2 + jZ_{IND} \tan \theta_2 \quad (9)$$

and:

$$Z_{IND} = \frac{P - Q}{R + S + T - U} \quad (10)$$

where :

$$P = 2Z_3 Z_4 Z_5 \cot \theta_3 \cot \theta_5 \quad (11)$$

$$Q = 2Z_3 Z_4^2 \cot \theta_3 \tan \theta_4 \quad (12)$$

$$R = j2Z_3 Z_4 \cot \theta_3 \quad (13)$$

$$S = j2Z_3 Z_5 \cot \theta_3 \cot \theta_5 \tan \theta_4 \quad (14)$$

$$T = jZ_4 Z_5 \cot \theta_5 \quad (15)$$

$$U = jZ_4^2 \tan \theta_4 \quad (16)$$

The resonant frequencies can be obtained when:

$$2Z_1 B + jA \tan \theta_1 = 0 \quad (17)$$

Analyzing the input impedance of odd-mode  $Z_{IN-odd mode}$  can be derived:

$$Z_{IN-odd mode} = j2Z_1 \tan \theta_1$$

The resonant frequencies odd mode can be determined from impedance condition  $Z_{IN} = \infty$ . The condition of the structure is found as follows

$$\tan \theta_1 = \infty \quad (18)$$

$$\theta_1 = \frac{(2n-1)}{2}\pi; \text{ for } n = 1,2,3 \dots \quad (19)$$

Furthermore, the next step is to add the effect of the notch resonator.

### B. Notch Band using Defected Microstrip Structure (DMS)

In order to remove unnecessary radio frequency (RF) signal, the rejection (notch) band was also proposed by using U-shaped defected microstrip structure (DMS). Moreover, the DMS is constructed at the center of crossed dumbbell resonator, as shown in Fig 3.

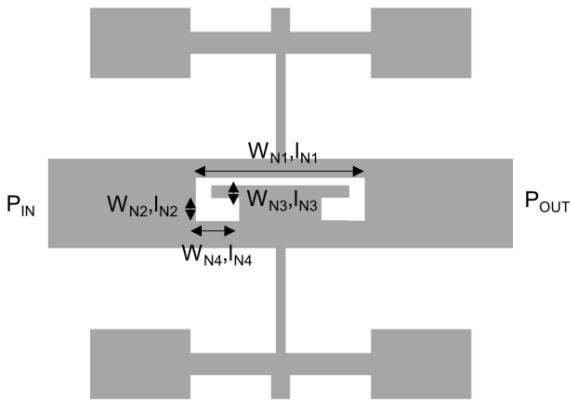


Fig. 3. The proposed defected microstrip structure (DMS) for notch band application

The  $W_{N1}$ ,  $W_{N2}$ ,  $W_{N3}$ , and  $W_{N4}$ , represent the width of the DMS resonator. The  $l_{N1}$ ,  $l_{N2}$ ,  $l_{N3}$ , and  $l_{N4}$  represent the length of the DMS resonator. The simulation and optimization is done by using The Momentum Advanced Design System (ADS). As a result, Fig 4 shows the insertion loss ( $S_{21}$ ) response with varied  $W_{N3}$  (mm). Furthermore, Fig 5 shows the return loss ( $S_{11}$ ) response with varied  $W_{N4}$  (mm). Fig 4. indicates that by increasing  $W_N$ , the frequency notch band is unchanged. However the value of  $S_{21}$  will increase slightly, but the attenuation is still lower than -15 dB.

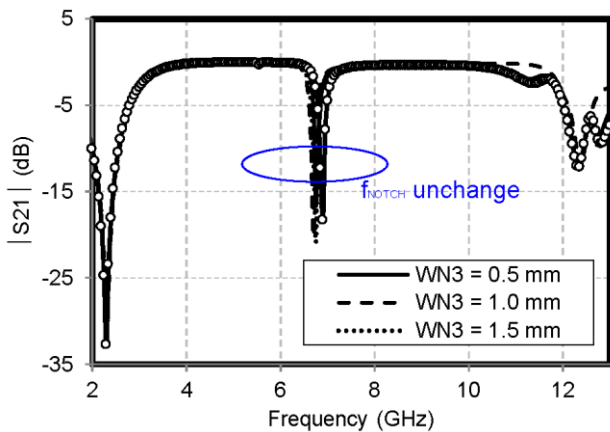


Fig 4.  $S_{21}$  (dB) response with varied  $W_{N3}$

Fig 5 shows that by increasing  $W_{N3}$  the frequency notch band is still stable. However the frequency value at the lowest  $S_{11}$  will shift slightly, but the value of  $S_{11}$  has still lower than -30 dB. The figure also shows that the cutoff frequency at upper and lower band unchanged.

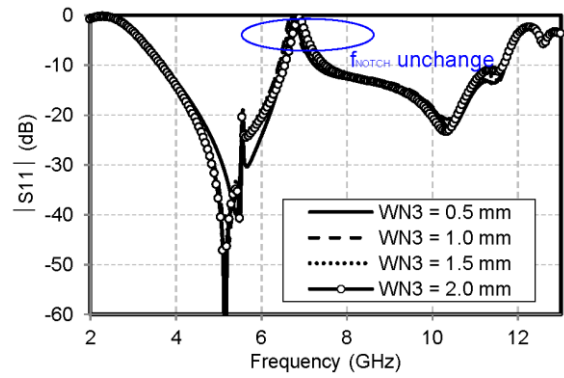


Fig 5.  $S_{11}$  (dB) response with varied  $W_{N3}$

Furthermore, Fig 6 and Fig 7 show the  $S_{21}$  and  $S_{11}$ , response with varied  $W_{N4}$ , respectively. The illustration from Fig 6, we can see that the frequency notch band is shifted independently. Although, there is a change in the notch band frequency, the upper and lower cut off frequency value remain stable. Therefore, the notch band frequency can be adjusted by modifying the U-shaped structure in term of  $W_{N4}$ . Moreover, the DMS method could produce the specific notch band without an expanded number of resonator or stub.

Moreover, Fig 7 shows the  $S_{11}$  (dB) response with varied  $W_{N4}$ . The data indicates that by increase a value of  $W_{N4}$ , the frequency of the notch band will be shifted to higher frequency. It is interesting to note that, the change in the value of frequency notch band by varied  $W_{N4}$ , was not accompanied by changes in the value of upper and lower frequency cutoff.

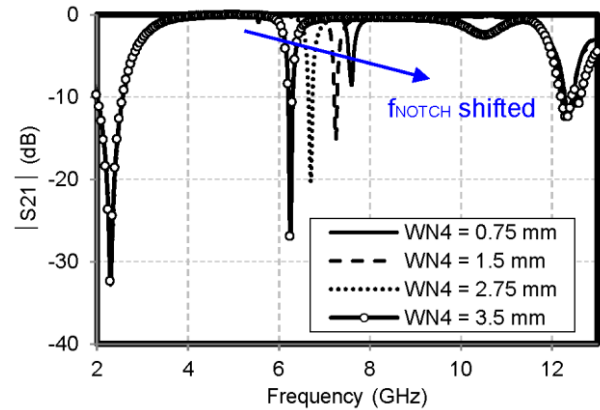


Fig 6.  $S_{21}$  (dB) response with varied  $W_{N4}$

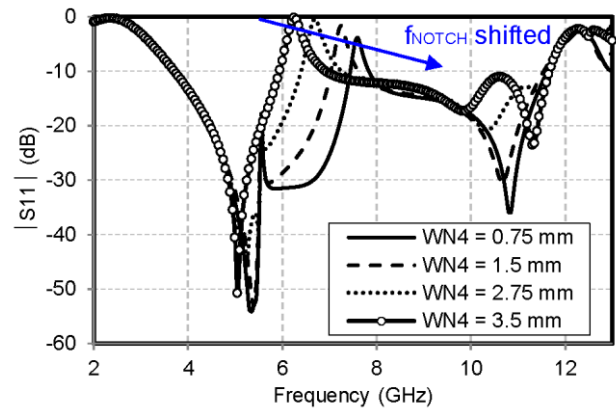


Fig 7.  $S_{11}$  (dB) response with varied  $W_{N4}$

### III. IMPLEMENTATION OF CROSSED DUMBELL-STUB RESONATOR WITH NOTCH BAND USING DEFECTED MICROSTRIP STRUCTURE

To validate the propose method, the prototype of BPF has been designed, built, and tested as shown in Fig 8a and 8b. Fig 8a and 8b show the photograph of UWB-BPF and UWB-Notch BPF, respectively. This BPF is fabricated on 2D - Duroid/RT 5880 substrate with permittivity  $\epsilon_r$  of 2.2, thickness  $h$  of 1.57 mm, and loss tangen tand of 0.0009.

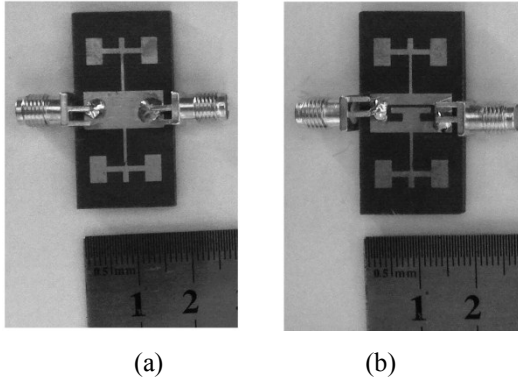
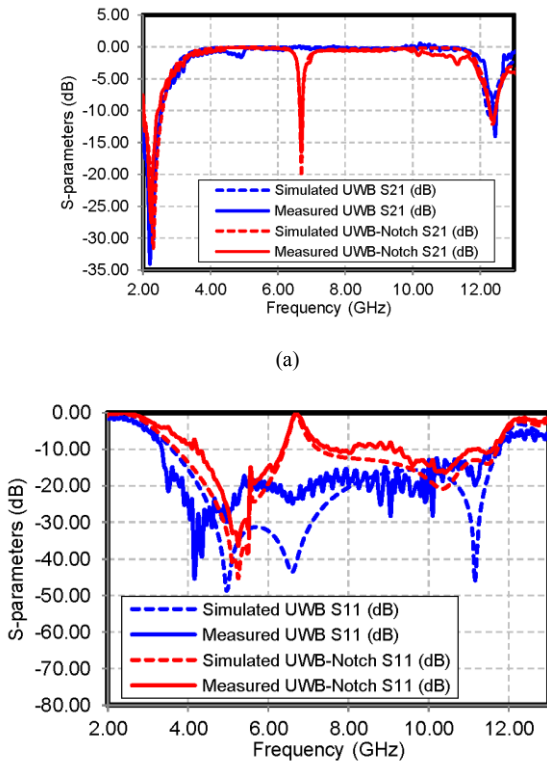


Fig 8. The photograph of (a) UWB-BPF and (b) UWB-Notch BPF.

Furthermore, after optimization, the following dimension of filter structure was fabricated:  $W_1 = 7$  mm,  $W_2 = 0.5$  mm,  $W_3 = 1$  mm,  $W_4 = 1$  mm, and  $W_5 = 5$  mm. The  $l_1 = 7.25$  mm,  $l_2 = 7$  mm,  $l_3 = 2$  mm,  $l_4 = 3.5$  mm, and  $l_5 = 3$  mm. Moreover, the size of  $W_{N1} = 0.5$  mm,  $W_{N2} = 0.75$  mm,  $W_{N3} = 1$  mm, and  $W_{N4} = 1.5$  mm, represent the width of the DMS resonator. The  $l_{N1} = 8.5$  mm,  $l_{N2} = 1.5$  mm,  $l_{N3} = 2$  mm, and  $l_{N4} = 2.75$ .



Figs. 9. Comparison of imulation and measurement results of (a)  $S_{21}$ , and (b)  $S_{11}$

Fig 9 (a) shows the comparison between simulation and measurement  $S_{21}$  results achieved by the UWB-Notch BPF.

A VNA Rohde Schwarz ZVA67 was used to test the fabricated prototype. Both simulated and measured results of the UWB-BPF have accomplished UWB requirements with a frequency range of 3.0 – 12.2 GHz. The S-parameters is slightly shifted due to the imperfection of soldering and pabrication process. Moreover, the measured result of UWB-Notch BPF has addition the notch band at 6.7 GHz with attenuation more than -20 dB. This notchband can be adjusted independently.

Fig 10(a) and 10(b) show the surface current distribution of lower band UWB-NotchBPF and upper band UWB-Notch BPF, respectively. The important information for the RF signal flows can be determined by plotting the surface current distribution. The surface current of UWB-BPF has been investigated by Momentum-ADS. The surface current distribution at the lower frequency band has flowed at the lower resonator, as shown in Fig 10(a). Furthermore, the surface current distribution at the upper frequency band has flowed at the upper resonator as shown in Fig 10(b). Moreover, Table 1 summarizes the comparison of the proposed UWB-BPF.

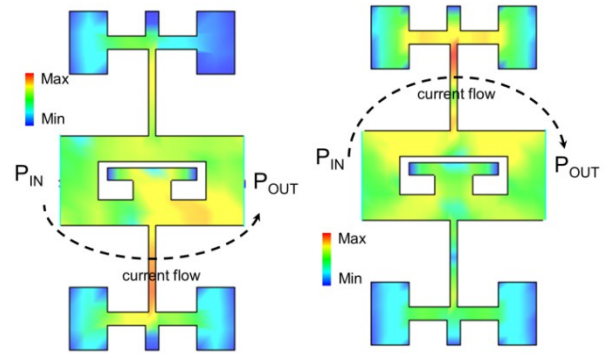


Fig. 10. Surface current distribution on of (a) lower band UWB-NotchBPF and (b) upper band UWB-Notch BPF.

Table 1. Summarizes the comparison of the proposed UWB-BPF

Ref	3 dB Pass-band (GHz)	$\epsilon_r / h$	Notch freq (GHz)/attenuation (dB)	Structure / Independent notch	Size $\lambda_G \times \lambda_G$ ( $\lambda_G$ : at 6.85 GHz)
[15]	3.1 – 10.6	2.2 / 0.78	5.22 / 20	2-D / no	0.61 x 0.50
[16]	3.0 – 10.8	2.2 / 0.50	8.1 / 20	2-D / no	0.55 x 0.35
[17]	3.6 – 10.2	10.8 / 0.63	5.6 / 15	2-D / no	0.82 x 0.17
[18]	2.8 - 10.8	2.65 / 1.0	5.47 / 20	2-D / no	0.82 x 0.36
[19]	2.6 - 10	3.15 / NA	6.4 / 8.0	3-D / no	1.36 x 0.32
<b>Proposed 1</b>	<b>3.0 – 12.2</b>	<b>2.2 / 1.57</b>	<b>-</b>	<b>2-D / NA</b>	<b>0.42 x 0.84</b>
<b>Proposed 2</b>	<b>3.0 – 12.2</b>	<b>2.2 / 1.57</b>	<b>6.7 / 22</b>	<b>2-D / yes</b>	<b>0.42 x 0.84</b>

NA = Not available

### IV. CONCLUSION

A compact ultra wideband (UWB) bandpass filter based on cross dumbbell stub with notch band structures is successfully implemented, and measured. In order to remove unnecessary radio frequency (RF) signal, the rejection

(notch) band was also proposed by using DMS. This BPF is fabricated on 2D - Duroid/RT 5880. The measured results show that the UWB-Notch has 3-dB passband from 3.0 – 12.2 GHz, with notchband at 6.7 GHz and the notch band has attenuation -22 dB. The design structure was verified by good agreement between simulated and measured result. In conclusion, the proposed filter design has excellent performance in term of insertion loss, high independent notch-band, compact size, and implementable structures.

#### ACKNOWLEDGMENT

The authors would like to thank Universitas Indonesia for funding through Hibah PIT9 Universitas Indonesia (UI), under contract No. NKB-0299/UN.R3.1/HKP.05.00/2019

#### REFERENCES

- [1] J. Liu, J. Lu, Z. He, T. Luo, X. Ying, and J. Zhao, "Super Compact Microstrip Uwb Bpf With Triple-Notched Bands," *Prog. Electromagn. Res. Lett.*, vol. 73, no. November 2017, pp. 61–67, 2018.
- [2] H. Peng, J. Zhao, and B. Wang, "Compact Microstrip Uwb Bandpass Filter With Triple-Notched Bands and Wide Upper Stopband," *Prog. Electromagn. Res.*, vol. 144, no. January, pp. 185–191, 2014.
- [3] J.-Q. H. and Q.-X. Chu, "Compact UWB Band-Pass Filter Utilizing Modified Composite Right/Left-Handed Structure With Cross Coupling," *Prog. Electromagn. Res. B*, vol. 29, pp. 269–288, 2011.
- [4] X. Li and X. Ji, "Novel compact UWB bandpass filters design with cross-coupling between  $\lambda/4$  short-circuited stubs," *IEEE Microw. Wirel. Components Lett.*, vol. 24, no. 1, pp. 23–25, 2013.
- [5] A. Taibi, M. Trabelsi, A. Slimane, M. T. Belaroussi, and J. P. Raskin, "A novel design method for compact UWB bandpass filters," *IEEE Microw. Wirel. Components Lett.*, vol. 25, no. 1, pp. 4–6, 2015.
- [6] S. W. Lan, M. H. Weng, C. Y. Hung, and S. J. Chang, "Design of a Compact Ultra-Wideband Bandpass Filter with an Extremely Broad Stopband Region," *IEEE Microw. Wirel. Components Lett.*, vol. 26, no. 6, pp. 392–394, 2016.
- [7] M. S. Razalli, A. Ismail, M. A. Mahdi, and M. N. bin Hamidon, "Novel Compact Microstrip Ultra-Wideband Filter Utilizing Short-Circuited Stubs With Less Vias," *Prog. Electromagn. Res.*, vol. 88, pp. 91–104, 2008.
- [8] C. X. Zhou, P. P. Guo, K. Zhou, and W. Wu, "Design of a Compact UWB Filter with High Selectivity and Superwide Stopband," *IEEE Microw. Wirel. Components Lett.*, vol. 27, no. 7, pp. 636–638, 2017.
- [9] M. S. Razalli, A. Ismail, M. A. Mahdi, and M. N. bin Hamidon, "Novel Compact 'Via-Less' Ultra-Wide Band Filter Utilizing Capacitive Microstrip Patch," *Prog. Electromagn. Res.*, vol. 91, pp. 213–227, 2009.
- [10] Y. C. Yun, S. H. Oh, J. H. Lee, K. Choi, T. K. Chung, and H. S. Kim, "Optimal Design of a Compact Filter for UWB Applications Using an Improved Particle Swarm Optimization," *IEEE Trans. Magn.*, vol. 52, no. 3, pp. 1–4, 2016.
- [11] P.-Y. Hsiao and R.-M. Weng, "Compact Open-Loop UWB Filter With Notched Band," *Prog. Electromagn. Res. Lett.*, vol. 7, pp. 149–159, 2009.
- [12] F. Wei and L. Chen, "Compact UWB Bandpass Filter With Notched Band," *Prog. Electromagn. Res. C*, vol. 4, pp. 121–128, 2008.
- [13] N. Daryasafar, S. Hamidi, and G. R. Shahryari, "Design and analysis of an ultra-wideband band-notched band-pass filter," *J. Electr. Eng.*, vol. 66, no. 2, pp. 113–116, 2015.
- [14] H. Lin, X. Xia, Z. Guo, and T. Yang, "Compact Uwb Filter With High Selectivity and a Deep Notched Band," *Prog. Electromagn. Res. Lett.*, vol. 63, no. October, pp. 123–128, 2016.
- [15] R. Ghatak, P. Sarkar, R. K. Mishra, and D. R. Poddar, "A compact UWB bandpass filter with embedded SIR as band notch structure," *IEEE Microw. Wirel. Components Lett.*, vol. 21, no. 5, pp. 261–263, 2011.
- [16] J. Xu, W. Wu, W. Kang, and C. Miao, "Compact UWB bandpass filter with a notched band using radial stub loaded resonator," *IEEE Microw. Wirel. Components Lett.*, vol. 22, no. 7, pp. 351–353, 2012.
- [17] S. W. Wong and L. Zhu, "Implementation of compact UWB bandpass filter with a notch-band," *IEEE Microw. Wirel. Components Lett.*, vol. 18, no. 1, pp. 10–12, 2008.
- [18] G. M. Yang, R. Jin, C. Vittoria, V. G. Harris, and N. X. Sun, "Small Ultra-wideband (UWB) bandpass filter with notched band," *IEEE Microw. Wirel. Components Lett.*, vol. 18, no. 3, pp. 176–178, 2008.
- [19] Zhang-Cheng Hao and Jia-Sheng Hong, "Compact UWB Filter With Double Notch-Bands Using Multilayer LCP Technology," *IEEE Microw. Wirel. Components Lett.*, vol. 19, no. 8, pp. 500–502, 2009.
- [20] T. Firmansyah, S. Praptodinyo, R. Wiryadinata, S. Suhendar, S. Wardoyo, A. Alimuddin, C. Chairunissa, M. Alaydrus, and G. Wibisono, "Dual-wideband band pass filter using folded cross-stub stepped impedance resonator," *Microw. Opt. Technol. Lett.*, vol. 59, no. 11, 2017.
- [21] T. Firmansyah, S. Praptodiyono, A. S. Pramudyo, C. Chairunissa, and M. Alaydrus, "Hepta-band bandpass filter based on folded cross-loaded stepped impedance resonator," *Electron. Lett.*, vol. 53, no. 16, 2017.
- [22] H. Wu and R. Yang, "A New Quad-Band Bandpass Filter Using Asymmetric Stepped Impedance Resonators," vol. 21, no. 4, pp. 203–205, 2011.



Teguh Firmansyah &lt;teguhfirmansyah@untirta.ac.id&gt;

---

## Acknowledgement of QIR 2019 Acceptance Letter

1 pesan

QIR 2019 &lt;qir2019@easychair.org&gt;

22 Juni 2019 pukul 12.23

Kepada: Teguh Firmansyah &lt;teguhfirmansyah@untirta.ac.id&gt;

Dear Teguh Firmansyah,

Your Conference Paper submission No.123 entitled "Compact UWB Bandpass Filter based on Crossed Dumbbell-Stub with Notch Band using Defected Microstrip Structure" has been accepted for the 16th International Conference of Quality in Research, which will take place 22-24 July 2019, in Padang Convention Center, Indonesia.

Please keep in mind that in order for your paper to be published in any of our listed publications, you will need to revise your paper in accordance to the comments and suggestions from the reviewers (via easy chair login <https://www.easychair.org/>). Full paper should also be submitted according the templates for its corresponding symposium as provided in the conference website. (<http://qir.eng.ui.ac.id/paper-submission/>).

Please submit your revised full paper by 15 July 2019 at the latest. However, we do urge that you submit them earlier. Below are items for your consideration for presenting a paper at the 16th International Conference of Quality in Research, Padang:


- Request your Support Letter for Visa Application/Letter of Invitation early to ensure that all paperwork is completed and approved on time.
- Register as the presenting author -- At least one of the authors must register as the presenting author and the required registration fee must be paid before 10 July 2019. Visit our website for additional information regarding registration. An early bird registration rate is available until 3 July 2019. Don't forget to submit your registration form along with your proof of payment to the conference secretariat (<http://qir.eng.ui.ac.id/wp-content/uploads/2019/03/QiR-2019-Registration-Form.doc>).
- Note that one author can be the presenting author on a maximum of 2 papers. Presenting authors must clearly mark in their registration for the conference of which paper(s) they will be presenting.

We look forward to receiving your revised Conference Paper.

General Chair,

Dr.Eng. Muhamad Sahlan, S.Si., M.Eng.

---

 **Letter of Acceptance QiR 2019 No 123.pdf**

977K