International Journal of Electronics and Communication Engineering and Technology (IJECET)
Volume 8, Issue 3, May-June 2017, pp. 10–16, Article ID: IJECET_08_03_002
Available online at
http://www.iaeme.com/IJECET/issues.asp?JType=IJECET&VType=8&IType=3
ISSN Print: 0976-6464 and ISSN Online: 0976-6472

FILTER DESIGN FOR IMPROVEMENT OF INTERFERENCE ON ADJACENT FREQUENCY

Ravirajsinh S Vaghela
R. P. Bhalodia College, BCA Department,
Manhar, Ploat-7, Rajkot, India

Dr. Atul Gonsai
Dr. Atul M. Gonsai, Computer Science Department,
Saurashtra University, Rajkot, India

ABSTRACT

This is paper is focus on the Radio signal's interference mitigation solution by new general filter equation. Introduction of the basic of filtering and types of filters which are basic for any filter base research. We generate two adjacent signal of BPSK and 8bit QAM signal in MATLAB and generate interference between them. In this situation we have examined our general filter equation and get different results.

Key words: RSP, BPSK, QAM

Cite this Article: Ravirajsinh S Vaghela and Dr. Atul Gonsai, Filter Design For Improvement of Interference on Adjacent Frequency, *International Journal of Electronics and Communication Engineering and Technology*, 8(3), 2017, pp. 10–16.
http://www.iaeme.com/IJECET/issues.asp?JType=IJECET&VType=8&IType=3

1. INTRODUCTION

Nearly every electronic system have radio signal processing techniques via Bluetooth, Wi-Fi or mobile signal or GPS. The perfect filter, whether it is a low pass, high pass, or band pass filter will demonstration no loss within the pass band.

These techniques are rapidly developing day by day due to tremendous technological developments in high speed computers, integrated circuit fabrication and field programmable arrays (FPGA). With these, digital signal processing has now become more reliable and speed processing is almost near infinity [1-3].

RSP used in most of application as backbone to transmit data to one place to other such as telecommunication, bio-medical engineering, internet. Among all above application need as same time so filtering is the needed on any devices. Currently available filters such as High pass, Band Stop, Low pass, Band pass, and notch filters. Notch filters have two different two types, one is IIR and FIR.

Purpose of filter design is to create frequency dependent modification of signal's data array. All filters work on frequency-dependent techniques that process signals. The core concept of filter one can express by testing the frequency dependent environment of the impedance of capacitors and inductors. In filter is working as voltage divider where the diversion leg is a reactive sensitive for effective resistance. If frequency is altered, the charge value of the sensitive resistance changes, and the voltage divider ratio changes.
Filter used for stabilize amplifiers by rising and falling of the gain at higher frequencies where high phase shift may cause oscillations. Main use of filters are separate signals and attenuating the unwanted frequencies.

2. BASICS TYPES OF FILTER

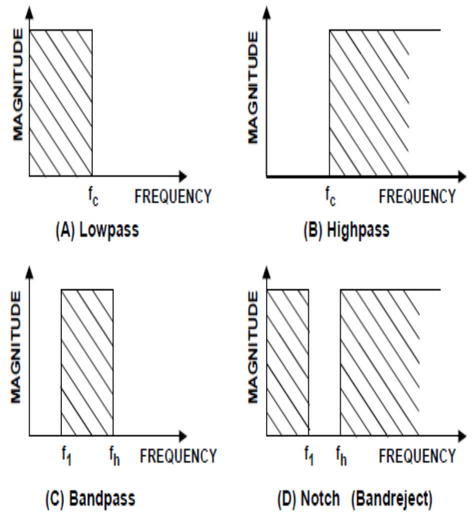

Figure 1 Basic type of Filters lowpass, Highpass, Bandpass, Notch

A band pass filter is the cascading the two filters, One is a high pass and second is a low pass.

The band pass will stop other frequency and simply allow in between frequency. A Model band pass filter is shown in **Figure 1.1(C)**.

An exact opposite to the band pass filter is band stop or in other buzzing word is notch filter. Here stopping the frequency which is cover in between. **Figure 1.1(D)** shows a notch model.

The perfect filters for every situation is not yet built or we cannot built. Another problem with filter is to real time filtering. Filter must be able to stop or pass the frequency but should not affect the actual speed of transmission. [5-6]

3. THE 5 FUNCTIONAL PARAMETERS OF A PRACTICAL FILTER ARE DEFINED AS UNDER

FC cut-off frequency where filter response leaves the error band most of -3db. The frequency at which the minimum attenuation in the stop band is reached is called stop band frequency (Fs). The *pass band ripple* (max) is the difference (error band) and the *minimum pass band attenuation* (min) defines the minimum signal attenuation within the stop band. The order of filter (M) is defined by the sheerness where in the transfer function M represents the number of poles. In the transfer function a pole is considered as root of the denominator and equally, a zero is considered as root of the numerator.

Simulation of BPSK & 8QAM signal

The goal of filter design is to perform frequency dependent alteration of a data sequence. A possible requirement might be to remove noise above 30 Hz from a data sequence sampled at 100 Hz. A more rigorous specification might call for a specific amount of passband ripple, stopband attenuation, or transition width. A very precise specification could ask to achieve the performance goals with the minimum filter order, or it could call for an arbitrary magnitude shape, or it might require an FIR filter.

You can also use the parametric modelling or system identification functions to design IIR filters. These functions are discussed in .Parametric Modelling.

This is a signal which is used in LTE with data. In LTE QAM (Quadrature Amplitude Modulation) 8-bit or 16-bit .This signal is a 8-bit QAM signal. Data of this signal is given below table.

This is a GPS Signal in this signal used BPSK (Binary Phase Shift Keying) Modulation. Data analysis of this signal is given in below table.

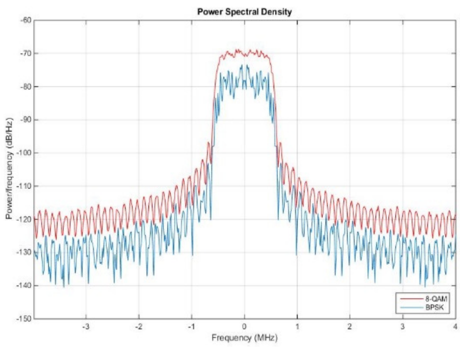

Figure 2 8QAM and BPSK signal adjacent simulation with interference presence

Both signal interfere to each other in major lobe. Both signal interfere at point of 0.5(MHz) and -0.5(MHz). For this interfere we can't do a proper operation based on signals. To remove this interfere require a filter and apply on that signal before receiving from the receiver. After applying which type of signal require that is given below signal graph. Interfere and all signal data given below table.

Table 1 8QAM and BPSK signal adjacent simulation with interference presence at -0.5 & 0.5

Frequency in MHz	Power/Frequency(dB/Hz)	
	BPSK	QAM-8
-3.5	-125.3	-118.5
-3	-129.2	-119.5
-2	-125.1	-118
-1.5	-128.5	-114.8
-1	-114.3	-112.9
-0.5	-73.81	-73.81
0	-81.4	-72.14
0.5	-73.85	-73.85
1	-114.3	-113.9
1.5	-128.5	-115.2
2	-125.1	-118.7
3	-129.4	-119.8
3.5	-127	-118

4. GENERAL FILTER EQUATION FOR INTERFERENCE

K*(s^2+wo^2)/(s^2+B*s+wo^2) **(1)**

Here K is a multiplayer which is amplify a signal that is also known as a gain. Centre frequency is denoted by fo, in Hz (fo = wo / (2 p)), Stopping Band Frequency width is denoted by fb of the stopping band, in Hz (fb = B / (2 p))

5. SIMULATION OF GENERAL EQUATION AND RESULTS

5.1. Simulation result Signal after applying general filter

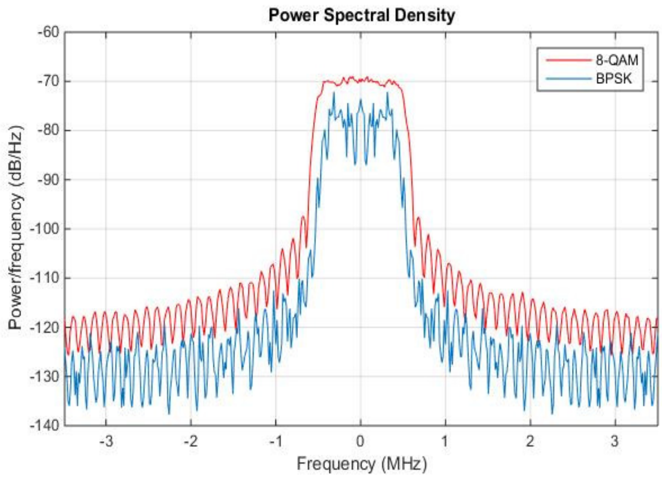

Figure 3 8QAM and BPSK signal adjacent simulation with interference mitigation with general equation]

Table 2 8QAM and BPSK signal adjacent simulation with interference mitigation with general equation

BPSK		**QAM-8**	
Frequency in MHz	**Power/ Frequency (dB/Hz)**	**Frequency in MHz**	**Power/ Frequency (dB/Hz)**
-3.5	-125.3	-3.5	-118.5
-3	-129.2	-3	-119.5
-2	-125.1	-2	-118
-1.5	-128.5	-1.5	-114.8
-1	-114.3	-1	-112.9
-0.5	-91.73	-0.5	-73.81
0	-81.4	0	-72.14
0.5	-91.71	0.5	-73.85
1	-114.3	1	-113.9
1.5	-128.5	1.5	-115.2
2	-125.1	2	-118.7
3	-129.4	3	-119.8
3.5	-127	3.5	-118

Here we changed a sample of 8-QAM and according to changed data 8-QAM signal become minor wide. But after simulation we can find interference mitigate after equation filter -0.50 and 0.50.

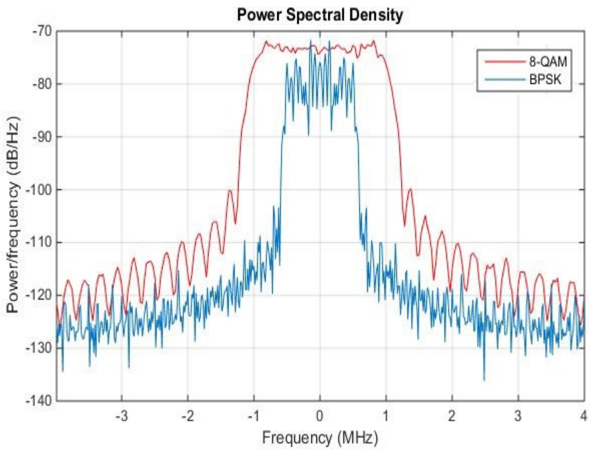

Figure 4 8QAM and BPSK signal adjacent simulation with interference mitigation with general equation at point -0.25 and 0.25.]

Table 3 8QAM and BPSK signal adjacent simulation with interference mitigation with general equation

Frequency in MHz	Power/Frequency(dB/Hz)	
	BPSK	QAM-8
-3.5	-122.5	-119.1
-3	-124.3	-118.6
-2	-132.2	-116
-1	-124.2	-77.01
-0.25	-72.1	-72.1
0	-83.53	-74.35
0.5	-72.1	-72.1
1	-124.2	-77.01
2	-132.2	-116
3	-124.3	-118.6
3.5	-122.5	-119.1

Here we changed a sample of 8-QAM and according to changed data 8-QAM signal become wide.

But after changing a data then also signal interfered in major lobe at point -0.25 and 0.25.

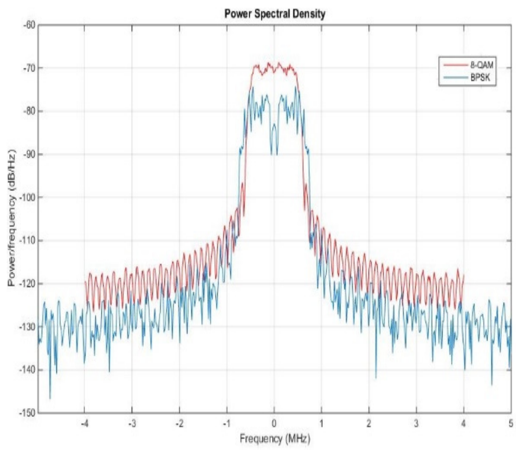

Figure 5 8QAM and BPSK signal adjacent simulation with different input frequency range interference mitigation with general equation

Table 4 8QAM and BPSK signal adjacent simulation with interference at point -0.5 and 0.5 mitigation with general equation]

Frequency	Power/Frequency(dI	
	BPSK	QAM-8
-4	-138.6	-119.4
-3	-131.1	-118.6
-2	-133.9	-115.6
-1	-119.7	-107.1
-0.5	-81.02	-81.02
0	-83.61	-70.81
0.5	-81.02	-81.02
1	-119.7	-107.1
2	-133.9	-115.6
3	-131.1	-118.6
4	-138.6	-119.4

In this signal we applied filter and a change a parameter of bpsk signal then after we getting an interference in major lobe at point -0.5 and 0.5.

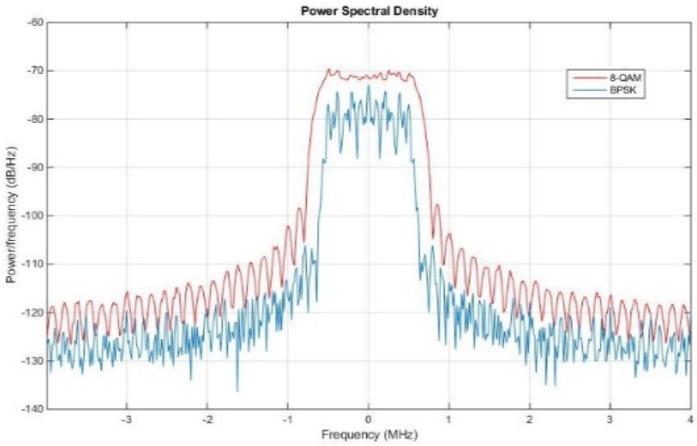

Figure 6 8QAM and BPSK signal adjacent simulation with interference four time at point -3.5,-2.2 and 3.5 that mitigation with general equation

Table 5 8QAM and BPSK signal adjacent simulation with interference four time at point -3.5,-2.2 and 3.5 that mitigation with general equation

Frequency	Power/Frequency(dI	
	BPSK	QAM-8
-3.5	-120.5	-120.5
-3	-115.6	-119.5
-2	-120.7	-120.7
-1	-116.2	-103
0	-72.87	-71.63
1	-116.2	-103
2	-120.7	-120.7
3	-115.6	-119.5
3.5	-120.5	-120.5

In this after applying a filter we get a near to desire signal. In this signal major lobe is not interfere at any point but minor lobe is interfere four time at point -3.5,-2.2 and 3.5 that we can neglect not completely but partially. So last is more efficient compare to upper both signal.

6. CONCLUSION

Here, we have generate the generalize equation for filtering process. After simulating different frequency with different input in adjacent scenario of 8QAM and BPSK amplitude. We get near desire result but not in all the scenario. In futures we may have best filter equation.

REFERENCES

[1] Meyer-Baese, Uwe, and U. Meyer-Baese. *Digital signal processing with field programmable gate arrays*. Vol. 65. Berlin: Springer, 2007.

[2] Brown, Stephen D., et al. *Field-programmable gate arrays*. Vol. 180. Springer Science & Business Media, 2012.

[3] Rose, Jonathan, et al. Architecture of field-programmable gate arrays: The effect of logic block functionality on area efficiency. *IEEE Journal of Solid-State Circuits* 25.5 (1990): 1217-1225.

[4] Geiger, Randall L., and Edgar Sanchez-Sinencio. Active filter design using operational trans conductance amplifiers: a tutorial. *IEEE Circuits and Devices Magazine* 1.2 (1985): 20-32.

[5] Hong, Jia-Shen G., and Michael J. Lancaster. *Microstrip filters for RF/microwave applications*. Vol. 167. John Wiley & Sons, 2004.

[6] Mitra, Sanjit Kumar, and Yonghong Kuo. *Digital signal processing: a computer-based approach*. Vol. 2. New York: McGraw-Hill, 2006.

[7] Gaurav Purohit, Divya Vyas, Kota Solomon Raju, V.K Chaubey, and Arvind Nehra, Hardware Co-Simulation of Bpsk and QPSK For Software Defined Radio, Volume 4, Issue 7 (2013), pp. 301-308 International Journal of Electronics and Communication Engineering & Technology (IJECET).

[8] Ami Munshi and Srija Unnikrishnan, Performance Analysis of Radar Based On Ds-Bpsk Modulation Technique, Volume 4, Issue 2, March – April, 2013, pp. 137-143, International Journal of Electronics and Communication Engineering & Technology (IJECET)

[9] Pratima Singh and Dr. A. K. Sharma. Performance Enhancement of Wi-Max Mobile Handover OFDM Using M-QAM System with Best-Relay Selection, International Journal of Electronics and Communication Engineering & Technology, 6(9), 2015, pp. 11-18.

[10] Levy, Ralph, Richard V. Snyder, and George Matthaei. Design of microwave filters. *IEEE Transactions on Microwave Theory and techniques* 50.3 (2002): 783-793.