Microwave filter

Name: Sparsh Arya

Registration Number:17BEC0656

Slot: F1

Subject: Microwave Engineering

OBJECTIVE

- For the given filter specifications, design and simulate the LPFs using Richard's Transformation and Stepped Impedance methods
- 2. Implement on standard substrate $\varepsilon r = 4.4$, H=1.6 mm, T=0.05 mm, Tan δ =0.001. System Impedance (Ohm)= 30
- 3. Given $Z_0 = 45$ Ohm
- 4. F-cutoff=4.5Ghz
- 5. Insertion-loss=-30DB at 8Ghz
- 6. Ripple magnitude=0(maximally flat)
- 7. Low Impedance = 35 Ohm
- 8. High Impedance= 125 Ohm

Procedure

Richard's Transformation

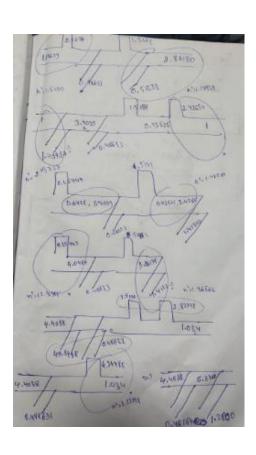
- Find value of N for corresponding ripple factor
- 2. Simplify the circuit to open circuit configuration using kurdos identity.
- 3. Create a schematic for the following circuit.
- 4. Run a frequency analysis.
- 5. Plot the graph.

- 1. Find value of N for corresponding ripple factor
- 2. Simplify the circuit using respective values of low impedance and high impedance.
- 3. Create a schematic for the following circuit.
- 4. Run a frequency analysis.
- 5. Plot the graph.

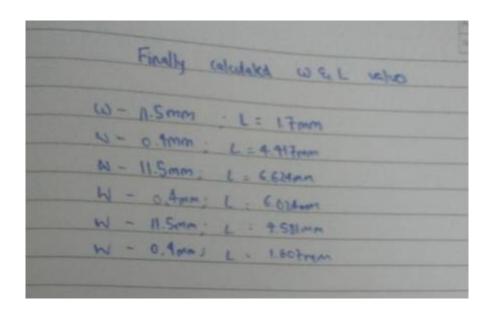
Calculations

fc = 1.5G/13 II = 3088 of 8G/13(f) R = 0 Zeau = 35/1 Znigh = 125/1 Znigh = 125/1 [ask = 5 Stradate LPF with year stribs (wout smoletic ii) Skepped Impedane Hethad N > log10 (10 ^{11/10} -1) 2 lug10 (2/12) = log10 (8/4.5) N = 6.0020 Thus gi 21 - 05176 = C, 91 - 1918 CL		low puss files Implementation
IL: 3088 at 8643(f) R: 0 Zeau: 35/L Znigh: 125/L Znigh: 125/L Took: 5 Simulate LPF with year stubs (court smulation) 103/R: 5 Simulate LPF with year stubs (court smulation) 2 logic (10 ³ -1) 3 logic (10 ³ -1) 4 logic (10 ³ -1) 2 logic (10 ³ -1) 3 logic (10 ³ -1) 4 logic (10 ³ -1) 2 logic (10 ³ -1) 3 logic (10 ³ -1) 4 logic (10 ³ -1) 4 logic (10 ³ -1) 2 logic (10 ³ -1) 2 logic (10 ³ -1) 3 logic (10 ³ -1) 4 logic (10 ³ -1) 5 logic (10 ³ -1)	ouven:	Zo: 45.N
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$R = 0$ $Z_{cas} = 35N$ $Z_{high} = 125N$ Z_{h		IL = -3048 at 86Hz (f)
Zhigh = 125A Tash : 5 Stradate LPF with year stubs (court simulation) ii; Stepped Impedance Hethad N ? log10 (10 ¹¹ /10-1) 2 10910 (10 ¹² /10-1) 2 10910 (10 ¹² /10-1) 2 10910 (10 ¹² /10-1) 1 10910 (10 ¹² /10-1) 2 10910 (10 ¹² /10-1)		
Thus 9: 93 - 19318 - C.		ZLOW = 355
Thus 9: 93 - 19318 - C.	(1)	ZHIGH = 1251
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$\frac{2 \log_{10}(\omega/\omega)}{2 \log_{10}(\log^2-1)}$ $\frac{2 \log_{10}(\log^2-1)}{2 \log_{10}(\log^2-1)}$ $N = 6.0020$ $\frac{91}{21} - 0.5176 = C,$ $\frac{91}{21} - 1.918 = C,$ $\frac{91}{3} - 1.9318 = C.$		N> 1000 (10 14/10-1)
$\frac{109_{10}(10^{3}-1)}{2(80_{10}(80_{10}))}$ $N = 6.0020$ $\frac{91}{10} - 0.5176 = C,$ $\frac{91}{10} - 1.918 = C.$		2 / va (W/w)
7 19,0 (8/4.5) N = 6.0020 Thus 9: 91 - 0.5176 = C, 92 - 1.9182 - L; 93 - 1.9318 - Cc		
7 19,0 (8/4.5) N = 6.0020 Thus 9: 91 - 0.5176 = C, 92 - 1.9182 - L; 93 - 1.9318 - Cc		2 logic (103-1)
Thus 9: 91 - 0.5176 = C, 92 - 1.9182 - L1		2 16910 (8/4.5)
Thus 9: 91 - 05176 = C, 92 - 19182 - L1		
91 - 05176 = C, 92 - 19182 - Li 93 - 19318 - CL		N = 6.0020
91 - 05176 = C, 92 - 19182 - Li 93 - 19318 - CL	The	91
13 - 19318 CL	11103	
13 - 19318 CL		92 - 14142 - Li
		93 - 19318 CL
94 - 1.9318 + 62		94 - 19318 . 42
gc - 1.4142 · C3		Gc - 1,4142 · C3
96 - 05176 43		96 - 05176 43



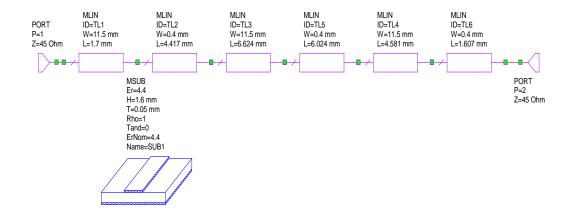


Calculations

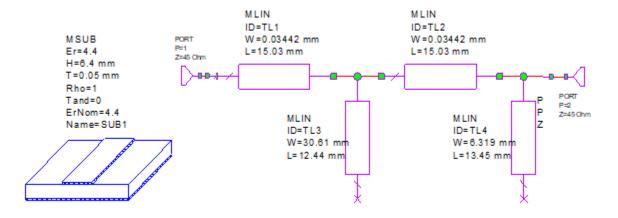


			Stepped impedance
	9:	Zelzn	BL values
1+	4	35	20.65
2	C	185	35.20
3.	L	35	38:586 77.578
5	C	125	48.02
5.	1	35	56.7
6	C	125	15.81

Design

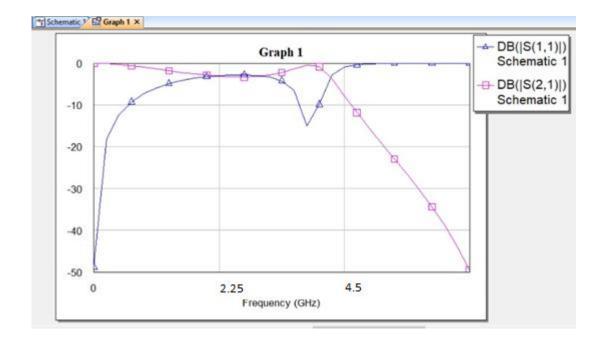


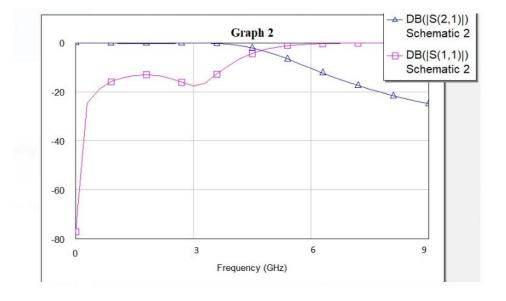
Richard's Transformation



Graph

Richard's Transformation





Results

- N=6
- Fc=4.5Ghz

Richard's Transformation

- N=6
- Fc=4.5Ghz

Inferences

The Low pass filter has been designed using Richard's transformation and Step impedance method.

The graphs have been constructed and the output values have been recorded.

References

- Microwave Engineering- David M. Pozar
- https://www.tutorialspoint.com/microwave_engineering/microwave engineering_introduction.htm
- https://www.microwaves101.com/encyclopedias/waveguide-mathematics
- https://en.wikipedia.org > wiki > Microwave engineering