Almost everything you wanted to know about filters but were afraid to ask.

Presented By:
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The Genesee County Radio Club

What are filters and why do I need to know about them?

Filters stop unwanted signals on both your transmitter and receiver.

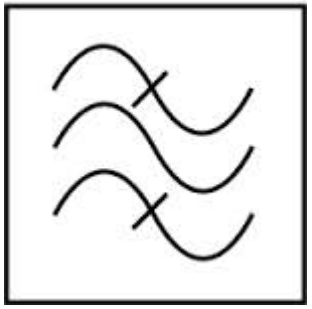
Most of us who are old enough remember the CB'ers coming in on our TV set with their unfiltered foot warmer (illegal) amplifiers.

We will be going over three of the filters used in radio technology. They are the Low pass filter, the High pass filter and the Band pass filter.

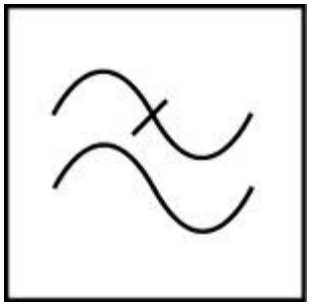
February - We will discuss the very basics of filters and list places where you can get the needed parts for your filter designs.

March – We will discuss the mathematics involved with filter design and go over band pass filters by Lew Gordon K4VX from the September 1988 QST.

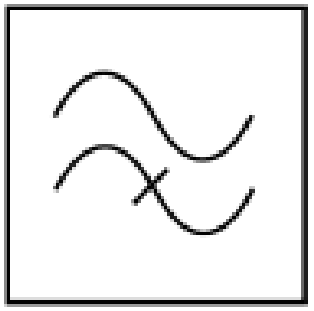
April – we will have a workshop on testing filter designs with a frequency generator and oscilloscope.



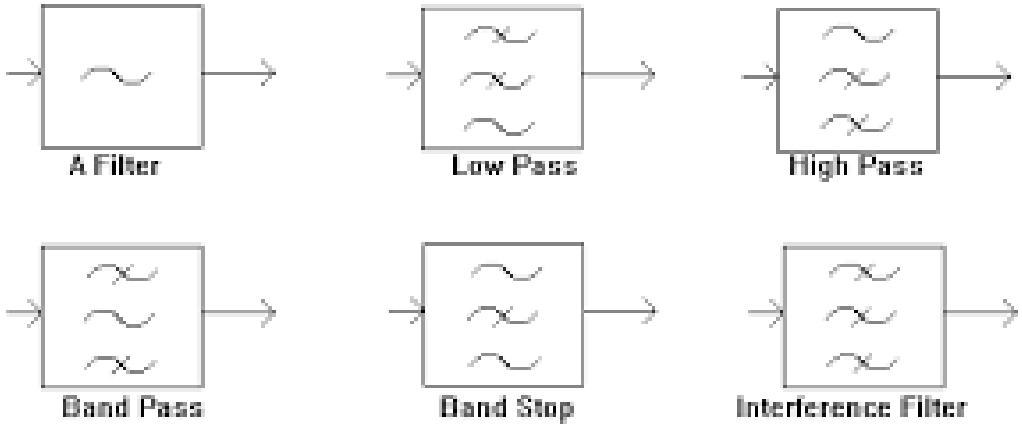
BPF



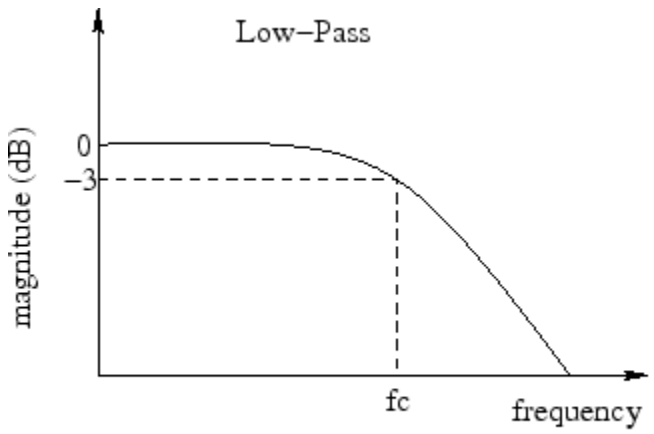
LPF

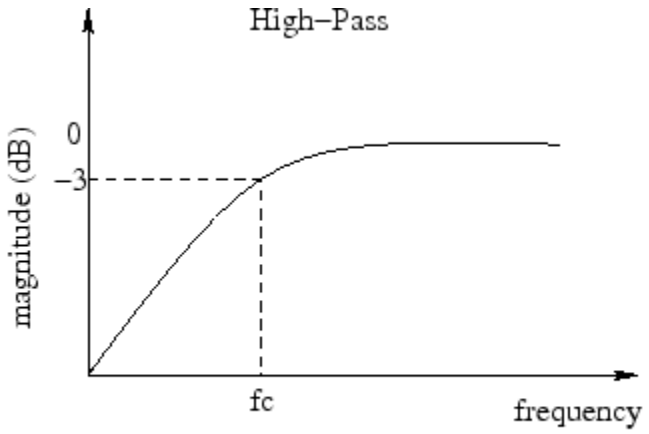


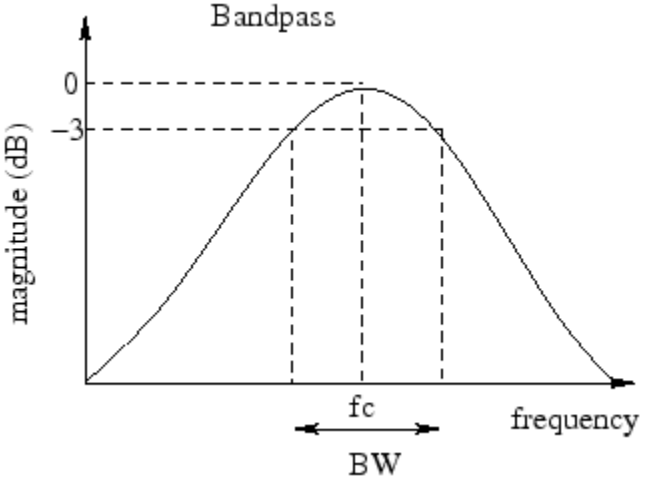
HPF

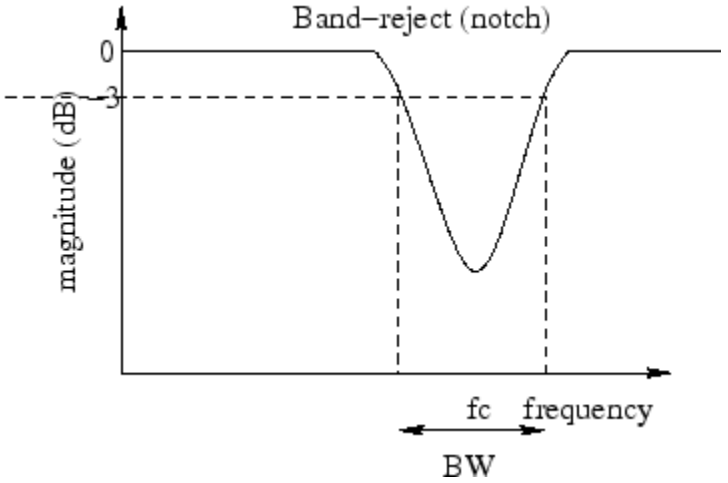


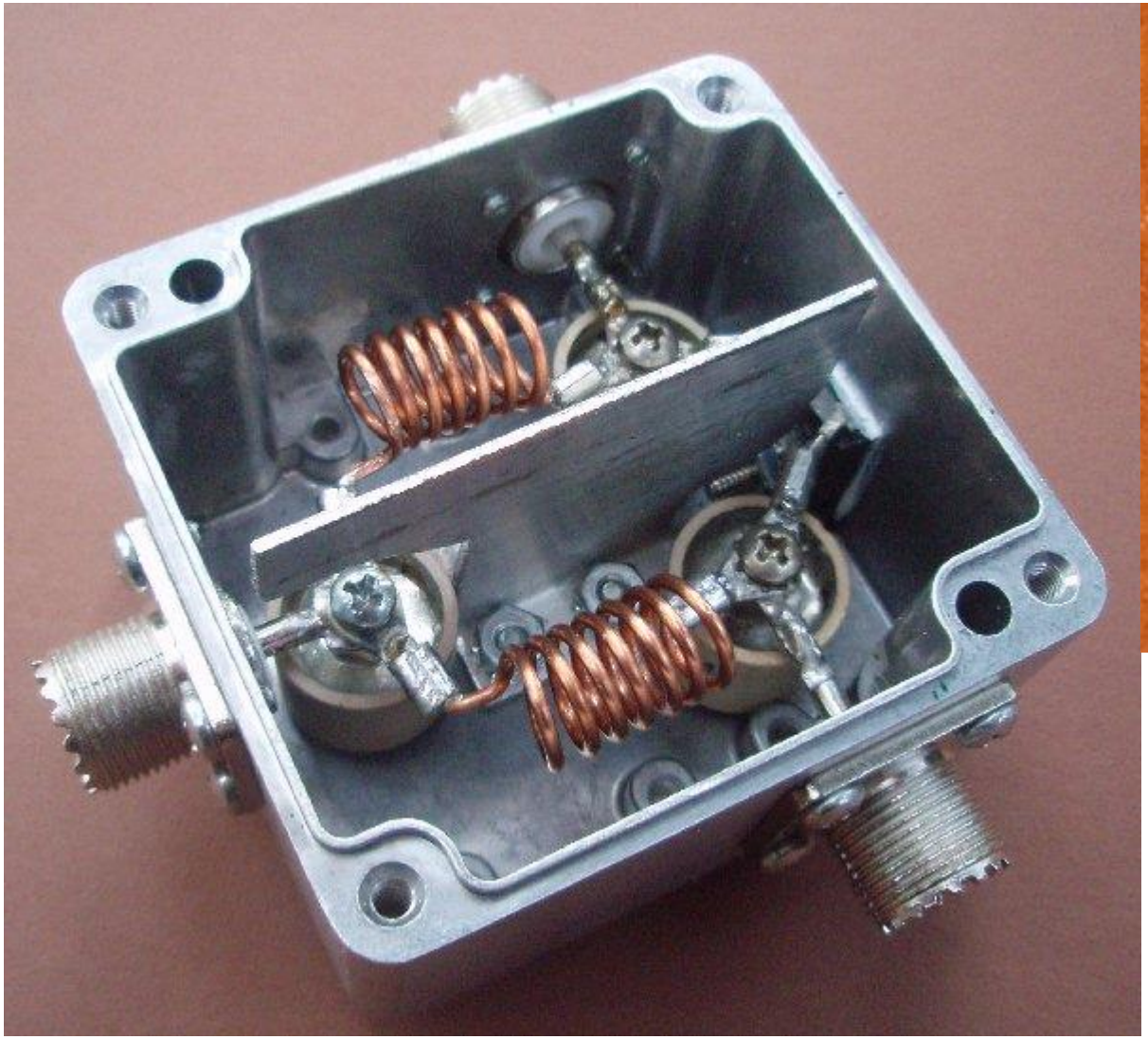
BLOCK DIAGRAM SYMBOLS FOR FILTERS

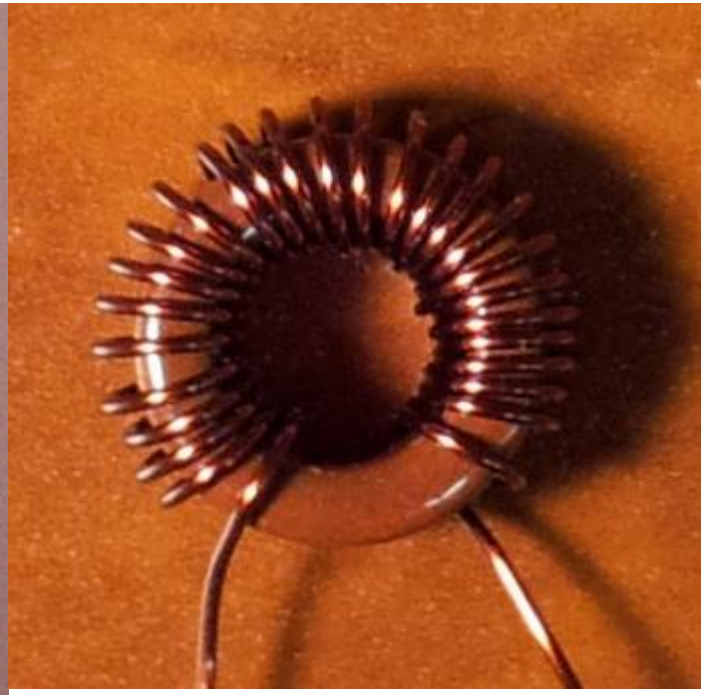

Low–Pass
magnitude (dB)
0
–3
fc
frequency


High–Pass
magnitude (dB)
0
–3
fc
frequency


Bandpass
magnitude (dB)
0
–3
fc
frequency
BW


Band–reject (notch)
magnitude (dB)
0
–3
fc
frequency
BW





Micro metals Toroidal Cores					
Mix	Color	Freq (MHz)	Stability	μ	Material
3	grey	0.05–0.5	370	35	Carbonyl HP
15	red/white	0.1–2	190	25	Carbonyl GS6
1	blue	0.5–5	280	20	Carbonyl C
2	red	2–30	95	10	Carbonyl E
7	white	3–35	30	9	Carbonyl TH
6	yellow	10–50	35	8	Carbonyl SF
10	black	30–100	150	6	Powdered iron W
17	blue/yellow	40–180	50	4	Carbonyl
12	green/white	50–200	170	4	Synthetic oxide

AL Values for Micro metals Iron Powder Toroidal Cores									
	Mix/Color / Frequency (MHz)								
	3 / grey	15 / red/wht	1 / blue	2 / red	7 / white	6 / yellow	10 / black	17 / blu/yel	12 / grn/wht
Size	0.05–0.5	0.1–2	0.5–5	2–30	3–35	10–50	30–100	40–180	50–200
T-12	60	50	48	20	18	17	12	7.5	7.5
T-16	61	55	44	22	—	19	13	8	8
T-20	76	65	52	27	24	22	16	10	10
T-25	100	85	70	34	29	27	19	12	12
T-30	140	93	85	43	37	36	25	16	16
T-37	120	90	80	40	32	30	25	15	15
T-44	180	160	105	52	46	42	33	18.5	18.5
T-50	175	135	100	49	43	40	31	18	18
T-68	195	180	115	57	52	47	32	21	21
T-80	180	170	115	55	50	45	32	22	22
T-94	248	200	160	84	—	70	58	32	—
T-106	450	345	325	135	133	116	—	—	—
T-130	350	250	200	110	103	96	—	—	—
T-157	420	360	320	140	—	115	—	—	—
T-184	720	—	500	240	—	195	—	—	—
T-200	425	—	250	120	105	100	—	—	—

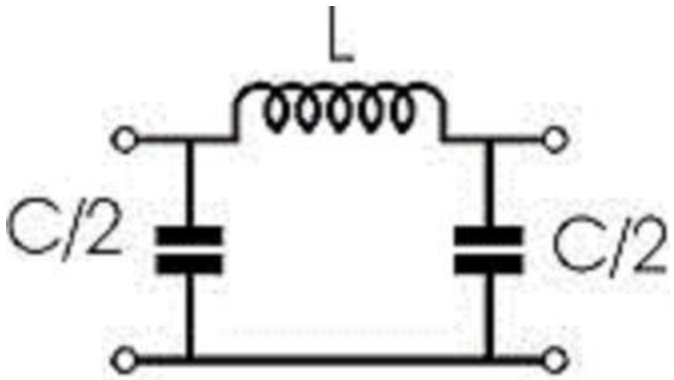
A_L = µH per 100 turns

Maximum Turns										
AWG	T-12	T-25	T-37	T-50	T-68	T-80	T-94	T-106	T-130	T-200
12	–	–	3	6	9	14	16	16	25	43
14	–	1	5	8	13	18	21	21	32	54
16	–	2	7	13	17	24	28	28	41	69
18	1	4	10	18	23	32	37	37	53	88
20	1	6	14	23	29	41	47	47	67	111
22	2	9	19	30	38	53	60	60	86	140
24	4	13	25	39	49	67	77	77	109	177
26	7	17	33	50	63	85	97	97	137	223
28	9	23	42	64	80	108	123	123	173	281
30	13	29	54	81	101	136	154	154	217	355
32	17	38	68	103	127	171	194	194	272	439
34	23	49	88	132	162	218	247	247	346	557

Pi Filter

The Pi Type which consists of two shunt capacitors with a series inductor.

This filter provides good performance with a minimum of component cost, since inductors are usually more expensive than capacitors. However, in some cases the above filter configuration does not provide sufficient attenuation of harmonics. This is because there is only one series component and there may be too much coupling between the input and the output of the filter.



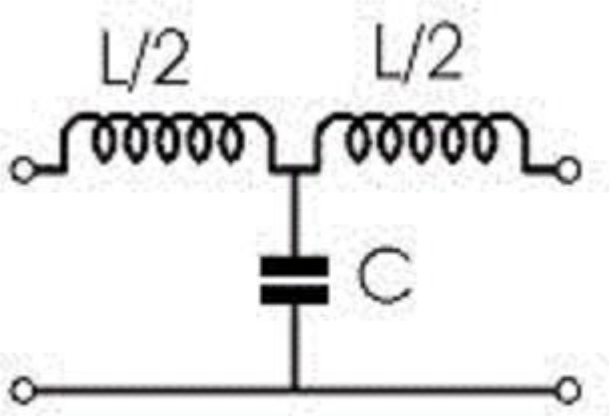
Pi section filter

T filter

The improved version of the filter solves this problem by using two series components.

This filter is of a T-type with two series inductors and one shunt capacitor. It provides greatly improved stop-band attenuation compared to the Pi-type filter. The coupling between the input and output is significantly reduced because two series components are used.

A slight disadvantage of this filter is that it is more sensitive to parasitic shunt capacitance. The component values must be fine-tuned to account for the PCB layout parasitics.



T section filter

3-Pole Bandpass Filter