

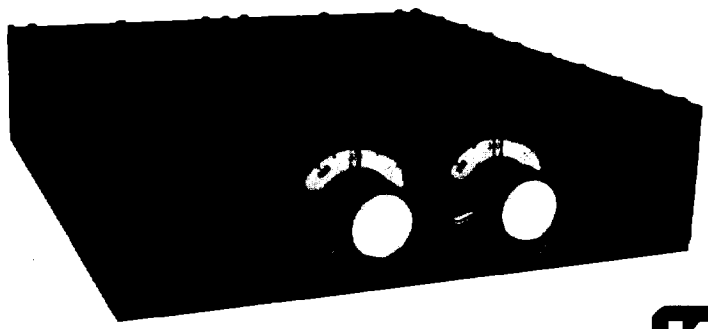
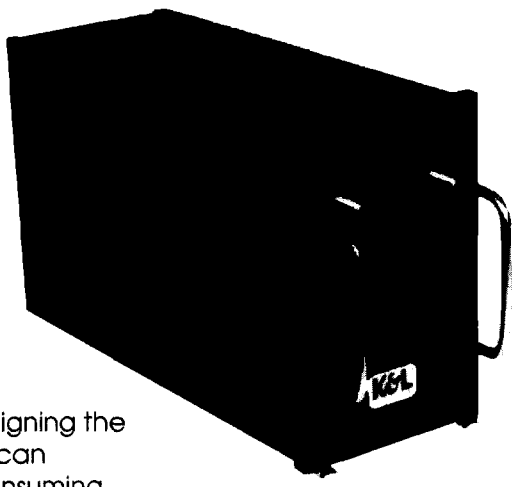


# Tunable Filters

## ◆ Introduction

Receivers or test and measurement systems usually require RF signal processing consisting of preamplification, attenuation, or preselection. Preselection is defined as the pretuning of desired signals and filtering of all interfering signals. The interference can be noise, harmonics, or adjacent channel signals. Without preselection, aligning the receiver or measuring signals can become a difficult and time consuming task. To remove the interference, tunable filters provide the best solution. K&L Microwave offers several series of tunable filters consisting of tunable bandpass (BT), tunable bandreject (TNF), tunable diplexer (TBD), tunable coaxial and tunable waveguide (FCT and FWT), tunable multicoupler (TM), and specialty filters that tune out unwanted interference.

K&L's BT series tunable bandpass filters cover the .8 to 3000MHz frequency range and attenuate all interference with greater than 45dB rejection. These filters are available with a 1% to 10% 3dB bandwidth in 3 to 6 sections. Because many of the BT series can accept up to 50 Watts of RF power, they can be placed directly in-line with transmitters.



K&L's TNF series tunable bandreject filters are available in the same high "Q" packages as the BT series. These filters are available with 3 to 6 sections and are capable of eliminating undesirable signals by greater than 50dB rejection. Three sections are standard in the TNF series line.

K&L's FCT and FWT series high frequency tunable bandpass filters cover the 600MHz to 21GHz frequency range with 2 to 6 sections and 3dB bandwidths from 0.1% to 2%. These filters in conjunction with the BT series allow complete tunable coverage from 800kHz to 21GHz.

K&L's TBD and TM series of tunable filters allow for simultaneous transceiver operations using a common antenna port. The TBD series are housed in a single aluminum case with

frequency ranges from 30MHz to 1850MHz.

Both diplexer and triplexer configurations are available. The standard TM series allows up to four individually housed tunable filters to operate from a common antenna port. These filters are available in the UHF and VHF bands and are combined in a single rack configuration.

To accommodate today's growing need for computerization, any of K&L's tunable filter series' can be configured with digital control. This added feature allows the flexibility to automate a wide variety of applications. Most computer interfaces are available with the standards being IEEE-488 (GP-IB), RS-232, or BCD. Other interfaces can be specified.

Phone: 410-749-2424



FAX: 410-749-5725





# Tunable Filters - BT Series

## ◆ Features

K & L Microwave's BT Series Tunable Bandpass Filters cover the frequency range of 0.8 to 3000MHz with each model typically covering a complete octave. These filters are available with 3 through 6 sections and a nominal 3dB bandwidth from 1% to 10%. Standard 3 and 5 section models are available with a 5% 3dB bandwidth offering low insertion loss values from 0.5dB through 1.3dB and a VSWR of less than 1.5:1.

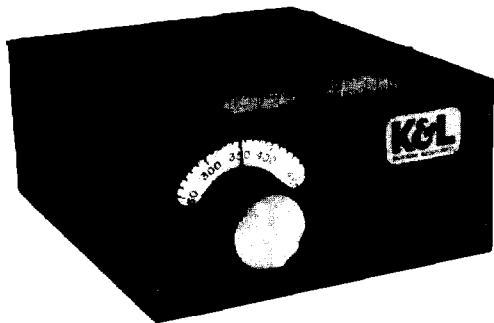
Each BT Series is constructed in a sturdy aluminum housing. Each section of the tunable filter is iris-coupled yielding a low ripple Chebyshev response.

Manual tuning of the BT Series is accomplished by a front panel vernier/dial assembly. Each dial is engraved with the direct-read-out center frequencies which eliminates the need for interpolating frequency calibration charts. (See the digitally controlled tunable filter section of this catalog for details on remote tuning of this filter.)

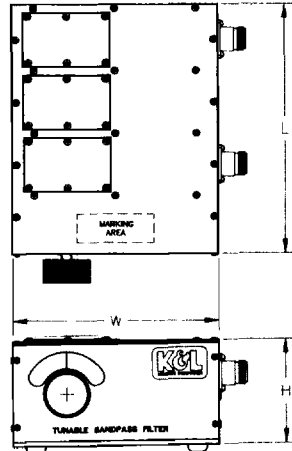
## ◆ Connectors

Connector	Code
SMA Female	O
SMA Male	OP
"N" Female	N
"N" Male	NP
TNC Female	T
TNC Male	TP
BNC Female	B
BNC Male	BP
"F" Female	F
"F" Male	FP

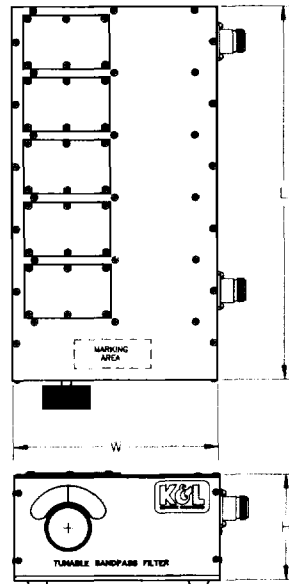
\* Filters containing the digital control option will be larger than specified. Contact factory for details.



## ◆ Mechanical



3 section filter



5 section filter

## ◆ To Order

D 5 BT - 250/500 - 5-N/N - G R V  
1 2 3 4 5 6 7 8 9 10

1. Digital control designation \* (remove if manually controlled)
2. Number of sections
3. Model
4. Frequency range (MHz)
5. Nominal 3dB bandwidth in % or MHz
6. Input connector
7. Output connector

### Digitally Controlled Options: (Remove if not used)

8. Control logic
9. Drive voltage
10. Tuning option  
(See digitally controlled tunable filter section of this catalog for details of these options.)

## ◆ Special Requirements

In addition to the standard line offered in the BT Series, K & L offers the engineering and manufacturing capabilities to handle a vast array of special requirements. Some of these capabilities are:

1. Digitally controlled
2. Special tuning ranges starting as low as 200kHz
3. 3dB bandwidths as narrow as 0.3%
4. Power handling capabilities up to 800 watts peak
5. Impedances of 50 or 75 Ohms with full test capabilities
6. Custom bandwidths and shape factors
7. Torque as low as 6 oz/in
8. Custom sizes to customer specification
9. Ruggedized capabilities (see additional information)
10. Military qualified capabilities



# Adjustable Filters-BT Series

## ◆ 5%, 5-Section Filters

Standard BT Series	Maximum Insertion Loss	L	W	H
5BT-0.8/1.5-5-N/N	4.5	22.00	9.32	4.19
5BT-1.5/3.0-5-N/N	3.0	22.00	9.32	4.19
5BT-3/6-5-N/N	2.5	22.00	9.32	4.19
5BT-5/10-5-N/N	2.5	22.00	9.32	4.19
5BT-6/12-5-N/N	2.5	22.00	9.32	4.19
5BT-12/24-5-N/N	2.5	14.70	7.00	4.00
5BT-15/30-5-N/N	2.5	14.70	7.00	4.00
5BT-24/48-5-N/N	1.3	9.80	5.38	2.75
5BT-30/76-5-N/N	1.3	9.80	5.38	2.75
5BT-32/64-5-N/N	1.3	9.80	5.38	2.75
5BT-48/95-5-N/N	1.3	9.80	5.38	2.75
5BT-63/125-5-N/N	1.3	9.80	5.38	2.75
5BT-95/190-5-N/N	1.3	9.80	5.38	2.75
5BT-125/250-5-N/N	1.3	9.80	5.38	2.75
5BT-190/375-5-N/N	1.3	9.80	5.38	2.75
5BT-200/400-5-N/N	1.3	9.80	5.38	2.75
5BT-250/500-5-N/N	1.0	9.80	5.38	2.75
5BT-375/750-5-N/N	1.0	9.80	5.38	2.75
5BT-500/1000-5-N/N	1.0	9.80	5.38	2.75
5BT-750/1500-5-N/N	1.0	9.80	5.38	2.75
5BT-1000/2000-5-N/N	1.0	7.38	2.88	2.75
5BT-1500/3000-5-N/N	1.0	7.38	2.88	2.75

## ◆ 5%, 3-Section Filters

Model Number	Maximum Insertion Loss	L	W	H
3BT-0.8/1.5-5-N/N	3.0	13.66	9.32	4.19
3BT-1.5/3.0-5-N/N	3.0	13.66	9.32	4.19
3BT-3/6-5-N/N	1.8	13.66	9.32	4.19
3BT-5/10-5-N/N	1.8	13.66	9.32	4.19
3BT-6/12-5-N/N	1.8	13.66	9.32	4.19
3BT-12/24-5-N/N	1.8	9.60	7.00	4.00
3BT-15/30-5-N/N	1.8	9.60	7.00	4.00
3BT-24/48-5-N/N	1.0	6.56	5.38	2.75
3BT-30/76-5-N/N	1.0	6.56	5.38	2.75
3BT-32/64-5-N/N	1.0	6.56	5.38	2.75
3BT-48/95-5-N/N	0.8	6.56	5.38	2.75
3BT-63/125-5-N/N	0.8	6.56	5.38	2.75
3BT-95/190-5-N/N	0.8	6.56	5.38	2.75
3BT-125/250-5-N/N	0.8	6.56	5.38	2.75
3BT-190/375-5-N/N	0.8	6.56	5.38	2.75
3BT-200/400-5-N/N	0.8	6.56	5.38	2.75
3BT-250/500-5-N/N	0.7	6.56	5.38	2.75
3BT-375/750-5-N/N	0.7	6.56	5.38	2.75
3BT-500/1000-5-N/N	0.7	6.56	5.38	2.75
3BT-750/1500-5-N/N	0.7	6.56	5.38	2.75
3BT-1000/2000-5-N/N	0.7	6.56	5.38	2.75
3BT-1500/3000-5-N/N	0.7	6.56	5.38	2.75

## ◆ Specifications

Type	Frequency Range (MHz)	Nominal 3dB BW	VSWR	Impedance	Shape Factor		Power Handling	Dial Accuracy
					30dB to 3dB	50dB to 3dB		
3 Section	0.8-3000	5%	1.5:1	50 Ohms	3.5:1	-	50 Watts	+1%
5 Section	0.8-3000	5%	1.5:1	50 Ohms	2.2:1	3.5:1	50 Watts	+1%

## ◆ 75 Ohm, 5 Section Filters

Model Number	Max. I.L.	Nominal 3dB BW	Shape Factor	
			30dB to 3dB	50dB to 3dB
5BT-55/110-5-F/F-75	1.3	5%	2.0:1	3.0:1
5BT-110/220-3-F/F-75	1.7	3%	2.0:1	3.2:1
5BT-220/440-1.5-F/F-75	3.0	1.5%	2.2:1	3.5:1
5BT-440/880-1-F/F-75	1.8	1%	2.5:1	3.5:1

## ◆ 75 Ohm, 5 Section Filter Specifications

Type	VSWR	Impedance	Size			Dial Accuracy
			L	W	H	
5 Section	1.5:1	75 Ohms	9.80	5.38	2.75	+1%

Filters containing the digital control option will be larger than specified. Contact factory for details.



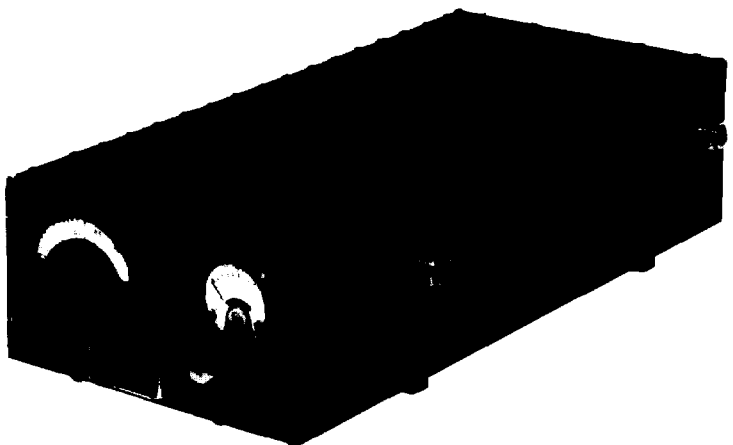


# Variable Filters - HBT Series

## ◆ Additional Information Ruggedized BT's (HBT)

### VHF - Low 5HBT-30/76-4-N/N

Center frequency tuning range : 30 to 76MHz  
 3dB bandwidth: 4% nominal  
 30dB bandwidth/3dB bandwidth=2.3/1  
 Insertion loss: 2.5dB maximum  
 VSWR: 1.5:1 maximum  
 Dial accuracy: ±1%  
 Power handling capability: 50 Watts average/peak  
 Size: 6"W x 14"L x 3.5"H  
 Temperature range (Operating): -40°C to + 52°C  
 Temperature range (Non-operating): -62°C to +71°C  
 Humidity: 0-95%

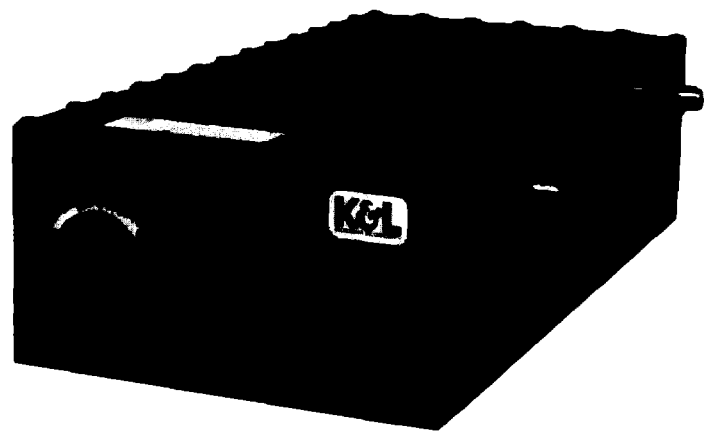


### VHF - High 5HBT-116/160-1.1-N/N

Center frequency tuning range: 116 to 160MHz  
 3dB bandwidth: 1.1% nominal  
 30dB bandwidth/ 3dB bandwidth = 2.3:1  
 Insertion loss: 3.25dB maximum  
 VSWR: 1.5:1 maximum  
 Dial accuracy: ±1%  
 Power handling capability: 50 Watts average/peak  
 Size: 6"W x 14"L x 3.5"H  
 Temperature range (Operating): -40°C to +52°C  
 Temperature range (Non-operating): -62°C to +71°C  
 Humidity: 0-95%

### UHF 3HBT-225/400-0.4-N/N

Center frequency tuning range: 225 to 400MHz  
 3dB bandwidth: 0.4% nominal  
 30dB bandwidth/ 3dB bandwidth = 3.5:1  
 Insertion loss: 1.8dB maximum  
 VSWR: 1.5:1 maximum  
 Dial accuracy: ±0.5%  
 Power handling capability: 100 Watts average/peak  
 Size: 9" W x 18.5"L x 5.25"H  
 Temperature range (Operating): -40°C to +52°C  
 Temperature range (Non-operating): -62°C to +71°C  
 Humidity: 0-95%





# Tunable Filters - TNF Series

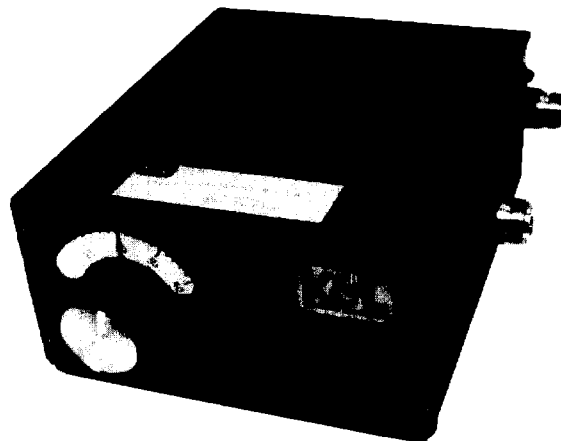
## ◆ Features

K & L Microwave's TNF Series Tunable Bandreject Filters cover the frequency range of 25 to 2000MHz with each model typically covering a complete octave. These filters are available with 3 through 6 sections and are capable of eliminating undesirable signals with greater than 45dB relative rejection. Standard 3 section models are available with passband insertion losses typically less than 0.5dB and a VSWR of less than 1.5:1.

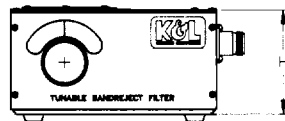
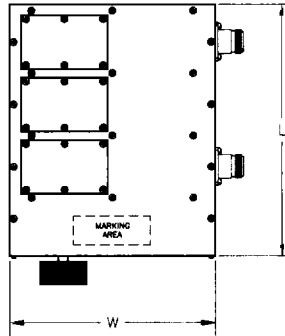
Each TNF Series is constructed in a sturdy aluminum housing. Manual tuning of the TNF Series is accomplished by a front panel vernier/dial assembly. Each dial is engraved with the direct-read-out center frequencies, which eliminates the need for interpolating frequency calibration charts. (See the digitally controlled tunable filter section of this catalog for details on remote tuning of this filter.)

## ◆ Connectors

Connector	Code
SMA Female	O
SMA Male	OP
"N" Female	N
"N" Male	NP
TNC Female	T
TNC Male	TP
BNC Female	B
BNC Male	BP
"F" Female	F
"F" Male	FP



## ◆ Mechanical



## ◆ To Order

**D 3 TNF - 50/100 - N /N - G R V**  
 1 2 3      4      5 6 7 8 9

1. Digital control  
(remove if manually controlled)
2. Number of sections
3. Model
4. Frequency range (MHz)
5. Input connectors
6. Output connectors

### Digitally Controlled Options: (Remove if not used)

7. Control Logic
8. Drive Voltage
9. Tuning Options  
(see digitally controlled tunable filter section of this catalog for details of these options)

Filters containing the digital control option will be larger than specified. Contact factory for details.

## ◆ Special Requirements

In addition to the standard line offered in the TNF Series, K&L offers the engineering and manufacturing capabilities to handle a vast array of special requirements. Some of these capabilities are:

1. Digitally controlled
2. Special tuning ranges starting as low as 1.5MHz
3. Extended passbands outside the filter tuning range  
(see additional information)
4. Impedances of 50 or 75 Ohms with full test capabilities
5. Custom bandwidths and shape factors
6. Custom sizes to customer specification
7. Military qualified capabilities

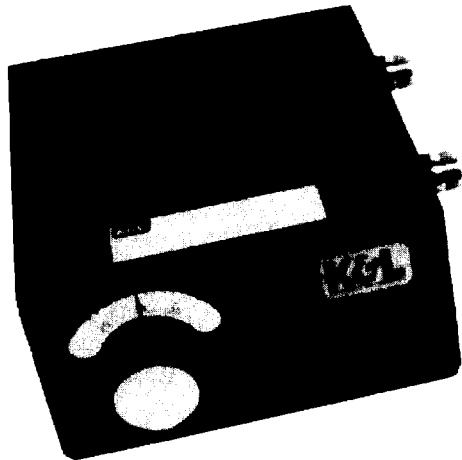




# Tunable Filters - TNF Series

## ◆ Typical Applications

Laboratory Measurement Systems  
 Co-location Signal Suppression  
 Harmonic Signal Suppression  
 Noise Suppression



## ◆ Specifications

Standard TNF Series	Frequency Range (MHz)	3dB Bandwidth Range (MHz) (Relative)	40dB Bandwidth Minimum (kHz) (Relative)	Typical Notch Depth (Relative)	Passband Insertion Loss - Max.	Passband VSWR	Impedance
3TNF-25/50-N/N	25-50	1-2.5	100	50dB	1.0dB	1.5:1	50 Ohms
3TNF-30/76-N/N	30-76	1-2.5	100	50dB	1.0dB	1.5:1	50 Ohms
3TNF-50/100-N/N	50-100	3-6	300	50dB	1.0dB	1.5:1	50 Ohms
3TNF-100/200-N/N	100-200	3-6	300	50dB	1.0dB	1.5:1	50 Ohms
3TNF-200/400-N/N	200-400	3-7	300	50dB	1.0dB	1.5:1	50 Ohms
3TNF-250/500-N/N	250-500	3-7	300	50dB	1.0dB	1.5:1	50 Ohms
3TNF-500/1000-N/N	500-1000	6-16	400	45dB	1.0dB	1.5:1	50 Ohms
3TNF-1000/2000-N/N	1000-2000	9-24	400	45dB	1.0dB	1.5:1	50 Ohms

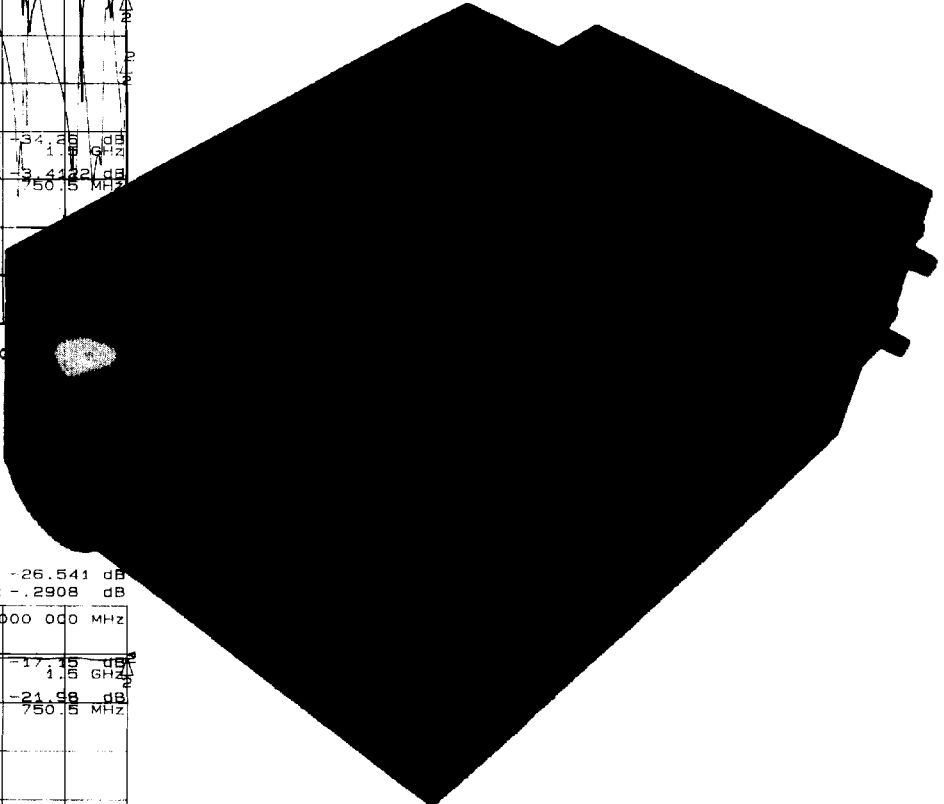
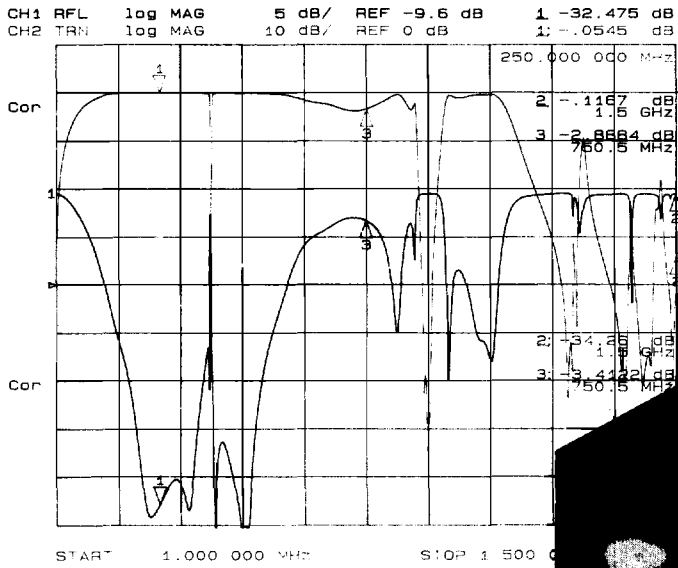




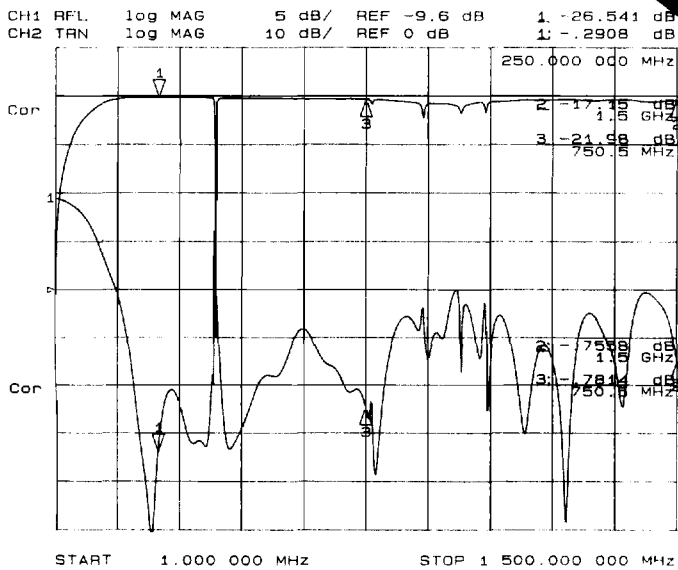
# Unstable Filters - TNF Series

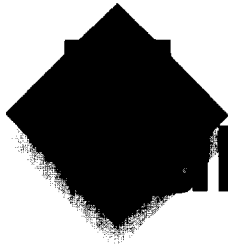
## ◆ Additional Information

**TNF Series - Extended Passband Option**  
**3TNF-250/500-N/N, Standard**



**TNF Series**  
**3TNF-250/500-N/N, Multiplexed**





# Tunable Filters- FCT/FWT Series

## ◆ Tunable Coaxial and Tunable Waveguide Filters

K&L Microwave's FCT and FWT series tunable bandpass filters cover the frequency range of 600MHz to 21GHz. The filters are available with 2 through 6 sections and a nominal 3dB bandwidth from 0.1% to 2%.

The FCT series covers the frequency range from 600MHz to 18GHz. Standard 2, 3, and 4 section models are available with a 0.1% to 1% 3dB bandwidth and a dial accuracy of 0.05%. These filters operate in TEM mode and are a quarter wavelength long at the center frequency. Consistent filter response and bandwidth is achieved by optimization of coupling loops and iris location.

The FWT series covers the frequency range from 2GHz to 21GHz. Three and four section models are available with a nominal 3dB bandwidth from 0.1% to 1.0% and a dial accuracy of 0.05%. These filters operate in TE<sub>111</sub> Right-Circular-Cylinder Wavelength mode which offers the highest "Q" and lowest insertion loss possible.

Connectors on this series can be either coaxial or waveguide. With coaxial inputs, K&L utilizes a special direct coupling technique which eliminates the need for waveguide to coaxial adapters. This coupling method reduces the overall size of each unit without degrading the units performance.

Manual tuning of both filters is accomplished through a single knob. Calibrated dials with a frequency reference chart are available. Direct frequency read-out tape drive mechanisms are also available as a special design option. (See digitally controlled tunable filter section of this catalog for details on remote tuning of this filter.)

## ◆ Mechanical

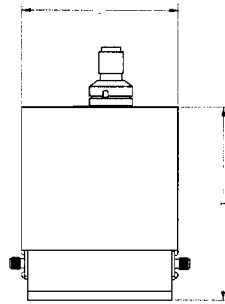


Figure 1

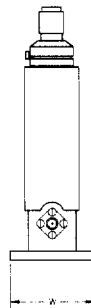


Figure 2



## ◆ To Order

D 4 FCT - 5900/6500- 17-O/O-G R V  
1 2 3 4 5 6 7 8 9 10

1. Digital control designation (remove if manually controlled)
2. Number of sections
3. Model
4. Tuning range (MHz)
5. Nominal 3dB bandwidth in % or MHz
6. Input connector
7. Output connector

### Digitally Controlled Options:

(Remove if not used)

8. Control Logic
9. Drive Voltage
10. Tuning Option  
(See digitally controlled tunable filter section of this catalog for details of these options.)

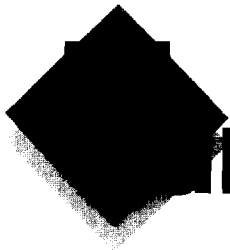
Filters containing the digital control option will be larger than specified. Contact factory for details.

## ◆ Connectors

Connector	Code
SMA Female	O
SMA Male	OP
"N" Female	N
"N" Male	NP
TNC Female	T*
TNC Male	TP*
BNC Female	B*
BNC Male	BP*
Cover Flange	V
Choke Flange	H

\* These connectors have a limited frequency range





# Adjustable Filters

## ◆ FCT Series - Normal Ranges

Tuning Range in MHz	Nominal 3dB Bandwidth	Typical Loss Per Section	Outline	"H" Dimension	"L" Dimension			"W" Dimension
					2 Section	3 Section	4 Section	
390-460	10MHz	0.25	Figure 1	12.00	3.00	3.00	3.00	3.00
750-1000	5MHz	0.75	Figure 1	8.90	3.00	3.00	3.00	3.00
1000-1250	5MHz	0.75	Figure 1	6.50	2.00	2.00	2.00	2.00
1250-1400	12MHz	0.60	Figure 1	6.50	2.00	2.00	2.00	2.00
1400-1700	12MHz	0.60	Figure 1	5.50	2.00	2.00	2.00	2.00
1700-2100	12MHz	0.70	Figure 1	4.50	2.00	2.00	2.00	2.00
1900-2400	15MHz	0.60	Figure 1	4.90	2.00	2.00	2.00	2.00
2300-2700	24MHz	0.70	Figure 1	4.50	2.00	2.00	2.00	2.00
2700-3100	15MHz	0.60	Figure 1	4.00	2.00	2.00	2.00	2.00
3100-3500	15MHz	0.75	Figure 1	4.10	2.00	2.00	2.00	2.00
3100-3900	15MHz	0.75	Figure 1	4.20	2.00	2.00	2.00	2.00
3500-4200	15MHz	0.75	Figure 1	4.00	2.00	2.00	2.00	2.00
4200-5000	15MHz	0.75	Figure 1	4.00	2.00	2.00	2.00	2.00
5000-6000	20MHz	0.85	Figure 2	4.40	2.25	2.75	3.25	1.75
5900-6500	17MHz	0.85	Figure 1	5.00	2.00	2.00	2.00	2.00
6400-7200	17MHz	0.85	Figure 1	4.00	1.50	1.50	1.50	1.50
5900-7200	50MHz	0.70	Figure 1	5.00	1.50	1.50	1.50	1.50
9600-10500	1%	0.80	Figure 2	4.00	2.23	2.74	3.25	1.75
10500-12400	1%	0.70	Figure 2	4.00	2.23	2.74	3.25	1.75
12400-13300	1%	0.70	Figure 2	4.00	2.23	2.74	3.25	1.75
13200-14500	1%	0.70	Figure 2	4.00	2.23	2.74	3.25	1.75
14000-15300	1%	0.70	Figure 2	4.00	2.23	2.74	3.25	1.75
16650-16950	1%	0.60	Figure 2	4.00	2.23	2.74	3.25	1.75

## ◆ FCT Series - Extended Ranges

Tuning Range in MHz	Nominal 3dB Bandwidth	Typical Loss Per Section	Outline	"H" Dimension	"L" Dimension			"W" Dimension
					2 Section	3 Section	4 Section	
1000-2000	1%	0.7	Figure 2	7.19	3.75	4.75	5.75	2.30
2000-4000	1%	0.7	Figure 2	5.69	2.59	3.34	4.09	1.75
4000-6000	1%	0.7	Figure 2	4.00	2.23	2.74	3.25	1.75
6000-8000	1%	0.7	Figure 2	4.00	2.23	2.74	3.25	1.75
8000-12400	1%	0.7	Figure 2	4.00	2.23	2.74	3.25	1.75
12400-18000	1%	0.7	Figure 2	4.00	2.23	2.74	3.25	1.75

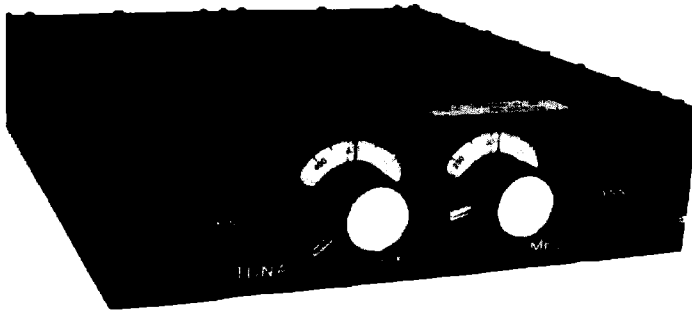




# Tunable Filters - TBD Series

## ◆ Tunable Bandpass Diplexers

K&L Microwaves TBD Series Tunable Bandpass Diplexers allow two transceivers to operate simultaneously from one common antenna. Each filter covers a specific frequency band in the 30MHz to 1850MHz range. These filters are available with 3 through 6 sections and nominal 3dB bandwidths from 1% to 10%. Standard 4, 5, and 6 section models are available with 1.5%, 2% , and 4% 3dB bandwidths offering low insertion loss values from 1dB through 3dB with minimum channel spacing from 4MHz to 50 MHz.



Each TBD Series is constructed in a sturdy aluminum housing. Each section of the tunable filter is iris-coupled yielding a low ripple Chebyshev response. Manual tuning is accomplished by two front panel vernier/dial assemblies. Each dial is engraved with the direct readout center frequencies which eliminates the need for interpolating frequency calibration charts. (See digitally controlled tunable filter section of this catalog for details on remote tuning of this filter.)



## ◆ Special Requirements

In addition to the standard line offered in the TBD Series, K & L offers the engineering and manufacturing capabilities to handle a vast array of special requirements. Some of these capabilities are:

1. Digitally controlled
2. Tunable Bandpass Triplexers (TBT) when an additional Input/Output port is required.
3. 19" rack mounting
4. Positive locking adjustment knobs
5. Power meter circuit with RF detection
6. Special tuning ranges
7. Power handling capabilities up to 200Watts peak
8. Custom bandwidths and shape factors
9. Custom sizes to customer specification
10. Military qualified capabilities

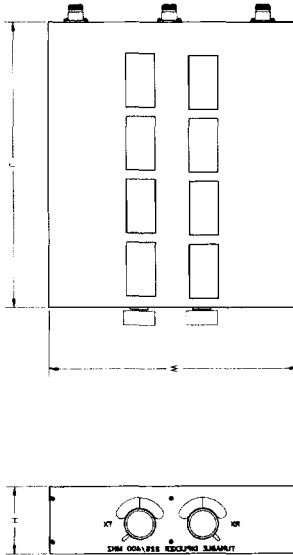


# Tunable Filters - TBD Series

## ◆ Typical Applications

- Co-site transceiver installations
- Co-location signal suppression
- Harmonic signal suppression
- Noise Suppression

## ◆ Mechanical



## ◆ To Order

**D 6 TB D - 225/400 - 2 - N/N - G R V**  
**1 2 3 4 5 6 7 8 9 10 11**

- Digital control designation (remove if manually controlled)
- Number of sections
- Model
- D= Diplexer T=Triplexer
- Center frequency tuning range
- Nominal 3dB bandwidth in % or MHz
- Rx/Tx connectors
- Antenna connectors

### Digitally Controlled Options: (Remove if not used)

- Control logic
- Drive voltage
- Tuning options  
(See digitally controlled tunable filter section of this catalog for details on these options.)

Filters containing the digital control option will be larger than specified. Contact factory for details.

## ◆ Connectors

Connector	Code
SMA Female	O
SMA Male	OP
"N" Female	N
"N" Male	NP
TNC Female	T
TNC Male	TP
BNC Female	B
BNC Male	BP

## ◆ Specifications

Standard TBD Series	Frequency Range MHz	Nominal 3dB BW	Channel Spacing (min)	Typical Insertion Loss	VSWR	Power Handling	Approximate Size Length x Width x Height
6TBD-30/76-4-N/N	30-76	4%	5MHz	3dB	1.75:1	50	17.5" x 19.0" x 3.5"
6TBD-30/88-2-N/N	30-88	2%	4MHz	3dB	1.75:1	50	21.0" x 14.0" x 4.0"
6TBD-136/174-2-N/N	136-174	2%	6MHz	3dB	1.75:1	50	11.3" x 10.5" x 3.0"
4TBD-225/400-2-N/N	225-400	2%	35MHz	1dB	1.75:1	50	11.9" x 10.8" x 2.8"
6TBD-403/512-2-N/N	403-512	2%	15MHz	3dB	1.75:1	50	11.3" x 10.5" x 3.0"
5TBD-610/960-2-O/O	610-960	2%	40MHz	2dB	2.0:1	20	5.8" x 3.71" x 4.08"
5TBD-1350/1850-1.5-O/O	1350-1850	1.5%	50MHz	2dB	2.0:1	20	5.8" x 6.1" x 8.0"





# Tunable Filters - Digital Controlled

## ◆ Digitally Controlled Tunable Filters

K & L Microwave's digitally-controlled tunable filters provide the capability and flexibility of eliminating interference through a totally automated system. Digital control can be integrated with any of the manual tunable filters described in this catalog. Tuning of each filter is typically accomplished by utilizing a servo-type stepping motor and gear train assembly to rotate the tuning shaft. In order to simplify the logic system complexity, an all-in-one microprocessor based system is used.

Utilization of an all-in-one microprocessor eliminates much of the circuitry required in typical microprocessor based systems. This yields smaller packaging and improved MTBF. Use of a microprocessor also allows for system flexibility through the use of modifiable assembly language software. The result is that many customizations can be incorporated with minimal effect on hardware.

Two options are available for correlation of frequency to tuning shaft position. The Infrared Reference Sensor option requires the microprocessor to find a reference point for each tuning cycle.



The second option utilizes an absolute Encoder for frequency to shaft position correlation. This Absolute Encoder option utilizes a positive feedback loop which allows for power failure or shutdown for an indefinite period of time. Upon power-up, the system still operates at its present frequency or can go to a new frequency upon command without going through a reset cycle. Side benefits of the closed loop and encoding systems are a high degree of resolution and accuracy. Most computer interfaces are available as standard.

## ◆ To Order

See appropriate section on standard series of each filter.

## ◆ Control Logic

Format	Code
Serial	
RS232	A
RS422	B
SDLC	C
Parallel	
BCD	E
Binary	F
IEEE-488	G

## ◆ Drive Voltages

Voltage	Code
12-14 VDC	Q
24-28 VDC	R
110 VAC	S

## ◆ Tuning Options

Tuning	Code
Infrared Sensor	I
Encoder	V



# Tunable Filters - Digital Controlled

## ◆ Typical Applications

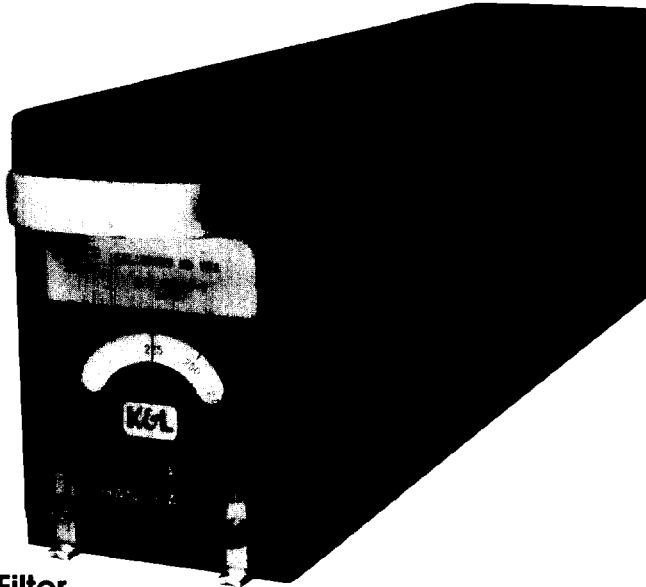
- Laboratory measurement
- Co-location signal suppression
- Harmonic signal suppression
- Noise suppression



## ◆ Special Applications

### High "Q" Digitally Controlled Bandpass Filter

Frequency Range (MHz)	Insertion Loss	Selectivity	Nominal 3dB Bandwidth	VSWR	Tuning Speed	Control Interface
UHF 225-400	<2.0dB	>55dB @+2.2%	0.15%	<1.5:1	10 seconds typical	RS232, RS422, IEEE-488, BCD
VHF 117-137	<2.0dB	>55dB @ +3.5%	0.20%	<1.5:1	10 seconds typical	Other



### 1/2 ATR Digitally Tunable Bandpass Filter

Frequency Range (MHz)	Insertion Loss	Nominal 3dB Bandwidth	VSWR	Shape Factor		Tuning Speed	Control Interface
				30dB to 3dB	50dB to 3dB		
225-400	2.1dB max.	2% nominal	1.5:1	2.2:1	3.5:1	7 seconds max.	RS232, RS422 IEEE-488, BCD Other



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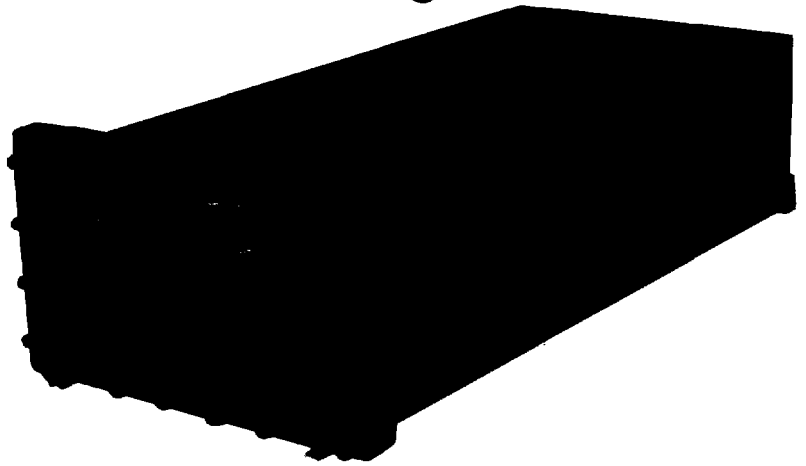
FAX: 410-749-5725





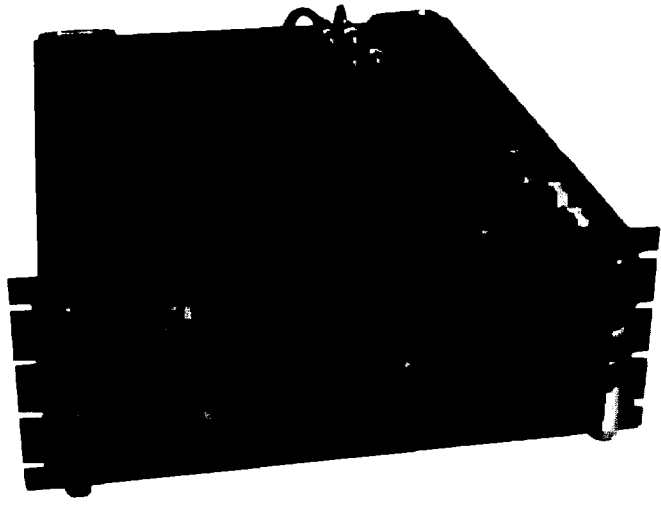
# Tunable Filters - Digital Controlled

## ◆ Special Applications



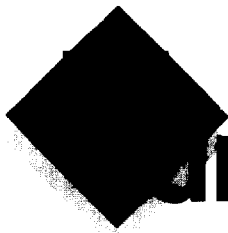
### UHF Digitally Tunable Diplexer

Tunable	Frequency Range (MHz)	Insertion Loss	Nominal 3dB Bandwidth	VSWR	Tuning Speed	Control Interface
	225-400	3dB max.	1.5%	1.6:1 max.	7 seconds max.	RS232, RS422 IEEE-488, BCD, Other
<b>Guard Band</b>	243	3dB max.	3MHz max.	2.0:1 max.	N/A	



### Digital Tracking Filter Network

Frequency Range (MHz)	Nominal 3dB Bandwidth	Shape Factor		Tuning Accuracy	Tuning Speed	Control Interface
		30dB to 3dB	50dB to 3dB			
20-1500	5%	2.1:1	3.5:1	0.25% of tuned center frequency	5 to 7 seconds	RS232, RS422 IEE-488, BCD Other



# Tunable Filters- TMA/TMG Series

## ◆ Tunable Multicouplers

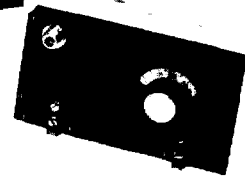
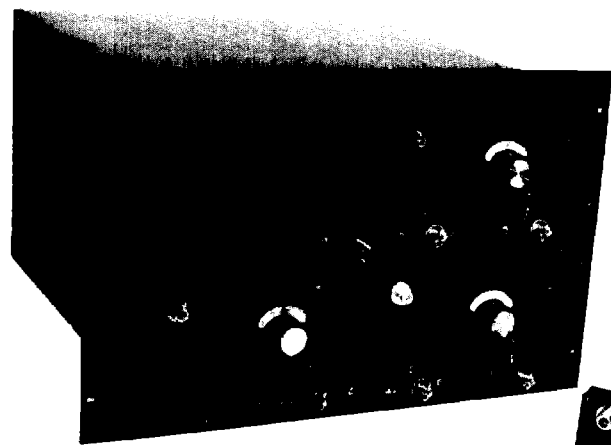
K&L Microwave's Tunable Multicouplers enable up to four transceivers to operate simultaneously in transmission and reception mode using a common antenna. Each multicoupler can be arranged in either ground base or airborne rack assemblies with up to four individually packaged tunable filters in each.

The filters within the tunable multicoupler can cover either the VHF (100-160MHz) or UHF (225-400MHz) communications band. Each filter is available with 3 through 6 sections and a nominal 3dB bandwidth ranging from 0.35 to 5%. Control of each tunable filter is either manually, through a front panel dial assembly, or remotely, through a digitally controlled option. For specifics on the filter configurations, refer to the BT series and the Digital Tunable sections of this catalog.

Model	Description
TMA	Manually tuned multicoupler airborne configuration
TMG	Manually tuned multicoupler ground based configuration

## ◆ Connectors

Connector	Code
SMA Female	O
SMA Male	OP
"N" Female	N
"N" Male	NP
TNC Female	T
TNC Male	TP
BNC Female	B
BNC Male	BP



## ◆ To Order

VHF: D 4/4 TMA-100/160 - 2-N/N-G R V  
 1 2 3 4 5 6 7 8 9 10 11

UHF: D 4/3 TMA- 225/400- 2 -N/N-G R V  
 1 2 3 4 5 6 7 8 9 10 11

1. Digital control designation (remove if manually controlled)
2. Number of channels
3. Number of sections
4. Model designator
5. Frequency Range: VHF (100/160) or UHF (225/400)
6. Nominal 3dB bandwidth in % or MHz
7. Filter Connectors
8. Antenna Connector

### Digitally Controlled Options: (Remove if not used)

9. Control logic
  10. Drive voltage
  11. Tuning option
- (Filters containing the digital control option will be larger than specified. Contact factory for details.)

## ◆ Special Requirements

In addition to the standard line offered in the TMA/TMG series, K&L offers the engineering and manufacturing capabilities to handle a vast array of special requirements. Some of these capabilities are:

1. Digitally controlled
2. 19" rack mounting
3. Special tuning ranges
4. Power handling capabilities up to 200 watts peak
5. Custom bandwidths and shape factors
6. Custom sizes to customer specifications
7. Military qualified capabilities



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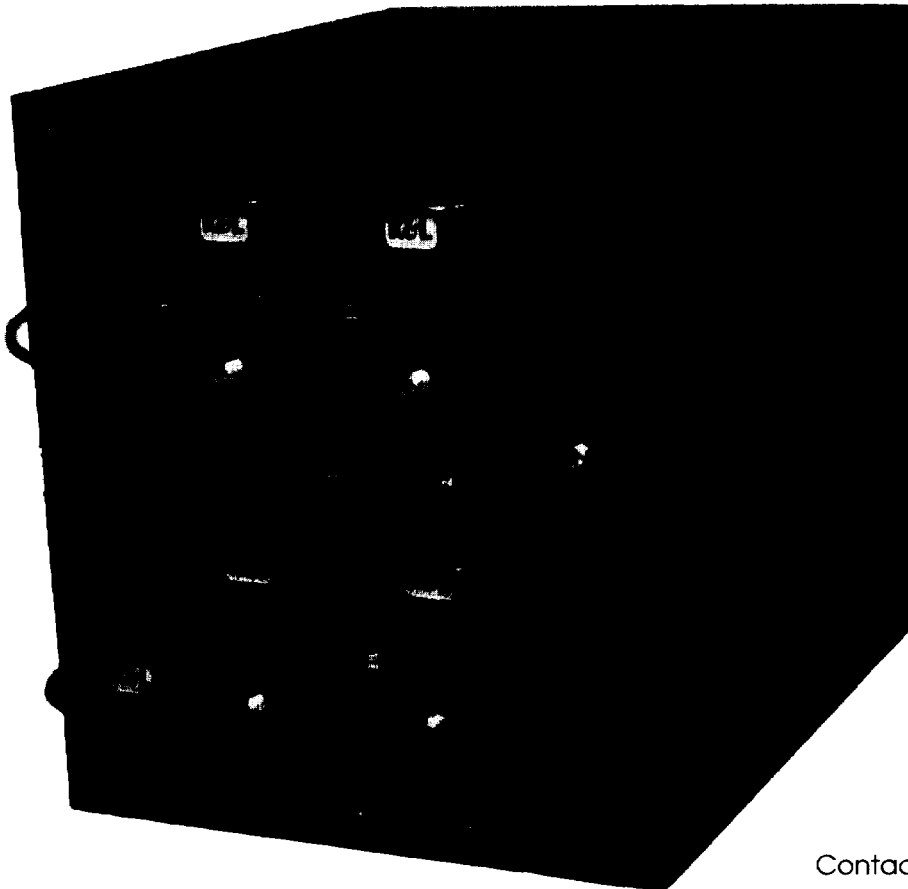




# Adjustable Filters- TMA/TMG Series

## ◆ Specifications

	VHF 0.7%	VHF 1%	VHF 2%	UHF 0.3%	UHF 1%	UHF 2%
Tuning Range	100-160MHz	100-160MHz	100-160MHz	225-400MHz	225-400MHz	225-400MHz
Impedance	50 Ohms	50 Ohms	50 Ohms	50 Ohms	50 Ohms	50 Ohms
VSWR	1.8:1 max	1.75:1 max	1.75:1 max	1.8:1 max	1.75:1 max	1.75:1 max
Loss @ F <sub>C</sub>	2.0dB max	1.5dB max	1.0dB max	2.0dB max	1.5dB max	1.0dB max
3dB BW	0.7% nom	1% nom	2% nom	0.3% nom	1% nom	2% nom
Channel separation for 50dB isolation	± 4%	4MHz @ 100MHz 5MHz @ 160MHz	7MHz @ 100 MHz 10MHz @ 160MHz	± 4%	8MHz @ 225MHz 15MHz @ 400MHz	15MHz @ 225MHz 25MHz @ 400MHz
Ultimate Isolation	80dB	80dB	80dB	60dB	80dB	80dB



Contact factory for mechanical

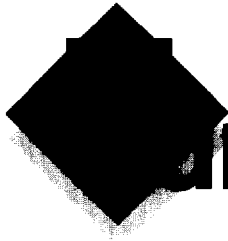


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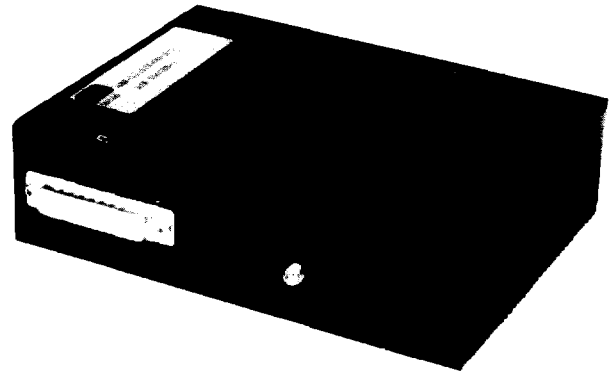


# Tunable Filters-Specialty Filters

## ◆ Introduction

K&L Microwave offers the engineering and manufacturing expertise to provide customized tunable filters developed around specific application needs. These filters range from low frequency bandpass tunable filters (0.2 to 0.4MHz) to fully active frequency hopping filters (225MHz to 400MHz).

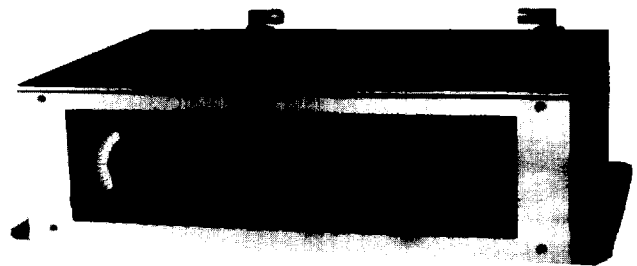
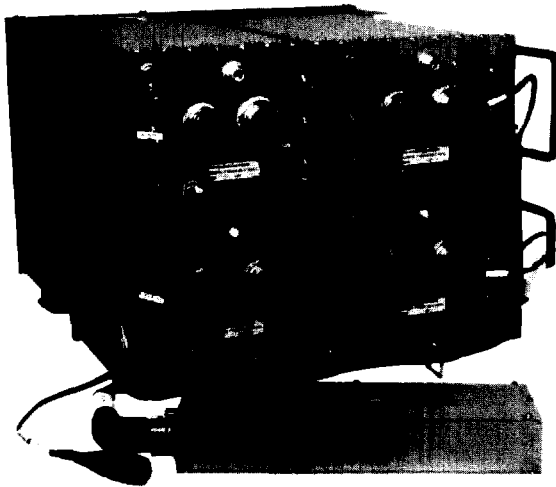
## Miniature Frequency Agile Filter 225MHz to 400MHz, Medium Power



## ◆ Special Applications

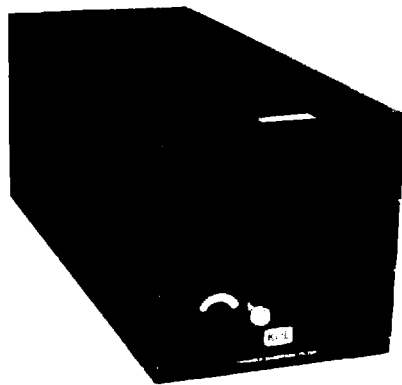
### Frequency Agile Multicoupler, 4 Port

### Tunable Filter/Tunable Antenna Coupler



### Tunable Bandpass Filter, 0.2 to 0.4MHz

### Miniature Folded Tunable Diplexer



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