TELONIC FIXED FREQUENCY FILTERS



TELONIC/BERKELEY

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TELONIC BERKELEY FIXED FREQUENCY FILTERS



A world leading manufacturer of RF and microwave components, Telonic Berkeley has a unique approach in the manufacture of filters: To offer an unlimited number of filter models in the widest selection of filter types, that can be ordered easily by the customer. As an example, this catalog contains over 20 types of filters from 10 MHz to 12GHz. Complementing this impressive array of filter types is the most complete assortment of GUARANTEED electrical and mechanical design data ever published.

Telonic Berkeley also manufactures a broad line of tunable filters. For complete information, contact our Customer Service Department and request the Tunable Filters Catalog.

LOW PASS FILTERS

- Tubular
- Lumped Element
- Stripline

HIGH PASS FILTERS

BANDPASS FILTERS

- Tubular
- Lumped Element
- Hi Q Cavity
- Helical Resonators
- Interdigital
- Combline
- GUARANTEED Filter Design and Specifying Data These conservative and comprehensive performance data include the effects of time, temperature, shock and vibration, and – for the first time – permit you to establish guaranteed performance specifications for custom filters in the field.
- Attenuation Curves
- Insertion Loss Curves
- Passband Relationship Curves
- Frequency and Bandwidth Tolerance Curves
- Filter Length Curves
- Outline Drawings

AIDS TO USE OF THIS CATALOG

If you are not familiar with specifying filters, we suggest you first read pages 6, 7 and 8.

ORIENTATION

- 1. Bandpass data in this catalog is presented as a function of 3 dB bandwidths and all curves are normalized to the nominal 3 dB bandwidth.
- 2. Lowpass data in this catalog is presented in terms of the VSWR cutoff frequency.
- 3. In general, insertion loss is inversely proportional to physical size. To reduce insertion loss for a fixed set of parameters, generally size must increase.

TO SELECT BANDPASS FILTERS:

(Refer to Fig. 1)

- 1. Determine frequencies to be passed. ('B' to 'C') From ____ MHz to ____ MHz.
- 2. Estimate 3 dB BW if different from 1. above, _____ MHz.
- 3. Calculate nominal center frequency 'A'; (Arithmetic mean of 'B' & 'C') _____ MHz.

- 5. Determine frequencies to be rejected 'D', _____ MHz 'E', _____MHz.
- 6. Determine amount of attenuation required at frequencies to be rejected, _____dB.
- 7. Determine maximum allowable insertion loss at point 'A', dB.
- 8. Calculate \triangle BW + and \triangle BW which will be used in later Frea @ E – Freq @ A, calculations.

$$\Delta BW += \frac{Heq}{3 \text{ dB BW}}$$



- 9. Refer to Filter Selection Guide (pg. 4-5) and write down the series names of the products which:
 - a) Operate in the passband frequency range desired.
 - b) Have the percentage bandwidth desired.
 - c) Perform the bandpass function desired.
- 10. Turn to pages indicated by types selected and complete calculations to determine:
 - a) Number of sections required to perform filtering function adequately.
 - b) Filter series required for insertion loss or size considerations.

TO SELECT LOWPASS FILTERS:

- (Refer to Fig. 2)
- 1. Determine VSWR cutoff frequency: 'A' _____ MHz.
- 2. Determine frequency where attenuation is required 'B' MHz.
- 3. Calculate relative frequency as ratio of frequency to be $R = \frac{B}{A' MHz}$ attenuated to frequency to be passed:
- 4. Determine attenuation level, _ dB.
- 5. Determine maximum insertion loss allowable, _____dB.
- 6. Refer to pages 9, 10 and 11 for proper filter selection.



TO WRITE THE PROPER PART NO.

1. Bandpass filter example







*See connector code for each filter series

ORDERING INFORMATION

HOW TO ORDER

Significant specifications and specific instructions should be included in your order whenever you desire special options or features.

Filters may be ordered by (A) standard model numbers that can easily be derived by following the ordering instructions in each filter section of this catalog or (B) by sending your specific requirements to Telonic Berkeley.

WHERE TO ORDER

In the United States and Canada your order may be placed through our local representative or placed directly with the factory:

Telonic Berkeley 1080 La Mirada Court Vista, CA 92081 760-744-8350

TECHNICAL DATA

Telonic Berkeley filters are 100% inspected to verify that all electrical and mechanical specifications are met. Written test data is provided on 10% of units shipped, or ten units, whichever is greater. This test data is recorded for performance at room temperature only. All units are, however, exposed to temperatures in excess of rated limits to ensure that they meet and exceed published specifications.

Test data covering an entire lot of filters ordered is available at an additional charge. Data recorded at temperature extremes may also be provided at extra cost. Telonic Berkeley would be pleased to quote our customers' specific test data requirements, and to supply such data as specified by purchase order.

TECHNICAL ASSISTANCE

Telonic Berkeley is represented throughout the world by a qualified staff of field engineers and representatives. They are available to supply you, without obligation, with technical data, literature, application engineering and assistance in selecting, specifying and ordering Telonic filters and instruments.

SHIPPING INSTRUCTIONS

Unless specific instructions accompany the order we shall use our own judgment as to the best method of shipment. Unless otherwise specified normal shipments will be by express or truck transportation. Small items are sent via parcel post. The price for our products includes packing but does not include shipping.

PRICES AND DELIVERY

Prices for all products are published on a separate price schedule and are in effect at the date of publication. All prices are f.o.b. factory and are subject to change without notice. Contact your nearest Telonic representative to confirm prices and obtain current delivery information. Formal price and delivery quotations remain in effect for 30 days.

CONDITIONS AND TERMS

Determination of prices, terms, conditions of sale and final acceptance of order are made only at Telonic, Laguna Beach, California. Terms are net 20 days and prices are f.o.b. factory. Unless credit has already been established shipments will be made C.O.D., or on receipt of cash in advance.

MINIMUM BILLING

The minimum billing per order is \$50.00. This applies to all purchases.

WARRANTY

Standard filters manufactured by Telonic are guaranteed for a period of ONE YEAR from date of purchase against defective materials and workmanship. Telonic expressly limits its liability to replacement or repair of the article furnished except for tubes or batteries. This warranty does not apply to products that have been disassembled, modified or subjected to conditions exceeding the applicable specifications and ratings. In the event of any of the foregoing, the guarantee will be void. Telonic disclaims any warranty other than as specifications without notice.

SERVICE AND PARTS

Repair service and parts are available from our plant at Laguna Beach, California.

To return items for repair, please contact the Sales Department at the factory for permission to return. All returned goods are to be shipped prepaid and must be identified by purchase order number, model number, serial number and nature of malfunction.

BANDWIDTH

SECTION 1 TURILLAP LOW/PASS FUTEPS	
Series TLP — Lumped constant, 1/2" diam., low cost, small size Series TLA — Lumped constant, 3/4" diam., intermediate loss, size, power Series TLC — Lumped constant, 1 1/4" diam., low loss, highest power	
SECTION 2. TUBULAR BANDPASS FILTERS	
 Series TBP — Lumped constant, 1/2" diam., lowest cost, most popular Series TBA — Lumped constant, 3/4" diam., medium loss and power Series TBC — Lumped constant, 1 1/4" diam., lowest loss, highest power 	2 - 30% 2 - 30% 2 - 30%
Series THP — Distributed constant, small size, low loss	_
SECTION 4. CAVITY BANDPASS FILTERS	
 Series TSF — Lowest loss helical resonator series Series TCF — Quarter-wavelength, coaxial, modular slotted box construction Series TCC — Quarter-wavelength, coaxial, lowest loss, re-entrant cavity Series TCA — Quarter-wavelength, coaxial, ideal size vs. performance parameters for general cavity filter req. Series TCG — Quarter-wavelength, coaxial, highest frequency, re-entrant cavity Series TCH — TM-010 mode extremely narrow band Series TCB — Adjustable quarter-wavelength, coaxial, up to 10% tuning range 	1 - 3% .3 - 3% .3 - 3% .3 - 3% .3 - 2% .1 - 1% .3 - 3%
SECTION 5. INTERDIGITAL BANDPASS FILTERS Series TIF — Strip line, air dielectric	3 – 30%
SECTION 6. COMBLINE BANDPASS FILTERS Series TSJ — Miniature combline filters utilizing air dielectric	1 – 15%
SECTION 7. MINIATURE BANDPASS FILTERS Series TSA — Smallest available helical filter, P.C.B. mounting available Series TSC — Intermediate size helical, P.C.B. mounting available	1 – 1 <i>5</i> % 1 – 1 <i>5</i> %



* Gray areas indicate special extended ranges.

FREQUENCY AND BANDWIDTH TOLERANCE CURVES

A DISCUSSION OF FREQUENCY AND BANDWIDTH TOLERANCES AS THEY APPLY TO FILTERS MANUFACTURED BY TELONIC.

Figures 1 and 2 illustrate the standard specification format for lowpass and bandpass filters. The shaded areas represent specification limits which apply under all operating conditions defined in the filter specifications.

A plot of the filter performance will always lie outside of the shaded areas.

Figures 3 and 4 show the plot of a typical filter superimposed on the same specification limits.

Each filter built to the same specifications may be slightly different, but will meet or exceed the electrical specifications while being exposed to the specified operating environmental conditions.

Should a requirement arise for a unit with a specific bandwidth tolerance, submit all of your requirements (mechanical, environmental, and electrical) to the factory. This will assure the optimal design to meet your needs.



FREQUENCY AND BANDWIDTH

PASSBAND RELATIONSHIPS

A DISCUSSION OF THE SHAPE OR FORM OF THE PASSBAND IN BANDPASS FILTERS.

In many cases it is necessary to know more about the passband of a filter than its insertion loss at the center frequency and its 3 db bandwidth.

The information on this page is intended as a design aid, to help in the selection of the best filter for each application.

Figure 5 illustrates the response of a "lossless" (infinite Q) filter of X db Chebyschev design. All of the attenuation is due to reflection and not dissipation. This theoretical filter design would provide a flat passband of X db ripple.

In practice, however, finite values of Q result in dissipative losses and therefore Figure 6 is a more realistic representation of the response of a typical filter.

The dissipative losses are greater at the band edges than at the center frequency. The passband of the filter becomes rounded at these edges.

Since both reflective and dissipative losses are present in each filter, the ripple caused by the reflective losses becomes superimposed on the rounded passband created by the dissipative losses. As a consequence, it is more meaningful to specify a "relative" bandwidth, as shown in Fig. 6, than a ripple bandwidth.

Figures 7 through 10 show the approximate relationships of the VSWR bandwidth and other relative bandwidths to the 3 db relative bandwidth. The number of sections and the insertion loss of the filter affect these relationships.

For Example:

SPECIAL FILTER CHARACTERISTICS

The following data will serve as general guidelines for filter requirements in the areas of phase matching, phase linearity and group delay.

Phase Matching:

A. Plus or Minus 2 degrees over 30 to 40% of the 3dB bandwidth

B. Plus or Minus 3 degrees over 50 to 60% of the 3dB bandwidth

C. Plus or Minus 5 degrees over 70 to 85% of the 3 dB bandwidth

D. Plus or Minus 1 degree over 5 to 15% of the 3dB bandwidth

Phase Linearity:

If the filter can be tuned to less than 1.3/1 VSWR

A. Plus or Minus 2 degrees over 30% of the 3dB bandwidth

B. Plus or Minus 3 degrees over 50 to 60% of the 3dB bandwidth

C. Plus or Minus 5 degrees over 60 to 70% of the 3 dB bandwidth

Group Delay:

The group delay response of all our filters very closely approximates the theoretical response for the Chebychev family (including Butterworth). As there are an infinite number of combinations of bandwidth, number of sections and design element values, questions regarding group delay must be currently answered by the factory.



PASSBAND RELATIONSHIP CURVES



TUBULAR LOWPASS FILTERS

■ 30 TO 2,750 MHz ■ 2 TO

Iz 2 TO 12 SECTIONS

DESCRIPTION

All Lowpass Series are typically of 0.1 db Chebyschev Design and are available with 2 thru 12 sections and practically any available RF connector (see pages 16, 17). Special designs are available on request.

The specifications for the example shown here are as follows: 1/2" diameter Lowpass Filter, VSWR cutoff frequency = 1600 MHz, 5 sections, TNC female conn.

	ILP	1000	_	5	C	C	
Series		\top		Т			T
Nominal Cutoff Frequency in MHz							
Number of Sections							
See Connector Code, Below { Input Conn. Output Conn.							
Suffix Number to be Assigned by the Factory to Identify the Specific Customer and Application							

1/00



NOTE 1: See page 6 for standard tolerance on cutoff frequency. The normal specification passband is from 0.4 x cutoff frequency to cutoff. A wider specification passband can be supplied. Telonic will be happy to advise on all such special requirements.

TUBULAR LOWPASS FILTERS

ATTENUATION CURVES



The curves above define the normal specification limits on attenuation for Telonic lowpass filters. The minimum attenuation level in db is shown as a function of the relative frequency.*

Calculate relative frequency as ratio of frequency to be attenuated to frequency to be passed: $R = \frac{B' MHz}{A' MHz}$

For example: Requirements—

1. Min. cutoff frequency = 1,600 MHz.

2. 35 db min. attenuation at 2,080 MHz.

1,600 MHz is within the standard frequency ranges of two different lowpass types — TLP and TLR. 2,080 MHz is at a relative frequency of 1.3 with respect to 1600 MHz. $\frac{2080}{1600} = 1.3$



INSERTION LOSS CURVES

INSERTION LOSS:

Loss = KN + .05 Where:

Reading from the 4-sec. curve (note ref. line) at a relative frequency of

1.3, we find that a four section TLP has a normal specification limit of 29 db and a five section TLP has a normal specification limit of 42 db.

Therefore a TLP of five or more sections would be required to meet the

35 db attenuation specification.

K = Loss constant

N = Number of sections

The insertion loss graph defines the loss constant which must be used to calculate the insertion loss specification. In addition, it illustrates the relative insertion loss and frequency ranges of the standard Telonic lowpass filters.

For example:

A five section filter with a cutoff frequency of 1,600 MHz is available in a TLP or a TLR configuration. In accordance with the formula above, the maximum insertion loss specifications are as follows.

TLP 1600 - 5CC: KN + .05 = .15 X 5 + .05 = .8 db TLR 1600 - 5CC: KN + .05 = .09 X 5 + .05 = .5 db



LENGTH OF LOWPASS FILTERS:

The approximate length of any Telonic lowpass filter can be read directly from these graphs.

Select the graph which represents the correct series of filter. On the frequency scale, locate the proper value of cut-off frequency. Read straight up to the length-curve line which corresponds to the proper number of sections. Then, from the point where the cutoff frequency and section line cross, read horizontally to get the proper filter length, in inches.

For example:

The approximate length of TLP 1600-5CC is 4.0 inches. Note example reading shown flagged on the TLP length curve.

All of the length information shown here is approximate. Exact length specifications must be quoted by the factory. In most cases a filter can be constructed shorter than the length shown here, but this may cause an increase in insertion loss. If a shorter unit or one with a specific length is needed, please submit all of your requirements — both electrical and mechanical. This will enable Telonic to quote the optimum design for your application.





TUBULAR BANDPASS FILTERS

■ 30 TO 2,400 MHz

■ 2 TO 30% BANDWIDTH ■ 2 TO 12 SECTIONS

DESCRIPTION

Telonic Tubular Bandpass Filters are of 0.1 db Chebyschev design and are available with from 2 to 12 sections.

Three different sizes and frequency ranges allow for the selection of an optimal design for each requirement. Almost any type of input or output connection is available as a standard item.

The specifications for example shown here are as follows: 1/2" diameter Bandpass Filter with center frequency at 500 MHz 3 db BW of 50 MHz minimum, 5 pole attenuation response as defined in curves on page 13, connector type is TNC female.

	TBP 500 — 50 — 5 C C	
Series		\top
Nominal Ce Freq. in MH	z	
Minimum 3	db Relative Bandwidth in MHz	
Number of S	Sections	
See Connect Code, Below	or {Input Conn	
Suffix Numb to Identify th	er to be Assigned by the Factory e Specific Customer and Application	



TUBULAR BANDPASS FILTERS

STOP BAND ATTENUATION:

These graphs show the minimum stop band attenuation in db for all three series of Telonic Tubular Bandpass Filters. Since the filter characteristics and production tolerances vary for differing bandwidths, it is necessary to establish differing specifications for each bandwidth of filter. Intermediate values may be interpolated. In each case the rejection frequency is plotted in "3 db bandwidths from center frequency." The exact relationships are as follows:

(1) 2 alla la suadi vidila francia contes fran	Rejection freq. MHz – Fc MHz					
(1) 3 db bandwidins from center freq. =	Min. 3 db BW MHz					
or Re	∍jection freq. MHz – Fc MHz					
(iii) Min. 3 db bandwidin in MHz = $-$	3 db BW Fc					
Any one of the following parameters m	nav be identified if the other three ar					

Any one of the following parameters may be identified if the other three and the center frequency are known.

Min. 3 db bandwidth (in MHz)
 Rejection Frequency (in MHz)
 Always verify that the frequency and bandwidth you have selected are within

the limitations shown for that series of filter.

Example 1: (See page 14, 10% curve).

Given:

Center frequency = 500 MHz Minimum 3 db BW = 50 MHz Number of sections = 5

Find: Minimum attenuation levels at 580 MHz and 425 MHz

ATTENUATION CURVES

From (1) above -

3 db BWs from Fc =
$$\frac{-380-300}{50}$$
 = + 1.60
and = $\frac{-425-500}{50}$ = -1.50

$$nd = \frac{1.50}{50} = -1.50$$

Since the 3 db bandwidth is exactly 10 % of the center frequency, the answer can be read directly from the graph marked 10% bandwidth.

F00 F00

Using the 5-section curve and the point +1.60 (580 MHz) we find the min. attenuation level is 50 db. At -1.50 (425 MHz) the minimum attenuation level is 40 db. **Example 2:**

Given:

Center frequency = 300 MHz Number of sections = 3 Atten. at 336 MHz = 40 db min. **Find:** The 3 db bandwidth

Min. 3 db BW = 3 db BW from Fc

Since we do not know the exact bandwidth we must estimate it and solve by an iterative process.

336 - 300

All of the 3 section curves show the high frequency 40 db point at between +2.5 and +3.1 3 db bandwidths from center freq. If we assume 2.8 we find an approximate value for the 3 db BW of 36/2.8 = 13 MHz.13 MHz is approximately 4% of 300 MHz, therefore we now know that we must interpolate between the 2% and 5% bandwidth graphs. The 2% graph shows +3.1 and the 5% graph shows +2.95. We now know that +3.0 is an accurate number to use in the above equation. The accurate value for the 3 db bandwidth is 36/3.0 = 12 MHz.



ATTENUATION CURVES

TUBULAR LOWPASS FILTERS



LENGTH CURVES

TUBULAR BANDPASS FILTERS





INSERTION LOSS CURVES



 $=\frac{2.2 \times 5.5}{1.4} + 0.2 = 1.4 \text{ db}$ 10

VSWR Bandwidth

NO. OF SECTIONS	2	3	4	5	6 OR MORE
VSWR Bandwidth Min. 3 db Bandwidth	0.4	0.7	0.8	0.85	0.9

TELONIC HIGHPASS FILTERS

■ 50 TO 1500 MHz

TELONIC BERKELEY NC

■ 2 TO 10 SECTIONS

All Highpass Series are typically of 0.1 db Chebyschev Design and are available with 2 thru 10 sections. Special designs are available on request.

	THP	350	5	C	С	
Series					\top	
Nominal Center	Freq. MHz 🗕					
Sections						
See Connector Code, Below	{Input Conn. Output Conn.					
Suffix Number to	o be Assigned b	y the Facto	ory			

to Identify the Specific Customer and Application

SERIES THP

CONNECTOR CODE

— N Jacк — N Plug

_

ELE	CTRICAL SPECIFICATIONS	Normal Spec. Limit	Areas of Interest		
Cut	off Frequency Range	100 MHz to 500 MHz	50 MHz to 1500 MHz		
Ma In I	ximum Insertion Loss Passband*	See Graph	Submit Requirements		
No (in	minal Impedance and out)	50 ohms	50 to 100 ohms		
Ma In I	ximum VSWR Passband	1.7:1	as low as 1.3:1		
Sto	p Band Attenuation	See Graph	Submit Requirements		
Nυ	mber of Sections	3 to 7	2 to 10		
Average Input Power (watts max. to 10,000 ft.)		5	12		
Input Peak Power (watts max. to 10,000 ft.)		20	100		
EN	VIRONMENTAL SPECIFICATIONS				
	Shock	30G	1000G		
Ŷ	Vibration	10G	50G		
DPERATII	Humidity	Up to 90%	To 100% with Condensation		
ľ	Altitude	Unlimited	Unlimited		
5	Temp. Range	-20°C to + 50°C	-54°C to +125°C		
[ORA	Shock	30G	1000G		
S	Vibration	10G	50G		
	Temp. Range	– 54°C to +71°C	– 62°C to +150°C		

*All highpass filters have an upper passband limit caused by distributed effects of the individual elements. This upper limit is dependent upon both frequency and number of sections, and can vary from 2x to 7x the cutoff frequency. Consult factory for further information.

BNC Jack BNC Plug TNC Jack TNC Plug SMA Jack SMA Plug Special *A *B C D _ x _ * BNC Connectors not standard above 1000 MHz

The curves at right define the normal specification limits on attenuation for Telonic highpass filters. The minimum attenuation level in db is shown as a function of the relative frequency.

Calculate relative frequency as ratio of frequency to be attenuated to frequency to be passed: 'B' MHz

$$R = \frac{B^{-1} M M L^{2}}{A^{\prime} M H z}$$

For example:

Requirements -

- 1. Min. cutoff frequency = 350 MHz.
- 2. 35 db min. attenuation at 250 MHz.
 - $250 \mbox{ MHz}$ is at a relative frequency of .71 with respect to 350 $\mbox{ MHz}.$ 250

$$R = \frac{250}{350} = .71$$

Reading from the 4-sec. curve at a relative frequency of .71, we find that a four section THP has a normal specification limit of 28 db and a five section THP has a normal specification limit of 38 db. Therefore a THP of five or more sections would be required to meet the 35 db attenuation specification.



HIGHPASS ATTENUATION CURVE



INSERTION LOSS CURVES



INSERTION LOSS:

Loss = KN + .2 (in db)

Where:

K = Loss constant

N = Number of sections

The insertion loss graph defines the loss constant which must be used to calculate the insertion loss specification.

For example:

In accordance with the formula above, the maximum insertion loss specifications are as follows.

THP 350-5CC

 $KN + 0.2 = .18 \times 5 + .2 = 1.1 db$

CAVITY BANDPASS FILTERS

■ 30 TO 12,000 MHz

Telonic Cavity Bandpass Filters exhibit lower losses and narrower bandwidths than Telonic Tubular Filters, as well as higher frequency ranges. For extremely high stability over the operating temperature range, most Cavity Filters can be temperature compensated. Where the normal attenuation characteristic is not appropriate, traps, or "band-reject sections" may be added for special applications.

■ 0.1 TO 3.0% BANDWIDTHS

These filters utilize helical resonators, coaxial resonators or resonant cavities. Resonant elements are subject to higher frequency spurious responses which can usually be suppressed with a Telonic Lowpass Filter, if required.



NOTE 1: See page 6 for standard tolerance and definition of center frequency and bandwidth.

The specifications for the example shown here are as follows:

This model is a fixed frequency cavity bandpass filter. It has a nominal center frequency of 1680 MHz and a minimum 3 db relative bandwidth of 42 MHz. The maximum insertion loss at 1680 MHz is 0.47 db (see page 20). The nominal input and output impedance is 50 ohms. The maximum VSWR at center frequency is 1.5:1. From Table 1, 0.8 x 42 MHz (minimum 3 db bandwidth) is 33.6 MHz for a VSWR of 1.5:1 or less from 1663.2 MHz to 1696.8 MHz.





CAVITY BANDPASS FILTERS

ATTENUATION



STOP BAND ATTENUATION:

This graph shows the minimum stop band attenuation in db for Telonic cavity bandpass filters with less than 3 db insertion loss. Filters with higher loss must be quoted by the factory.

The rejection frequency is plotted in "3 db bandwidths from center frequency." The exact relationships are: (1) 3 db bandwidths from Fc

= <u>Rej. freq. MHz - Fc MHz</u> Min. 3 db BW MHz or (**II**) Min. 3 db bandwidth in MHz

> = Rej. freq. MHz - Fc MHz 3 db BWs from Fc

Any one of the following parameters may be identified if the other three and the center frequency are known.

(1) Min. 3 db bandwidth (in MHz).

(2) Number of sections.

- (3) Rejection Frequency (in MHz).
- (4) Attenuation Level (in db).

Always verify that the frequency and bandwidth you have selected are within the limitations shown for that series of filter.

For example:

Given:

Center frequency = 1,680 MHz Minimum 3 db BW = 42 MHz Number of sections = 4 Find: Minimum attenuation level at 1,608 MHz and 1,752 MHz. From (1) above: 3 db BWs from Fc $= \frac{1608 - 1680}{42} = -1.71$ and $\frac{1752 - 1680}{42} = +1.71$ Reading directly from the graph at the points -1.71 and

Reading directly from the graph at the points -1.71 and +1.71 we find the minimum attenuation level of 40 db.

INSERTION LOSS



CAVITY BANDPASS FILTERS



TCA

TCG

тсн

TCB



Table 1 VSWR Bandwidth

NO. OF SECTIONS	2	3	4	5	6 OR MORE
VSWR Bandwidth Min. 3 db Bandwidth	0.4	0.7	0.8	0.85	0.9

Table 2 CONNECTOR CODE



INTERDIGITAL BANDPASS FILTERS

■ 1,000 TO 9,000 MHz

■ 3.0 TO 30% 3 DB BANDWIDTHS

DESCRIPTION

Telonic Interdigital Bandpass Filters fill the need for moderate and wide bandwidth filters in the 1.0 to 6.0 GHz spectrum. The standard unit is available with as many as 17 sections, to meet extreme selectivity requirements.

These 0.1 db Chebyschev filters exhibit almost exact duplication of the mathematical model. Their skirts or stopbands are geometrically symmetrical.





4 TO 17 SECTIONS

The specifications for the example shown here as follows:

This unit is a fixed frequency interdigital bandpass filter. It has a nominal center frequency of 2,175 MHz and a minimum 3 db relative bandwidth of 350 MHz. The maximum insertion loss at 2,175 MHz is .55 dB. (See Insertion Loss Curve page 23). The nominal input and output impedance is 50 ohms. The maximum VSWR at 2,175 MHz is 1.5:1. The minimum bandwidth over which the VSWR remains less than 1.5:1 is 315 MHz (from 2,017.5 MHz to 2,332.5 MHz).

The filter has 8 sections and its minimum stopband attenuation is 60 db at 1811.1 MHz and 2595.1 MHz.

OUTLINE DRAWINGS



VSWR Bandwidth



NOTE 1: See page 6 for standard tolerance and definition of center frequency and bandwidth.

*Submit specific requirements

INTERDIGITAL BANDPASS FILTERS

ATTENUATION CURVES



NOTE 1: Consult factory when selectivity requirement exceeds 8 sections.

INSERTION LOSS CURVES





MINIATURE COMBLINE BANDPASS FILTERS

WIDE RANGE 1.4 TO 10 GHz (TSJ) MINIMUM INSERTION LOSS

DESCRIPTION

The Telonic Series TSJ Miniature Combline Bandpass Filters are designed for compact size and provide the lowest possible passband insertion loss consistent with their size. They offer wide stopband rejection extending up to 28 GHz, and 3 dB bandwidths varying from 1 to 15%. Because these filters are extremely small and light weight, they are well suited for use in aircraft, missile, and satellite transceivers and receivers.



MINIATURE SIZE LIGHT WEIGHT HIGH REJECTION WIDE STOPBAND

These filters are of the 0.1 dB Chebyschev combline design and are available with three to eight sections. Measuring 1/2 inch thick the TSJ filters provide compactness with exceptional mechanical rigidity. Several styles of miniature connectors are available.

Customer requirements can be used to design a standard filter as shown below.



Connector Code

S — SMA Jack T — SMA Plug				
Other connector types are available. Contact factory.				

VSWR Bandwidth

NO. OF SECTIONS	2	3	4	5	6 OR MORE
VSWR Bandwidth Min. 3 db Bandwidth	0.4	0.7	0.8	0.85	0.9

OUTLINE DRAWINGS



* Submit specific requirements.

2. Dimensions and weight vary according to frequency and bandwidth, and therefore should be quoted from factory when critical.

3. "L" dimensions, see specifications.

^{1.} For information regarding relative bandwidths other than 3 dB and other VSWR levels, refer to page 7.

ATTENUATION CURVES



3 db BWs from Fc

you have selected are within the limitations shown for that series of filter.

$$= \frac{5190 - 6000}{300} = -2.7$$

and
$$\frac{6810 - 6000}{300} = +2.7$$

Reading directly from the Attenuation curves, points -2.7 and +2.7, we find the minimum attenuation level of 50 dB. and 54dB respectively.

INSERTION LOSS CURVES

Figure 2. Insertion Loss Curves



At border or crossover frequencies (2, 3, 4, and 7 GHz) the loss constant (K) may be specified for either higher stop band limit or lower insertion loss. For example: (1) the higher the loss constant, the greater the upper stop band limit but the higher the insertion loss; (2) the lower the loss constant, the lower the insertion loss but the upper stop band is also slightly decreased (see Table 5).

MINIATURE BANDPASS FILTERS

■ MINIATURE SIZE ■ 40 TO 1000 MHz ■ CONVENIENT PACKAGING ■ PRINTED CIRCUIT BOARD APPLICATIONS

DESCRIPTION

Telonic Series TSA and TSC Miniature Bandpass Filters employ a unique helical resonator design to achieve "state-of-the-art" performance. These small, 0.1 dB Chebyschev Filters are packaged for maximum convenience.

TSA and TSC Filters can be supplied with a wide variety of standard co-axial connectors, or flexible or semi-rigid cable of any length. The filters can also be supplied with pins for direct attachment to a printed circuit board. All connectors can be on any set of the narrower faces of the filter.

The specifications for the example shown here are as follows: Series TSC filter, nominal center frequency of 300 MHz, 3dB relative bandwidth of 30 MHz and has 5 sections. Connectors are SMA jacks on input and output.



SERIES TSA

ELECTRICAL SPECIFICATIONS							
Center Frequency Range TSA		Normal Spec. Limit	200 – 600 MHz				
		*Areas of Interest	160 – 1000 MHz				
Center Frequency Range	Normal Spec. Limit	40 to 500 MHz					
TSC		*Areas of Interest	30 to 600 MHz				
Minimum 3 db Relative Bandwidth (in % of	Normal Spec. Limit	1.0% – 15%					
center frequency)		*Areas of Interest	up to 20%				
Maximum insertion loss At Center Frequency		Normal Spec. Limit	See insertion loss curves				
		*Areas of Interest	Special Requirements				
Nominal Impedance		Normal Spec. Limit	50 ohms				
(in c	ind out)	*Areas of Interest	50 – 100 ohms				
Max	cimum VSWR at	Normal Spec. Limit	1.5: 1.0				
Center Frequency		Areas of Interest	1.25 : 1.0				
Min	imum VSWR Bandwidth		See lable 1				
		Areas or interest					
Stop	Band Attenuation	Normal Spec. Limit	See Attenuation curves				
		Areas of Interest					
Nur	nber of Sections	*Arcost of Interest	2 to 6				
		Areas of Interest					
Average Input Power		Normal Spec. Limit	115 (3 dB BW MHz)				
(wat	ts max. to 10,000 ft.)		Loss Constant x Fc MHz				
		*Areas of Interest	Special Requirements				
Peak Power Input (watts max. to 10,000 ft.)		Normal Spec. Limit	100 (3 dB BW MHz)				
			Fc MHz				
		*Areas of Interest	Special Requirements				
OPE	RATING ENVIRONME						
Shock Vibra	Shock	Normal Spec. Limit	30g. 11 m sec.				
	onock	*Areas of Interest	Special Requirements				
	Vibration	Normal Spec. Limit	10g, 5 to 500 Hz				
	VIDIGIION	*Areas of Interest	Special Requirements				
+ 	Humidity	Normal Spec. Limit	90% Relative				
		*Areas of Interest	100%				
	Altitude	Normal Spec. Limit	120,000 ft.				
		*Areas of Interest	Unlimited				
Temperature	Townsonations	Normal Spec. Limit	0°C to 50°C				
	*Areas of Interest	-54°C to + 125°C					

* Submit specific requirements.



ELONIC TSC 8 SN:

SERIES TSC

ATTENUATION CURVES

These graphs show the minimum stop band attenuation in dB for the TSC Miniature Filters at different bandwidths. Intermediate values may be interpolated.

For Example: TSC 300 - 30 - 555

Rejection freq. MHz - Fc MHz 3 dB Bandwidths from Center Frequency = Minimum 3 db Bandwidth MHz

To determine the frequencies corresponding to 40 dB attenuation, read from stop band attenuation 10% bandwidth the number of 3 dB bandwidths away from center frequency corresponding to 40 dB level. On the lower frequency side, it is -1.2, and 1.5 on the higher frequency side. The frequency corresponding to 40 dB on the lower skirt = 300 - 1.2 x30 = 264 MHz. The frequency corresponding to 40 dB on the upper skirt = $300 + 1.5 \times 30 = 345$ MHz. Based on specific requirements:

- 1. If a certain minimum 3 dB bandwidth and definite rejection at specified frequencies are required, the appropriate number of sections can be selected from the attenuation curve. The insertion loss can then be determined from the insertion loss curve.
- 2. If a certain min. 3 dB bandwidth and a definite insertion loss are required, the maximum number of sections is found by using the insertion loss curves, estimating rejection at specified frequencies, or determining the frequencies corresponding to any attenuation level using the attenuation curves.

In case of special requirements not encompassed in the above data, Telonic Berkeley should be contacted directly.

ATTENUATION CURVES



INSERTION LOSS CURVES

Table 1 VSWR Bandwidth

OUTLINE DRAWINGS

TSA 20 MIN. TYP. % 2-56 NC-2B x 1/8 DP. (2) PIN 036 DIA. TYP. X Ŧ 11/2 .500 1/16 1%4 TYP. % 000 ØÓØ 3% 2-56 NC-2B x 1/8 DP. (2) SMA FEMALE, TYP. .500 114 Ŀ L CONNECTOR PAIRS MAY BE LOCATED IN ANY OF THE POSITIONS SHOWN ABOVE (A, B, C) **MECHANICAL SPECIFICATIONS** $3/8 \times \frac{11}{16} \times L_{1}, L_{1} = 1 \frac{1}{2} + \frac{n}{4}$ approx. where n = no. of sections Size Weight Usually less than 1.5 oz. max without connector.

Table 2 CONNECTOR CODE

The products covered in this catalog represent Telonic Berkeley's general filter product line. We specialize in fulfilling your unique filter requirements and welcome the opportunity to discuss your specifications with you.

We have the capabilities to build filters to meet your exact needs. For more information, please call our Customer Service Department:

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Web: www.telonicberkeley.com email: info@telonicberkeley.com

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