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K&L Microwave Product Catalog

Filtering Solutions for Your Global Market

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SPACE HERITAGE

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Supporting Space Exploration through the Development of Innovative Technology.

K&L Microwave has contributed to the aerospace industry for over 40 years and has been part of the following programs:

- Apollo 17
- Iridium Satellite Constellation
- GPS-R
- GPS-R (V-Sensor Program)
- GPS III
- Thuraya Satellite Communications
- MSV Satellite Telephony
- COSMO-Sky Med
- OCEANSAT 2
- SKYNET 5
- CHIRP
- Mars Curiosity Rover
- Exomars Rover
- “P-Series” of Satellites
- Orion Crew Expeditionary Vehicle
- Soil Moisture Active Passive Satellite
- Mars Curiosity Rover
- Mars Opportunity Rover
- SAOCOM Satellite
- SARAL Satellite

Workmanship Standards:
IPC-J-STD-001 with Space Addendum
IPC –A-610

ENABLING COMMUNICATIONS AND SIGNAL CONTROL

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About K&L

Company Profile



K&L Microwave designs and manufactures a full line of RF and microwave filters, duplexers, and integrated assemblies, including ceramic, lumped element, cavity, waveguide, and tunable filters. K&L's products are used in a wide variety of defense electronics, homeland security, space, and commercial communication systems.

K&L Microwave is a subsidiary of Dover Corporation, a diversified global manufacturer with annual revenue exceeding $7 billion. Dover is committed to operational excellence, innovation, and market leadership. K&L was founded in 1971 and acquired by Dover in 1983, and has been a leading supplier of filters and filter-based products throughout its history.

K&L has three facilities in Salisbury, Maryland, with a total of 170,000 square feet. K&L has been a pioneer in vertical integration in the filter industry, enabling faster response times. Capital investment includes over 100 network analyzers; an on-site calibration lab; advanced circuit design and electromagnetic analysis software packages; laser-welding and laser-labeling devices; a custom-designed plating and wastewater closed-loop operation; a fully equipped machine shop with computer-numerically controlled (CNC) vertical mills, horizontal mills, and lathes; power-testing equipment; and a test laboratory featuring thermal shock chambers and specialized measurement equipment for vibration, leak, humidity, salt-fog, and a variety of other environmental requirements. In addition, K&L streamlines production by teaming with customers to implement lean manufacturing and maintains a Dominican Republic facility for high-volume, commercial throughput.

K&L Microwave's Salisbury operation adheres to all federal, state, and local laws and regulations, including, but not limited to, those of OSHA, the EPA, the Sarbanes-Oxley Act, and the EEOC, as well as United States government import and export regulations and a wastewater discharge permit with the City of Salisbury.

Our Goal

K&L's mission is to produce high-quality, cost-effective solutions based on customers' specific needs. By controlling internal design and production processes, K&L ensures and guarantees high quality and exceptional product performance. The K&L team is committed to achieving excellence through aggressive investment in research and development, through capital investments in manufacturing technology, and through the use of proven and innovative designs.

Product Development and Selection

K&L Microwave is a design-to-order RF and microwave filter manufacturer. As such, the technical sales force and engineers work closely with customers' engineering groups to provide design support and custom solutions. Partnering in this way allows K&L to provide enhanced value through integrated technologies. Senior engineers often travel to client facilities to conduct "lunch-and-learn" sessions and to participate in design reviews. For customers who visit our web site (www.klmicrowave.com), K&L's Filter Wizard® software simplifies the selection of the right filter product.

Quality, Sustainability, and Compliance

K&L maintains a comprehensive quality management system focused on areas directly impacting product safety and reliability, and is AS 9100 registered. AS 9100 certification is the worldwide mark of excellence for the aircraft/aerospace industry. K&L's Salisbury facilities are ISO 14001:2004 registered. K&L applies soldering and workmanship practices that conform to

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customer and military standards, American National Standards Institute (ANSI) standards, and IPC standards, including IPC J-STD-001 and IPC-A-610, and has the capability to meet RoHS requirements upon request.

AS 9100

ISO 14001

RoHS Compliance

The European Economic Community (EEC) Restriction of Hazardous Substances (RoHS 2011/65/EU) directive dictates that all products sold in Europe and certain other locations will be free of designated hazardous materials, with some exceptions. One significant exception is for any product used in a military application.

Specific materials that are banned based on the RoHS directive include:

- Lead
- Mercury
- Hexavalent Chromium
- Polybrominated Biphenyls (PBB)
- Polybrominated Diphenyl Ethers (PBDE)
- Cadmium

Since K&L Microwave serves both the military and commercial markets with custom designed filters and filter-related assemblies, the RoHS directive requires K&L's customers to identify the need for RoHS compliance in their specifications and/or orders. K&L has the capability to meet RoHS requirements and does so upon request.

Conflict Minerals Policy

K&L Microwave periodically publishes updated summaries of its response to the Conflict Minerals disclosure requirements of the Dodd-Frank Wall Street Reform and Consumer Protection Act, Section 1502. K&L's parent company, Dover Corporation, is a NYSE listed company and, as such, provides disclosures under SEC reporting requirements.

K&L does not knowingly source any materials, parts, or products that contain Conflict Minerals from the Covered Countries, as defined in Dodd-Frank. Determining the source of the Conflict Minerals contained in the many parts, components, and materials used in K&L's products is a detailed, lengthy task. As part of Dover Corporation, K&L strives for full compliance with Dodd-Frank requirements. For K&L's latest published due diligence process update, please see "Statement on Conflict Minerals" at http://www.klmicrowave.com/supply-chain.php.

We appreciate the ongoing support and cooperation of suppliers and customers in our Conflict Minerals disclosure process to ensure the effective handling of disclosures and requirements.

REACH Compliance

K&L supports the European REACH regulation objective of improving the protection of human health and the environment.

With respect to the REACH regulation, K&L's products are considered articles (components) and shall not release any substance when used as intended and according to recommended specifications and parameters.

The European Chemical Agency (ECHA) has identified a list of substances that are considered as Substances of Very High Concern (SVHC). K&L has determined that delivered products do not contain any of these SVHCs above the threshold of 0.1% by weight as required by the REACH legislation.

K&L Microwave continues to take all necessary steps to produce products in accordance with the requirements of the REACH regulation. We will inform our customers, upon request, of any exceptions to the REACH requirements.

SVHC candidate list web resource: https://echa.europa.eu/candidate-list-table

For K&L's current REACH Compliance statement, including a summary of SVHC candidate list revision dates, please visit http://www.klmicrowave.com/environmental.php.

About K&L

Ordering Information

Always order by model or part number. For modifications or special testing to meet specific requirements, contact our sales department. Your order may be placed directly to the factory or through your local representative.

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Salisbury, Maryland 21801
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sales@klmicrowave.com

Unless shipping instructions accompany the order, K&L will exercise judgment as to the best method of shipment. The prices of our products include packing, but do not include shipping costs.

Delivery

Delivery times may vary based on product complexity and factory loading. To obtain current delivery schedule, contact our sales department or your local representative. Expedited delivery of as little as 72 hours may be available for certain products at an additional charge.

Prices

Determination of price, terms and conditions of sale, and final acceptance of orders are made only at our plant in Salisbury, MD. Prices quoted are FCA Salisbury, MD. Terms are Net 30 Days for established accounts.

Specifications

We reserve the right to discontinue any item or product without notice and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

Warranty

Products manufactured by K&L Microwave are warranted against defective material and workmanship for one year from date of shipment. K&L's obligation for any defect(s) shall be limited to repair (or replacement) of defective part(s). K&L assumes no liability if defects result from improper use, operation above rated capacities, repairs not made by K&L, or misapplication of equipment. No other warranty is expressed or implied, and K&L neither makes nor authorizes any other person to make any other warranty concerning its products. K&L is not liable for consequential damages. Warranty returns must be first authorized by the sales department and are to be returned prepaid. Customers requiring product service should contact K&L directly, at which time a Return Material Authorization (RMA) number will be assigned to authorized return. The RMA number should be attached to documentation included with the unit(s) being returned.

On the Web

In parallel with this catalog, K&L Microwave provides information on existing products and new product releases at the company's main web site, www.klmicrowave.com, and offers the Filter Wizard® web application at www.klfilterwizard.com.

Filter Wizard® is a filter synthesis and selection tool that streamlines identification of filter products meeting customer specifications across a large portion of K&L's standard product offerings. Filter Wizard® includes bandpass, lowpass, highpass, and bandreject response types, with all-pole and elliptic solutions. The selection tool's bandpass search capabilities include Chip & Wire filters, Ceramic filters, Cavity filters (combline and interdigital), Thin Film Lumped Element filters, and Waveguide filters, as well as KeL-fil®, KeL-com®, Mini-Max®, Mini-Pack®, and high-Q ceramic puck options. Filter Wizard® accelerates user progress from specification to RFQ for RF and microwave filters spanning an ever-increasing range of response types, bandwidths, and unloaded Q values.

Much of the time, Filter Wizard® can speed selection of the right filter product for your communications

network, RF subassembly, or military system application from a vast number of available designs. Provide the Filter Wizard® web application with your desired specifications, and the software will return a list of products that match, placing response graphs, outline drawings, and downloadable s-parameters at your fingertips.

Strength and Synergy

K&L Microwave is one of four companies belonging to Microwave Products Group (MPG). The MPG companies design, manufacture, and sell special electronic components and systems, including high-performance microwave and RF filters, switched filter banks, switches, switch matrices, integrated assemblies, and co-site signal interference solutions.

MPG products are used in military, space, telecom infrastructure, and industrial applications where function and reliability are crucial. K&L's three MPG (www.dovermpg.com) sister companies are BSC (www.bscfilters.com), Dow-Key Microwave (www.dowkey.com), and Pole/Zero (www.polezero.com). K&L and sister company Dow-Key Microwave partner to provide tailored test system architectures and innovative rack assemblies.

About Dover Corporation

Dover is a diversified global manufacturer with annual revenue exceeding $7 billion. We deliver innovative equipment and components, specialty systems, consumable supplies, software and digital solutions, and support services through four operating segments: Energy, Engineered Systems, Fluids, and Refrigeration & Food Equipment. Dover combines global scale with operational agility to lead the markets we serve. Recognized for our entrepreneurial approach for over 60 years, our team of 29,000 employees takes an ownership mindset, collaborating with customers to redefine what's possible. Headquartered in Downers Grove, Illinois, Dover trades on the New York Stock Exchange under "DOV." Additional information is available at dovercorporation.com.



Terms & Definitions

ATTENUATION - Voltage loss in dB incurred by a signal in passing through a dissipative network or other medium.

BAND REJECT FILTER - A filter that rejects one band of frequencies and passes both higher and lower frequencies. Sometimes called a notch filter.

BANDWIDTH - The width of the passband of a bandpass filter is the frequency difference between lower and upper 3 dB points.

BANDPASS FILTERS - A filter that passes one band of frequencies and rejects both higher and lower frequencies.

BESSEL FUNCTION - A mathematical function used to yield maximally constant time delay in a filter with no consideration for amplitude response. This function is very close to a Gaussian function.

BUTTERWORTH FUNCTION - A mathematical function used to yield maximally constant amplitude response in a filter with no consideration for time delay, or phase response.

CENTER FREQUENCY (f_0) - In standard Bandpass Filters the center frequency is either geometrically or arithmetically calculated.

Geometrically: $f_0 = \sqrt{(F_1 \times F_2)}$

Arithmetically: $f_0 = 1/2\ (F_1 + F_2)$

CHARACTERISTIC IMPEDANCE - The characteristic impedance of a filter is usually taken as equal to L/C where L is the total series inductance in henries and C is the total shunt capacity in farads. Characteristic impedance is measured in ohms.

CHEBYSHEV FUNCTION - A mathematical function that produces a curve that ripples within certain bounds (see ripple). This produces a squarer amplitude response than the Butterworth Function but with less desirable phase, and time delay characteristics. There is a whole family of Tchebycheff functions (0.1 ripple, 0.5 ripple, etc.).

CUT-OFF FREQUENCY (f_c) - The upper passband edge in lowpass filters or the lower passband edge in highpass filters. The passband edge closest to the stop band, sometimes called the 3 dB point.

DECIBEL (dB) - A unit of gain or attenuation for expressing the ratio of two voltages. It is used to describe voltage gain, voltage loss, performance figure or anything which can be considered as a ratio of two voltages. A decibel is defined as 20 Log (E_1/E_2) where E_1 and E_2 are two voltages such as input and output voltages, or peak voltage and average voltage, etc.

DISSIPATION - Energy losses in a filter due to resistive or core losses, etc.

DISTORTION - Generally, the modification of signals which produce undesirable end effects. These modifications can relate to phase, amplitude, delay, etc. The distortion of a sine wave is usually defined as the percentage of signal power remaining after the fundamental sine wave component has been removed.

ELLIPTIC FUNCTION - A mathematical function used to yield the squarest possible amplitude filter response with a given number of circuit elements. The elliptic function has a Tchebycheff response in both the passband and the stop band. The elliptic function filter has a poorer phase response and transient response than any of the classical transfer functions.

ENVELOPE DELAY - The propagation time delay of the envelope of an amplitude modulated signal as it passes through a filter. Sometimes called time delay or group delay. Envelope delay is proportional to the slope of the phase shift response versus frequency curve. Envelope delay distortion occurs when the delay is not constant at all frequencies in the passband area.

FILTER Q - An important parameter of bandpass and band reject filters:

Bandpass & Band Reject: $Q = \dfrac{f_0}{\text{3 dB Bandwidth}}$

GAUSSIAN FUNCTION - A mathematical function used to design a filter which passes a step function with zero overshoot with maximum rise time. Similar to a Bessel Function filter.

HIGHPASS FILTER - A filter which passes high frequencies and rejects low frequencies.

INSERTION LOSS - The loss of signal caused by a filter being inserted in a circuit. It has many different definitions and is measured in dB. In general it is the ratio of voltage, delivered to the load (at peak frequency response) with the filter in the circuit to the voltage in the load if a perfect lossless matching transformer replaced the filter. When a filter is inserted between two circuits whose impedances differ widely, it is sometimes more practical to specify insertion loss some other way.

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LINEAR PHASE FILTER - A filter that exhibits a constant change in phase per unit of frequency. The resultant plot of frequency versus phase is a straight line. This type of filter ideally displays a constant delay in its passband.

LOAD IMPEDANCE - The impedance that normally must be connected to the output terminals of the filter in order to meet filter specifications; the filter will drive this load.

LOWPASS FILTER - A filter which passes low frequencies and rejects high frequencies.

OVERSHOOT - The amount in percent by which a signal exceeds its steady-state output on its initial rise.

PASSBAND - The frequency range in which a filter is intended to pass signals.

PASSBAND RIPPLE - Variations of attenuation of frequency within the passband of a filter.

PHASE SHIFT - The changing of phase of a signal as it passes through a filter. A delay in time of the signal is referred to as phase lag. In normal networks, phase lag increases with frequency, producing a positive envelope delay (see envelope delay).

RELATIVE ATTENUATION - Attenuation measured with the point of minimum attenuation taken as zero dB, or Relative Attenuation = Attenuation minus Insertion Loss.

RESPONSE - The term used to describe how a filter reacts to input signals. It is defined as the ratio of the input signal compared to the output signal (for amplitude response and phase response).

RIPPLE - Generally referring to the wavelike variations in the amplitude response of a filter. Tchebycheff and Elliptic Function filters ideally have equi-ripple characteristics, which means that the differences in peaks and valleys of the amplitude response in the passband are always the same. Butterworth, Gaussian, and Bessel functions have no ripple. Ripple is usually measured in dB.

RISE TIME - The length of time it takes a step-function at the output of a filter to move from 10% to 90% of its steady state value on the initial rise.

ROLL OFF - A term used to describe the stop band characteristics of a filter. For example, a filter may be specified to have a roll off of 42 dB per octave. This is a somewhat obsolete method of specifying a filter characteristic. It implies that the second octave would be down 84 dB and the third octave 126 dB and so on. In reality the ultimate attenuation levels off at somewhere around 80 dB and spurious "come-backs" are difficult to keep below 80 dB.

SHAPE FACTOR - An important parameter of all filters:

Bandpass & Band Reject: $S = \frac{\text{Attenuation Bandwidth}}{\text{3 dB Bandwidth}}$

Lowpass & Highpass: $S = \frac{\text{Attenuation Frequency}}{\text{3 dB Cut-Off}}$

STEP FUNCTION - A signal change in amplitude from one level to another which occurs in zero time. Usually refers to a rectangular front waveform used in testing transient response.

STOP BAND - The area of frequency where it is desirable to reject or attenuate all signals as much as practical. Also called reject band.

TIME DELAY - The amount of time it takes for certain signals to pass through a filter.

Specifying Filters

Filter Structures

K&L filters are available in bandpass, lowpass, bandreject and highpass designs. When specifying your filter needs, be sure to supply all pertinent passband and stopband information. To achieve the best results, additional specifications such as phase, group delay, power, size and mechanical requirements should be supplied.

Lumped Element

The elements in the filter are lumped (i.e. concentrated over a small area). The inductors are coils of wire wound around cylindrical formers, and the capacitors are parallel plate chips or simpler portions of substrate material.

Combline

Combline filters replace the inductors in a lumped element filter with distributed inductors or lengths of transmission line leaving the capacitors lumped, although distributed capacitance is sometimes used.

Advantages:
- High "Q" factors can be obtained
- Small size can be traded off with "Q"
- Bandwidths from 3% to 18% can be obtained
- Designs cover 500 MHz to 40 GHz

Interdigital

Interdigital filters are entirely distributed networks consisting of an array of short circuit quarter wavelength lines.

Advantages:
- High "Q" factors can be obtained
- Small size can be traded off with "Q"
- Bandwidths from 5% to 50% can be obtained
- Designs cover 1000 MHz to 18 GHz

Suspended Substrate Stripline (S.S.S.)

These filters are also entirely distributed consisting of both series and shunt transmission line sections.

Advantages:
- Very selective devices are standard
- Designs cover 2 GHz to 18 GHz

Waveguide

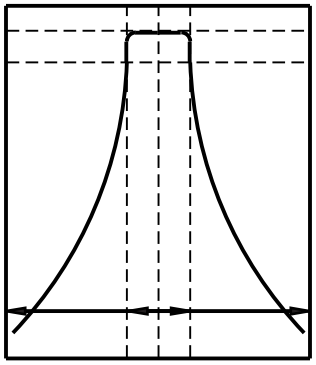
Waveguide filters consist of half wavelength cavities separated by inductive irises. These are made by placing posts through the guide and soldering them to the waveguide at both top and bottom.

Advantages:
- Extremely high "Q" factor can be realized
- Very selective devices can be made
- Designs cover 1 GHz to 40 GHz

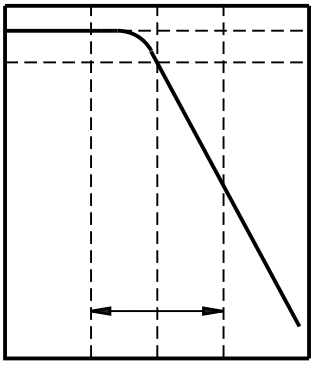
Ceramic

- Use coaxial ceramic resonators
- May achieve higher "Q" than a lumped element filter in a comparable package
- Extremely temperature stable
- Good choice where bandwidth doesn't exceed 10%.

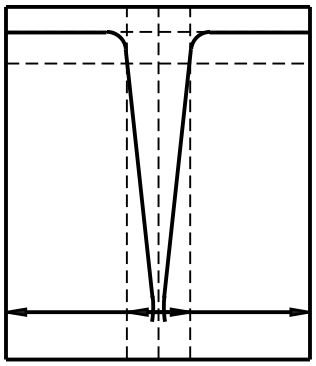
Bandpass



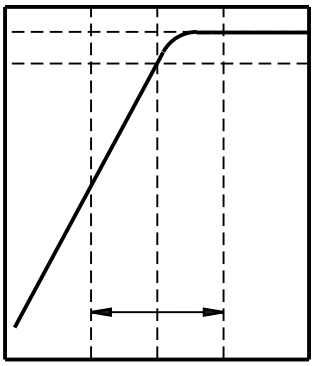
Lowpass



Bandreject



Highpass



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Tables

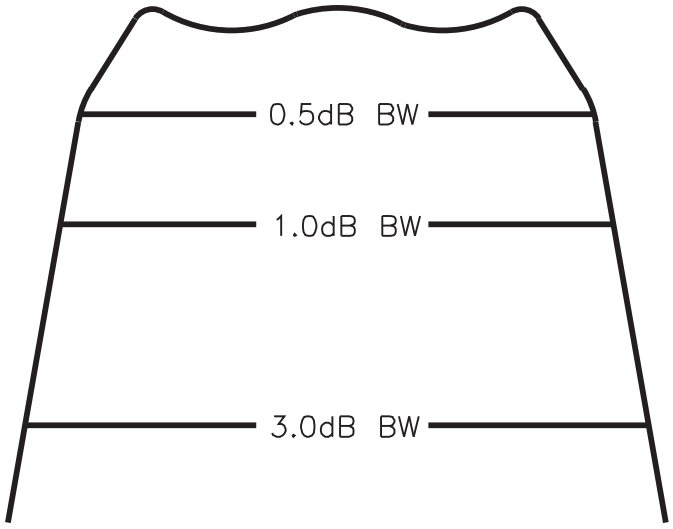
The tables on this page indicate the 0.5, 1.0, 1.5:1 VSWR and ± 5° phase bandwidths with regard to the normalized 3 dB bandwidth.

Example:
Determine all the bandwidths below for our filter model 5B121-500/T80-O/O
1. The insertion loss is

$$\frac{(2)(5.5)}{16} + 0.2 = 0.9 \text{ dB}$$

From the tables:

The 0.5 dB BW = (83%)(80) = 66 MHz
The 1.0 dB BW = (88%)(80) = 70 MHz
The 1.5:1 VSWR BW = (85%)(80) = 68 MHz
The ±5 phase BW = (78%)(80) = 63 MHz



* Custom tolerances available on request.

0.5 dB Bandwidth vs. 3 dB Bandwidth

Insertion Loss dB	Number Sections		
	2	3	4-10
0.5-1.0 dB	58%	75%	83%
1.0-1.5 dB	53%	71%	79%
1.5-2.0 dB	49%	67%	74%
2.0-2.5 dB	44%	62%	70%
2.5-3.0 dB	40%	58%	66%
3.0-4.0 dB	35%	54%	61%
4.0-5.0 dB	26%	45%	52%

1.0 dB Bandwidth vs. 3 dB Bandwidth

Insertion Loss dB	Number Sections		
	2	3	4-10
0.5-1.0 dB	69%	82%	88%
1.0-1.5 dB	65%	80%	85%
1.5-2.0 dB	61%	78%	83%
2.0-2.5 dB	58%	76%	81%
2.5-3.0 dB	54%	74%	79%
3.0-4.0 dB	50%	72%	77%
4.0-5.0 dB	42%	68%	72%

All dimensional tolerances shown in the catalog, unless otherwise stated, shall be in accordance with DOD-STD-100 and ANSI Y14.5M.
.XX+ .030 inches
.XXX + .010 inches

Metric Conversion:
1" = 25.4mm

1.5:1 VSWR Bandwidth vs. 3 dB Bandwidth

Insertion Loss dB	Number Sections				
	2	3	4	5	6-10
.5-1.5 dB	50%	60%	80%	85%	90%
1.5-2.0 dB	50%	60%	80%	85%	90%
2.0-2.5 dB	51%	61%	80%	85%	90%
2.5-3.0 dB	52%	63%	81%	85%	91%
3.0-3.5 dB	55%	66%	83%	88%	94%
3.5-4.0 dB	57%	70%	86%	91%	97%
4.0-4.5 dB	59%	70%	91%	95%	102%

3 dB Bandwidth Tolerance (Percent of f_c)

Percent Bandwidth	Tolerance on Percent BW
1-4%	-0. + 0.5%
4.1-30%	-0. + 2%
30.1-60%	-0. + 4%
60.1-100%	-0. + 6%

±5° Phase Bandwidth vs. 3 dB Bandwidth for Linear Phase Filters

Insertion Loss dB	Number Sections		
	2	3	4-10
0.5-1.0 dB	53%	70%	78%
1.0-1.5 dB	48%	66%	74%
1.5-2.0 dB	44%	62%	69%
2.0-2.5 dB	39%	51%	65%
2.5-3.0 dB	35%	53%	61%
3.0-4.0 dB	30%	49%	56%
4.0-5.0 dB	21%	40%	47%

Testing & Environmental Capabilities

Test Function	Capabilities	Reference Military Standard
Temperature Altitude Barometric Pressure Thermal Vacuum Gross Leak Fine Leak	70,000 Ft. -54°C to 105°C 70,000 Ft. -54°C to 105°C 7.5 X 10^{-7} 1 X 10^{-5} 1 X 10^{-8}	MIL-STD-810 MIL-STD-202 MIL-STD-202 MIL-STD-202 MIL-STD-202
Low Temperature High Temperature Thermal Shock Temperature Cycling Life	-65°C 130°C -65°C to 130°C -65°C to 125°C 85°C to 130°C	MIL-STD-810 MIL-STD-810 MIL-STD-202 MIL-STD-202 MIL-STD-202
Sine Vibration Random Vibration Random over Sine Vibration	5 Hz to 3,000 Hz 10 Hz to 2,000 Hz 10 Hz to 2,000 Hz	MIL-STD-810 & MIL-STD-202 MIL-STD-810 & MIL-STD-202 MIL-STD-810
Mechanical Shock - Half Sine Mechanical Shock - Sawtooth	30 g to 150 g – 11 ms 10 g to 50 g – 11 ms	MIL-STD-202 & MIL-STD-810 MIL-STD-202 & MIL-STD-810
Humidity Moisture Resistance Salt Fog Salt Atmosphere	35°C to 75°C – 95% Humidity 35°C to 75°C – 95% Humidity 35°C – 95% Humidity 35°C – 95% Humidity	MIL-STD-810 MIL-STD-202 MIL-STD-810 MIL-STD-202
Insulation Resistance Dielectric Withstand Voltage Resistance to Solvents Radiographic Inspection	100 volts – 1 X 10 6 100 volts to 500 volts	MIL-STD-202 MIL-STD-202 MIL-STD-202 MIL-STD-202
Power Testing	1 MHz to 250 MHz – 1000 watts 1,000 MHz to 2,000 MHz – 100 watts 1,800 MHz to 2,500 MHz – 60 watts	

Preferred test methods per MIL-STD-202. Testing per MIL-STD-810 and MIL-STD-883 available upon request.

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Explanation of Supplemental Codes

(Can be one or two characters)
/A Amplitude Matched
/B Bessel Response
/C Contiguous Multiplexer
/D Delay Matched
/E Equiripple Bandwidth
/H Half dB Bandwidth
/N Non-contiguous Multiplexer
/P Phased Matched
/Q High Power Requirements
/T Three dB Bandwidth
/U One dB Bandwidth
/W Butterworth Response
/X Special

Multiplexer

Four character medium and topology code
_ Z _ _ Diplexer
_ M _ _ Multiplexer

Special Packaging

"1" is used as 3rd character in medium topology code.
__ __ 1 __

Explanation of Topology of Codes

LP/HP/BP
0 - Special
1 - Chebyshev
2 - S.E.L.F.
Symmetrical Equiripple Lumped Filter

BP
0 - Special
1- Resonant Ladder
2 - Capacitively Coupled "tank"
3 - "tank" with Tubular End Sections
4 - Lowpass/Highpass Cascade
5 - Lumped Tubular or "mesh"
6 - Narrowband S.E.L.F.
7 - Broadband S.E.L.F.
8 - General Parameter
9 - Unspecified

Specific Examples for Each Product Line are:

9B111-500/H50-O/O 9 section Chebyshev filter in a **one and a quarter inch tubular,** center frequency 500 MHz with a half dB bandwidth of 50 MHz and SMA female connectors on both ends.

6C42-1000/UW30-O/OP 6 section Butterworth **cavity filter** in a 42 series package, center frequency 1000 MHz, one dB bandwidth 30 MHz, SMA female on input and SMA male on the output.

9ED30-4000/U2000-N/NP 9 section **interdigital filter** in a 30 series package, center frequency of 4000 MHz, its 1 dB bandwidth is 2000 MHz and it has N-type connectors, input female and output male.

6IB33-2500/TA212-O/O 6 section **IB filter**, tank circuit with tubular end sections in an IB package, center frequency 2500 MHz with a 3 dB bandwidth of 212 MHz, SMA female connectors on both ends, amplitude matching is specified.

3MC10-500/TD45-O/OP 3 section **miniature cavity filter,** center frequency of 500 MHz with a 3 dB bandwidth of 45 MHz. Delay matching is specified and the connectors are SMA female on input and SMA male on the output.

Multiplexers

In a multiplexer the second character in the medium and topology code is replaced by a Z in the case of a diplexer and by M in case of any other multiplexer. The lowest and highest passband frequencies are specified in the part number.

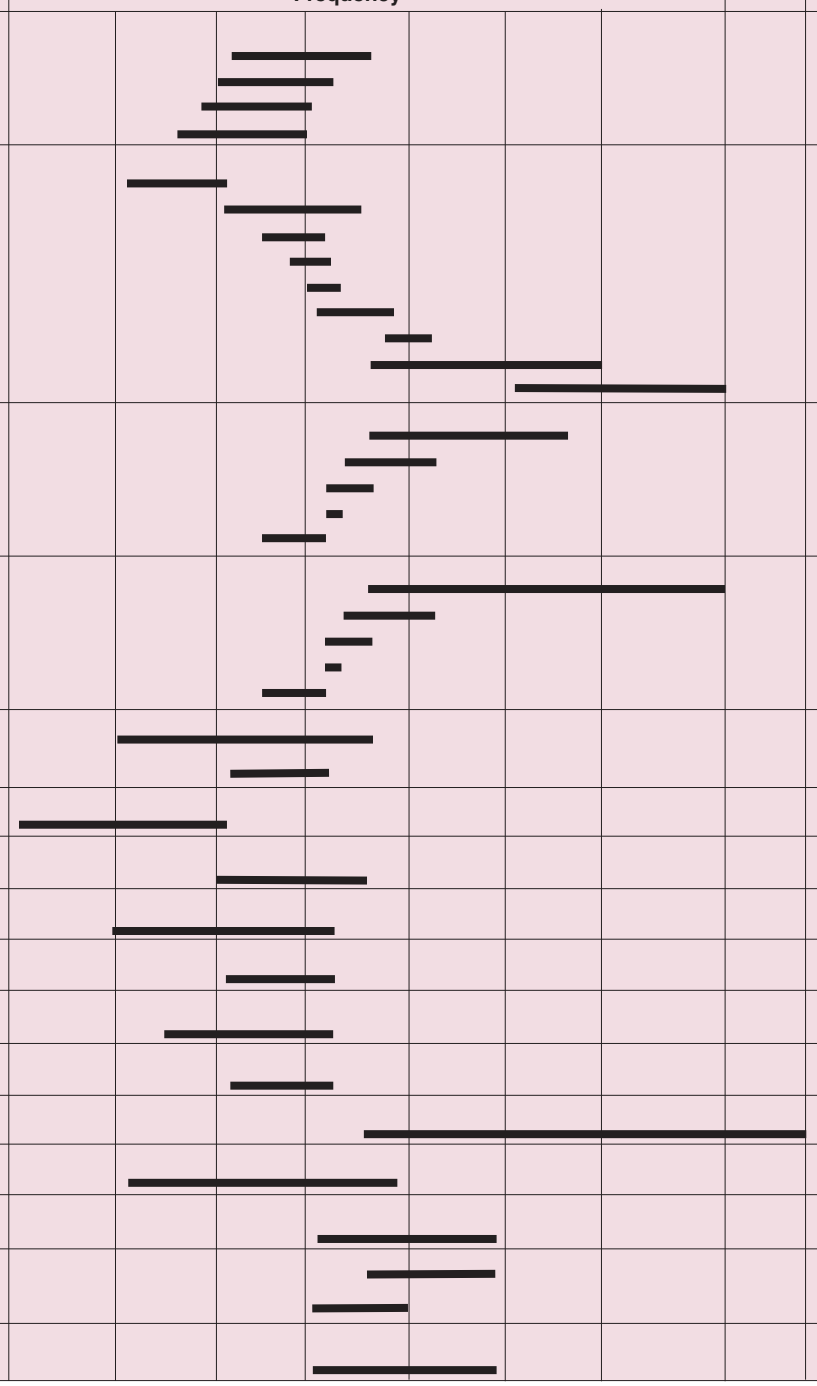
Multiplexers

7FZ30-3000/TC4500-O This **diplexer** consists of 2 seven-section combline filters in a 30 series package. The lower channel bandedge is at 3000 MHz and the channels are contiguous passing up to 4500 MHz. All three connectors are SMA female.

Topology vs. Frequency Range

◆ Bandpass Filters

Topology	Page	(GHz)	% BW
Tubular			
B250 Series	39	.20 — 6	4 — 40
B120 Series		.10 — 2.5	
B340 Series		.08 — 1.7	
B110 Series		.06 — 1.0	
Cavity			
C20 Series	50	.03 — .14	.2 — 3.5
C30 Series		.14 — .45	
C40 Series		.45 — 2	
C42 Series		.8 — 2.5	
C45 Series		1 — 3	
C50 Series		2 — 10	.2 — 3
C52 Series		8 — 12	
C60 Series		6 — 30	.1 — .8
C62 Series		21 — 40	.1 — 1.5
Interdigital			
ED10 Series	53	7 — 18	*5 — 50
ED20 Series		4 — 10	
ED30 Series		3 — 8	
ED40 Series		2 — 5	
ED50 Series		.5 — 2	
Combline			
FV10 Series	51	7 — 40	*3 — 18
FV20 Series		4 — 10	
FV30 Series		3 — 8	
FV40 Series		2 — 5	
FV50 Series		.5 — 2	
Microminiature			
IB Series	25	.01 — 3	3 — 70
UB Series	28	.3 — 2.5	5 — 20
Lumped Component			
LB Series	18	.0005 — .2	1 — 200
Miniature Cavity			
MC Series	36	.1 — 6	1 — 70
KeL-Com			
KCB Series	48	.010 — 3	5 — 7
Mini-Max			
MMB Series	46	.2 — 3	3 — 20
Dielectric Resonators			
DR Series	68	.5 — 3	1 — 10
Ceramic			
KeL-fil Series	70	.27 — 3	1 — 30
Waveguide			
WP Series	63	5 — 94	1 — 20
Tunable			
BT Series	85	.03 — 8	1 — 5
Suspended Substrate			
SB Series	77	2 — 18	50 — 100
Combline			
Mini-Pack	61	6 — 18	3 — 10
Surface Mount Cavity	62	2 — 10	3 — 10
Printed			
AB Series	Contact Factory	2 — 18	3 — 65



* Varies with package and frequency.

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◆ Highpass Filters

Topology	Page	Frequency	(GHz)
Microminiature IH Series	30		.01 — 2
Lumped Component LH Series	20		.002 — .25
Suspended Substrate SH Series	78		2 — 18
KeL-Com KCH Series	Contact Factory		.01 — 1.99
Mini-Max MMH Series	Contact Factory		.02 — 3



◆ Lowpass Filters

Topology	Page	Frequency	(GHz)
Microminiature IL Series	33		.01 — 6
Tubular L250 Series L120 Series L340 Series L110 Series	42		.2 — 20 .08 — 3 .10 — 2 .06 — 1
Lumped Component LL Series	22		.0001 — 2.5
Suspended Substrate SL Series	79		2 — 18
KeL-Com KCL Series	Contact Factory		.01— 1.99
Mini-Max MML Series	Contact Factory		.02 — 3



◆ Notch Filters

Topology	Page	Frequency	(GHz)	% BW
Lumped Component LN Series	Contact Factory		.001 — .1	10 — 40
Cavity N Series	Contact Factory		.03 — 10	.5 — 5
Tunable TNF Series	87, 93		.03 — 2	4 — 8
Microminiature IN Series	Contact Factory		.1 — 2	10 — 40



Topology vs. Frequency Range

Duplexers

Frequency Range	Receive	Transmit	Page #
AMPS Full-Band	824 — 849 MHz	869 — 894 MHz	102-104
EGSM Band	880 — 915 MHz	925 — 960 MHz	105-107
800 MHz SMR Band	806 — 821 MHz	851 — 866 MHz	Contact Factory
900 MHz SMR Band	869 — 901 MHz	935 — 940 MHz	Contact Factory
DCS Full-Band	1710 — 1785 MHz	1805 — 1880 MHz	108-110
PCS Full-Band	1850 — 1910 MHz	1930 — 1990 MHz	111-114
UMTS / IMT Full-Band	1920 — 1980 MHz	2110 — 2170 MHz	115-116

Dual Band Duplexers

AMPS Band	824 — 849 MHz	869 — 894 MHz	Contact Factory
PCS Band	1850 — 1910 MHz	1930 — 1990 MHz	117-118
EGSM Band	880 — 915 MHz	869 — 894 MHz	Contact Factory
DCS Band	1710 — 1785 MHz	1805 — 1880 MHz	Contact Factory
DCS Band	1710 — 1785 MHz	1805 — 1880 MHz	Contact Factory
UMTS / IMT Band	1920 — 1980 MHz	2110 — 2170 MHz	Contact Factory

Receive Filters

AMPS Full-Band	824 — 849 MHz	121
EGSM Band	890 — 915 MHz	122
DCS Full-Band	1710 — 1785 MHz	123
PCS Full-Band	1850 — 1910 MHz	124
UMTS / IMT Band	1920 — 1980 MHz	125

Transmit Filters

AMPS Full-Band	869 — 894 MHz	Contact Factory
EGSM Band	925 — 960 MHz	Contact Factory
DCS Full-Band	1805 — 1880 MHz	Contact Factory
PCS Full-Band	1930 — 1990 MHz	126
UMTS / IMT Band	2110 — 2170 MHz	127

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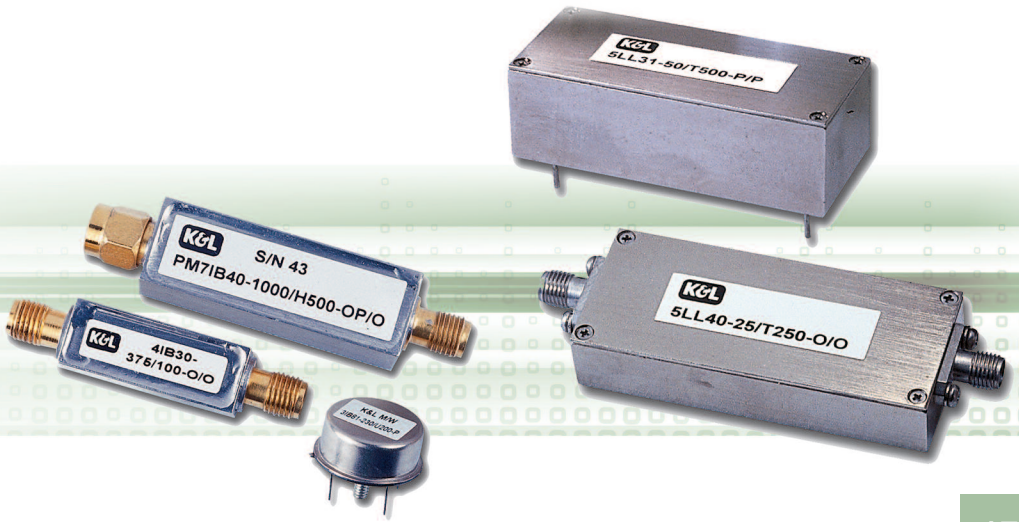
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Lumped Components

K&L Microwave offers Lumped Component filters with a broad selection of frequencies, topologies, and mechanical configurations. Use of standard packages has enabled K&L to provide custom units while keeping design time to a minimum. Packages available include the LB series, which cover the 0.5 to 200 MHz frequency range, as well as the IB series, which cover the 30 to 10,000 MHz frequency range. The topologies are offered in highpass, lowpass, bandpass, bandreject and multiplexer designs.

Special design capabilities include, but are not limited to, elliptical, pseudo-elliptical, amplitude equalization, group delay equalization, bessel, gaussian, and highpower requirements.

Each model can be packaged to withstand severe environmental stresses including temperature, humidity, shock, vibration, and acceleration.



LB Series

Features:

- Covers the 0.5 MHz to 200 MHz Frequency Range
- 3 dB BW Available from 1-200%
- Designs Available in 3-10 Sections
- Low Insertion Loss
- 0.05 dB Chebyshev Response
- Small, Ruggedized Package
- Custom Designs Available



Specifications:

Model	Frequency (MHz)	3 dB % BW	VSWR	Average Power (Watts)	Impedance (Ohms)*	No. of Sections	Shock	Vibration	Temperature	Relative Humidity
LB30	5-150	3-50 / 50-200	1.5:1 / 1.7:1	15	50	3-10	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%
LB40	15-200	3-50 / 50-200	1.5:1 / 1.7:1	10	50	3-10				
LB50	0.5-200	3-50 / 50-200	1.5:1 / 1.7:1	20	50	3-10				

* 75 ohms also available.

Attenuation:

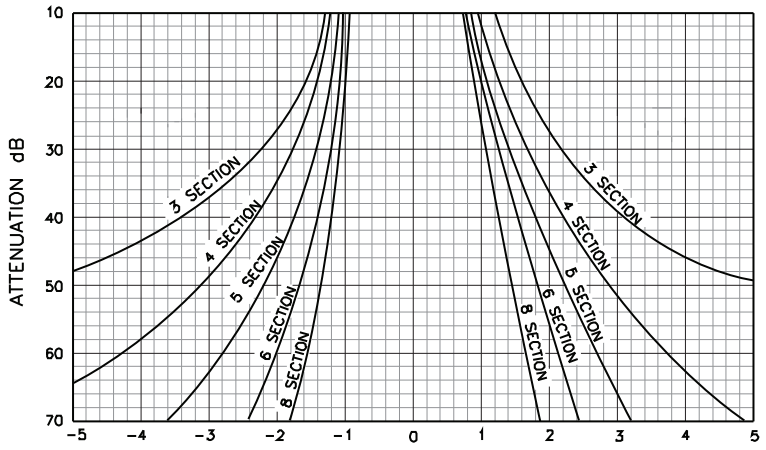
The adjacent curve shows the attenuation as multiples of the bandwidth for filters with 2-8 sections. The following formula is used:
3 dB bandwidths from center frequency=

$$\frac{\text{Reject Frequency - Center Frequency}}{\text{3 dB Bandwidth}}$$

Example:

Center Frequency = 21.4 MHz
3 db Bandwidth = 2
Number of Sections = 6

Find the attenuation at 17.4 and 25.4 MHz by substituting in the formula 3 dB bandwidth from center frequency = $\frac{17.4-21.4}{2}$ = -2 BW's and



3 dB bandwidth from center frequency= $\frac{25.4-21.4}{2}$ = +2 BW's

From the curve, we find the attenuation in dB for a 6-section response -2 bandwidths from center frequency to yield 60 dB, and +2 bandwidths from center frequency to yield 58 dB.

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To Order:

6 L B 30 — 21.4 / U 2 — O / O
1 2 3 4 5 6 7 8 9

Code	Description	Code	Description
1	Number of Sections	5	Center frequency (MHz)
2	Series (L-lumped)	6	Supplemental Codes (See Page 13)
3	B-Bandpass	7	Bandwidth (MHz)
4	Package Designator - Style 3	8	Input Connector
		9	Output Connector

Insertion Loss

The following formula is used to determine the maximum insertion loss at center frequency. For specification purposes, the result is always rounded up to the next tenth of a dB.

$$\text{Insertion Loss} = \left(\frac{(\text{Loss Constant})\ (\text{No. of Sections} + 0.5)}{\%\ 3\ \text{dB BW}}\right) + 0.4$$

Example:
Bandpass Model = 6LB30-30/T3-O/O

$$\text{Insertion Loss} = \left(\frac{(5.5)(6.5)}{10}\right) + 0.4 = 4.0\ \text{dB}$$

Model	Loss Constant
LB30	5.5
LB40	6
LB50	4.75

Connectors:

Connector Style	Connector Code	LH30	LH40	LH50
N Female	N	.75"/19.05mm	*NR	.75"/19.05mm
N Male	NP	*NR	*NR	.79"/20.06mm
BNC Female	B	.72"/18.29mm	*NR	.72"/18.29mm
BNC Male	BP	.88"/22.35mm	*NR	.88"/22.35mm
TNC Female	T	.75"/19.05mm	*NR	.75"/19.05mm
TNC Male	TP	.85"/21.59mm	*NR	.85"/21.59mm
SMA Female	O	.38"/9.65mm	.38"/9.65mm	.38"/9.65mm
SMA Male	OP	.50"/12.7mm	.50"/12.7mm	.50"/12.7mm
Cable	C	6" RG 188	6" RG 188	6" RG 188
PC Mounting	P	See pg. 24	See pg. 24	See pg. 24
Sealectro Female	S	.38"/9.65mm	.38"/9.65mm	.38"/9.65mm
Special	X	Contact Factory	Contact Factory	Contact Factory

*NR = Not Recommended

LH Series

Features:

- Covers the 0.1 MHz to 250 MHz Frequency Range
- Designed for Both Narrowband Low Frequency and Broadband High Frequency Applications
- Low Insertion Loss
- 0.05 dB Chebyshev Response
- Small, Ruggedized Package
- Custom Designs Available



Specifications:

Model	Frequency (MHz)	VSWR	Average Power (Watts)	Impedance (Ohms)*	No. of Sections	Shock	Vibration	Temperature	Relative Humidity
LH30	2-150	1.5:1	15	50	2-10	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%
LH40	10-250	1.5:1	10	50	2-10				
LH50	0.1-10	1.5:1	20	50	2-10				

* 75 ohms also available.

Attenuation:

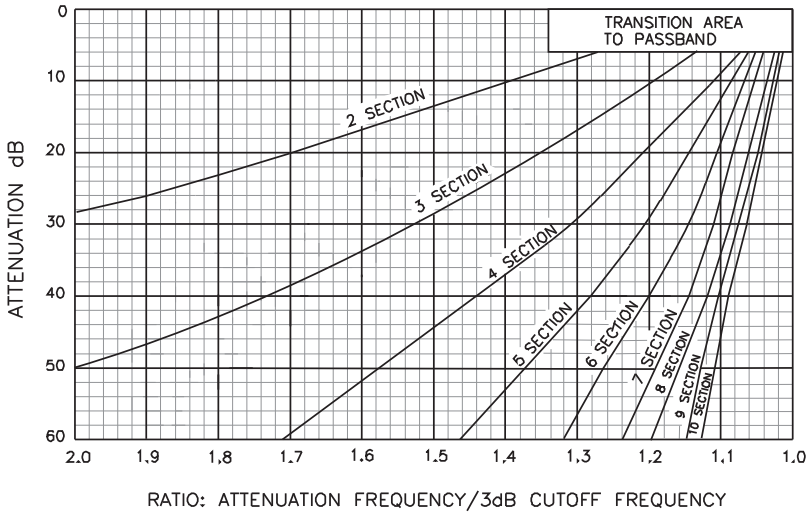
The adjacent curve shows the attenuation as multiples of the 3 dB cutoff frequency. The following formula is used:

$$\frac{\text{3 dB Cut-off Frequency}}{\text{Reject Frequency}}$$

Example:

Model = 5LH30-50/T150-0/0
Reject Frequency = 35 MHz
3 dB Cut-off = 50 MHz
Number of Sections = 5
By Substituting in the formula the multiples of the 3 dB Cut-off = $\frac{50}{35}$ =1.4

From the curve, a 5-section filter response 1.4 multiples away yields 54 dB.



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To Order:

5 L H 30 — 50 / T 150 — O / O
1 2 3 4 5 6 7 8 9

Code	Description
1	Number of Sections
2	Series (L-lumped)
3	H-Highpass
4	Package Designator - Style 3
5	3 dB cut-off frequency (MHz)
6	Supplemental Codes (See Page 13)
7	Upper Passband Frequency (MHz)
8	Input Connector
9	Output Connector

Insertion Loss

The following formula is used to determine the maximum insertion loss at 90% of the 3 dB cut-off frequency. For specification purposes, the result is always rounded up to the next tenth of a dB.

Insertion Loss = (Loss Constant) (No. of Sections + 0.5) + 0.25

Example:
Highpass Model = 5LH30-50/T150-O/O
Insertion Loss = (0.12)(5.5) + 0.25 = 1.0 dB

Model	Loss Constant
LH30	0.12
LH40	0.14
LH50	0.09

Connectors:

Connector Style	Connector Code	LH30	LH40	LH50
N Female	N	.75"/19.05mm	*NR	.75"/19.05mm
N Male	NP	*NR	*NR	.79"/20.06mm
BNC Female	B	.72"/18.29mm	*NR	.72"/18.29mm
BNC Male	BP	.88"/22.35mm	*NR	.88"/22.35mm
TNC Female	T	.75"/19.05mm	*NR	.75"/19.05mm
TNC Male	TP	.85"/21.59mm	*NR	.85"/21.59mm
SMA Female	O	.38"/9.65mm	.38"/9.65mm	.38"/9.65mm
SMA Male	OP	.50"/12.7mm	.50"/12.7mm	.50"/12.7mm
Cable	C	6" RG 188	6" RG 188	6" RG 188
PC Mounting	P	See pg. 24	See pg. 24	See pg. 24
Sealectro Female	S	.38"/9.65mm	.38"/9.65mm	.38"/9.65mm
Special	X	Contact Factory	Contact Factory	Contact Factory

*NR = Not Recommended

LL Series

Features:

- Covers the 0.1 MHz to 2500 MHz Frequency Range
- Designs Available in 2-10 Sections
- Low Insertion Loss
- 0.05 dB Chebyshev Response
- Small, Ruggedized Package
- Custom Designs Available



Specifications:

Model	Frequency (MHz)	VSWR	Average Power (Watts)	Impedance (Ohms)*	No. of Sections	Shock	Vibration	Temperature	Relative Humidity
LL30	2.5-150	1.5:1	15	50	2-10	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%
LL40	10-200	1.5:1	10	50	2-10				
LL50	0.1-10	1.5:1	20	50	2-10				

* 75 ohms also available.

Attenuation:

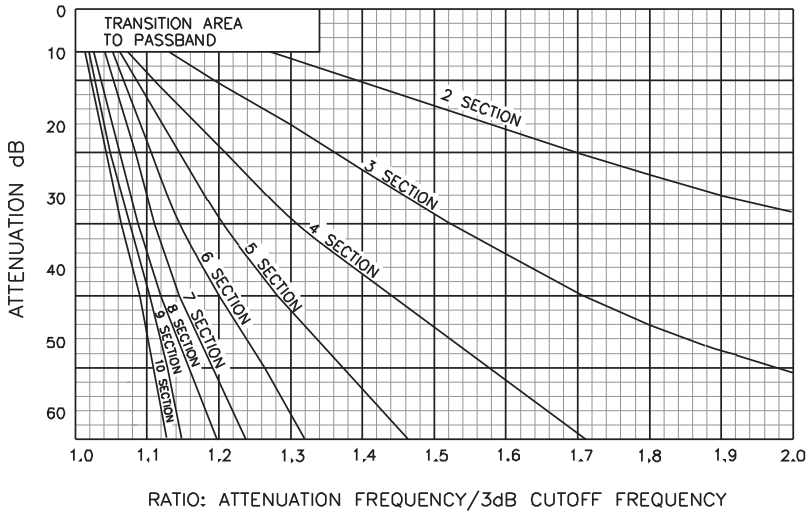
The adjacent curve shows the attenuation as multiples of the 3 dB cutoff frequency. The following formula is used:

$$\frac{\text{Reject Frequency}}{\text{3 dB Cut-off Frequency}}$$

Example:

Model = 5LL31-50/T500-0/0
Reject Frequency = 70 MHz
3 dB Cut-off = 50 MHz
Number of Sections = 5
By Substituting in the formula the multiples of the 3 dB Cut-off = $\frac{70}{50}$ =1.4

From the curve, a 5 section filter response 1.4 multiples away yields 54 dB.



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To Order:

5 L L 30 — 50 / T 500 — O / O
1 2 3 4 5 6 7 8 9

Code	Description	Code	Description
1	Number of Sections	5	3 dB cut-off frequency (MHz)
2	Series (L-lumped)	6	Supplemental Codes (See Page 13)
3	L-Lowpass	7	Upper Passband Frequency (MHz)
4	Package Designator - Style 3	8	Input Connector
		9	Output Connector

Insertion Loss

The following formula is used to determine the maximum insertion loss at 90% of the 3 dB cut-off frequency. For specification purposes, the result is always rounded up to the next tenth of a dB.

Insertion Loss = (Loss Constant) (No. of Sections + 0.5) + 0.25

Example:
Lowpass Model = 5LL30-50/T500-O/O
Insertion Loss = (0.12)(5.5) + 0.25 = 1.0 dB

Model	Loss Constant
LL30	0.12
LL40	0.14
LL50	0.09

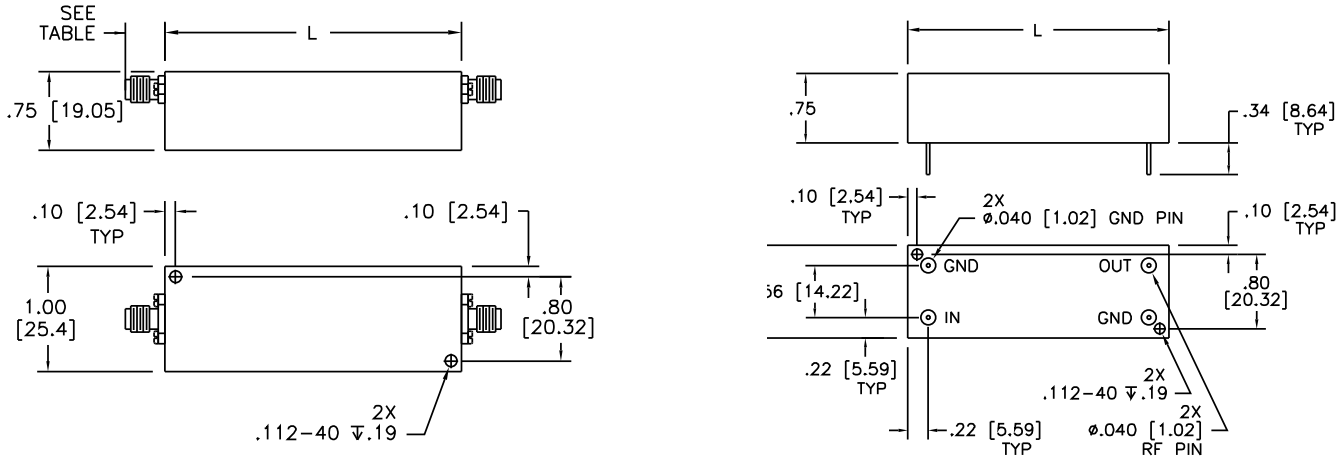
Connectors:

Connector Style	Connector Code	LH30	LH40	LH50
N Female	N	.75"/19.05mm	*NR	.75"/19.05mm
N Male	NP	*NR	*NR	.79"/20.06mm
BNC Female	B	.72"/18.29mm	*NR	.72"/18.29mm
BNC Male	BP	.88"/22.35mm	*NR	.88"/22.35mm
TNC Female	T	.75"/19.05mm	*NR	.75"/19.05mm
TNC Male	TP	.85"/21.59mm	*NR	.85"/21.59mm
SMA Female	O	.38"/9.65mm	.38"/9.65mm	.38"/9.65mm
SMA Male	OP	.50"/12.7mm	.50"/12.7mm	.50"/12.7mm
Cable	C	6" RG 188	6" RG 188	6" RG 188
PC Mounting	P	See pg. 24	See pg. 24	See pg. 24
Sealectro Female	S	.38"/9.65mm	.38"/9.65mm	.38"/9.65mm
Special	X	Contact Factory	Contact Factory	Contact Factory

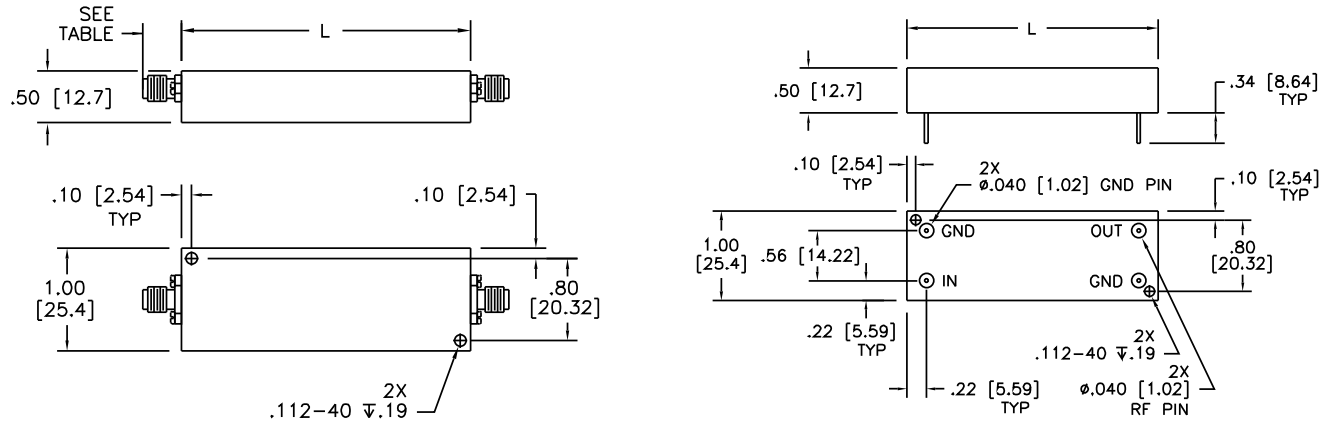
*NR = Not Recommended

LB, LH, LL Series Outlines

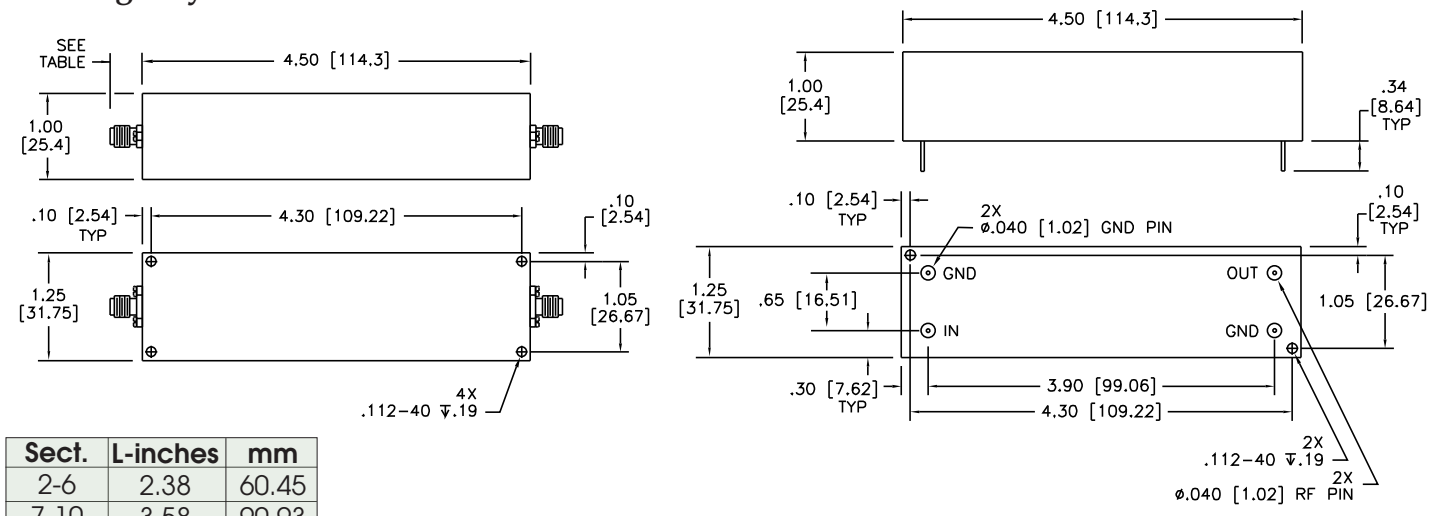
Package Style 3:



Package Style 4:



Package Style 5:



Sect.	L-inches	mm
2-6	2.38	60.45
7-10	3.58	90.93

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Microminiature Bandpass — IB Series

Features:

- Small, Compact Package
- Covers the 30 MHz to 6 GHz Frequency Range
- Standard 3 dB BW Available from 3-15%
- 3 dB BW also Available up to 70% (Contact Factory)
- Designs Available in 3-10 Sections
- 0.05 dB Chebyshev Design
- Ruggedized Package
- Custom Designs Available



Specifications:

Frequency (MHz)	3 dB % BW	VSWR	Average Power (Watts)	Impedance (Ohms)	No. of Sections	Shock	Vibration	Temperature	Relative Humidity
30-6000*	3-70	1.5:1	1	50	2-10	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%

* Certain combinations of frequency and bandwidth are not practical. Contact Factory with your requirements.
All packages can be provided to full MIL-SPEC environmental requirements.

Insertion Loss:

The insertion loss at the center frequency of the filter is determined by the equation:

$$\text{Loss} = \left(\frac{(\text{Loss Constant})\ (\text{No. of Sections} + 0.5)}{\%\ 3\ \text{dB BW}} \right) + 0.3$$

Where the loss constant is frequency dependent and may be found from the table to the side.

Example:
At 500 MHz, 5 sections, 60 MHz BW

$$\text{Loss} = \left(\frac{(4.4)(5.5)}{12} \right) + 0.3 = 2.3\ \text{dB}$$

Loss Constant:

Center Frequency (MHz)	Constant
30-159	8.8
160-199	7.8
200-299	6.8
300-399	5.7
400-499	4.9
500-599	4.4
600-699	4.0
700-799	3.7
800-899	3.5
900-999	3.25
1000-6000	3.0

Microminiature Bandpass — IB Series

Attenuation:

These curves show the attenuation normalized to the 3 dB bandwidth for filters with 2-8 sections. The following formula is used: 3 dB bandwidths from center frequency =

$$\frac{\text{Reject Frequency - Center Frequency}}{\text{3 dB BW}}$$

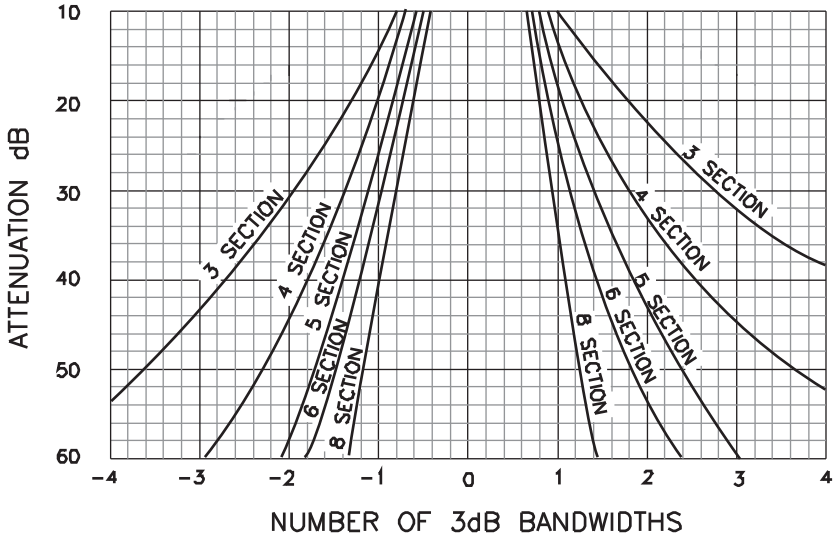
Example:

Center Frequency = 500 MHz
3 dB Bandwidth = 60 MHz
Number of Sections = 5

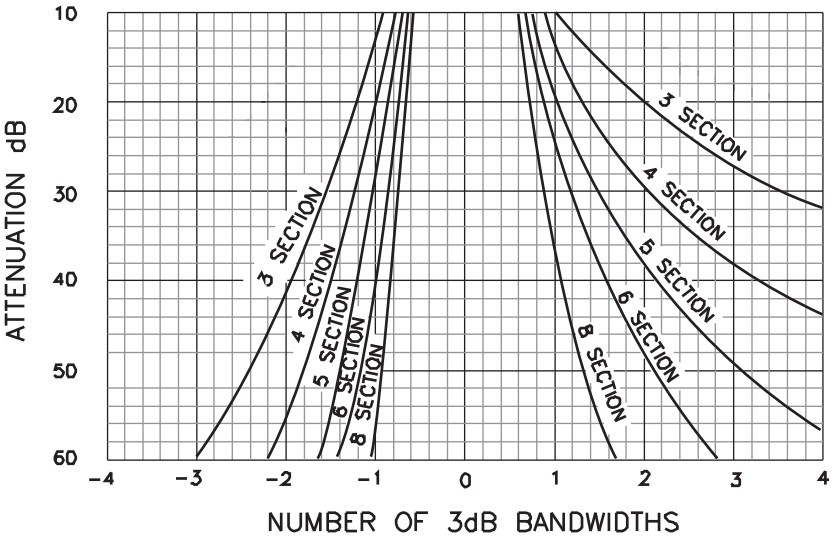
Find the attenuation at 400 and 600 MHz by substituting in the formula 3 dB bandwidths from center frequency = $\frac{400-500}{60}$ = -1.67 BW's
and 3 dB bandwidths from center frequency = $\frac{600-500}{60}$ = +1.67 BW's

From the 7 to 15 % curve we find the attenuation in dB for a 5-section response -1.67 BW's from center frequency yields 60 dB, and +1.67 BW's from center frequency yields 34 dB.

For Bandwidths 3 to 7%



For Bandwidths 7 to 15%



To Order:

5	I	B	30	—	500	/	T	60-	P	/	P
1	2	3	4		5		6	7	8		9

Code	Description
1	Number of Sections
2	Series (I - Microminiature)
3	B - Bandpass
4	Package Designator - Style 3
5	Center Frequency (MHz)
6	Supplemental Codes (See Page 13)
7	Bandwidth (MHz)
8	Input Connector
9	Output Connector

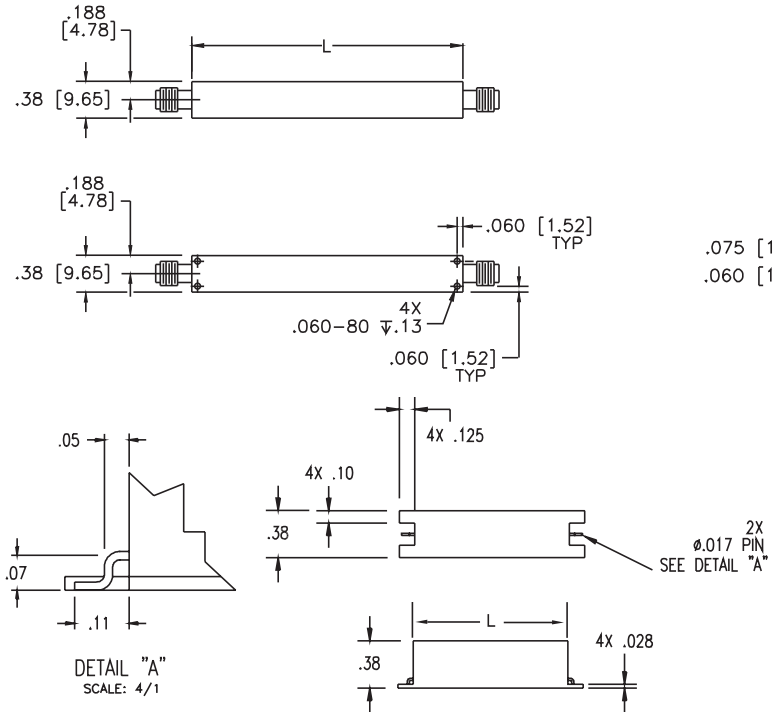
Connectors:

Connector	Code
SMA Female	O
SMA Male	OP
PC Pins	P

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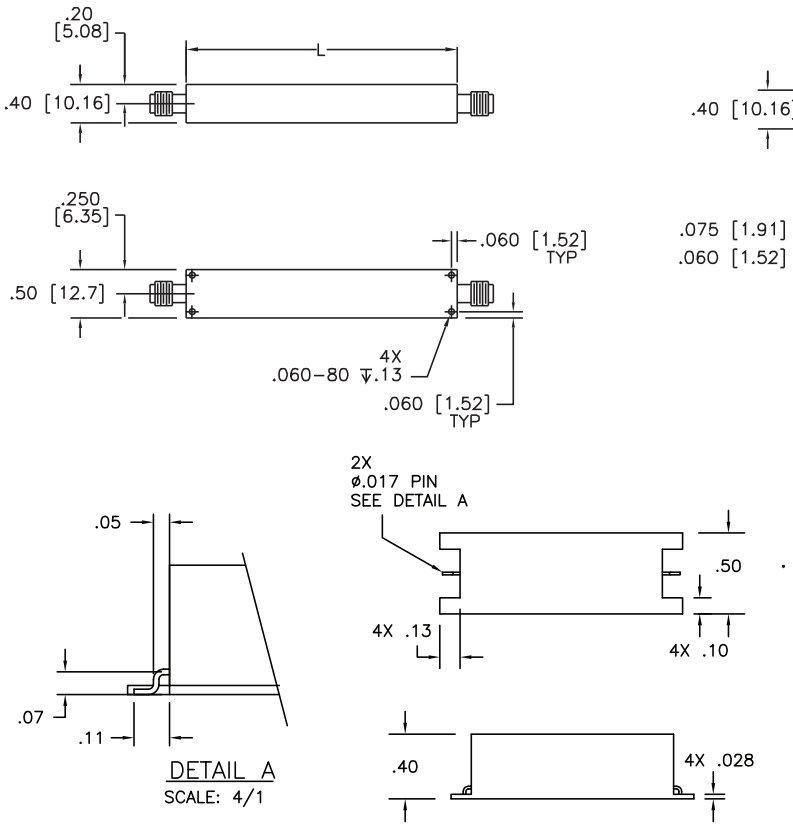
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Salisbury, MD 21801

Package Style 3:



Section	L-Inches	L-mm
2-3	.75	19.05
4-5	1.0	25.40
6-7	1.50	38.10
8-9	1.75	44.45
10	2.0	50.80

Package Style 4:

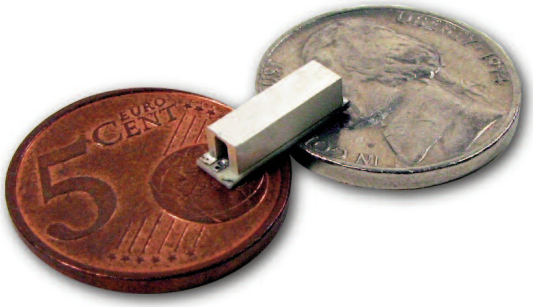


Section	L-Inches	L-mm
2-3	.75	19.05
4-5	1.0	25.40
6-7	1.50	38.10
8-9	1.75	44.45
10	2.0	50.80

Ultra-Miniature — UB Series

Features:

- Extremely small size
- Bandpass, Lowpass Options
- Highpass and Band Stop Options to be added
- Surface mount configuration



Specifications:

- Frequency Range 300 to 2500 MHz
- 5 to 15% Bandwidth for f_0 < 1000 MHz
- 10 to 20% Bandwidth for f_0 ≥ 1000 MHz
- 2 to 5 Resonant Sections
- Power Handling 1 Watt CW
- Typical Size 0.45"L x 0.25"W x 0.14"H Surface Mount for 2 and 3 Sections
- Typical Size 0.65"L x 0.25"W x 0.14"H Surface Mount for 4 and 5 Section

To Order:

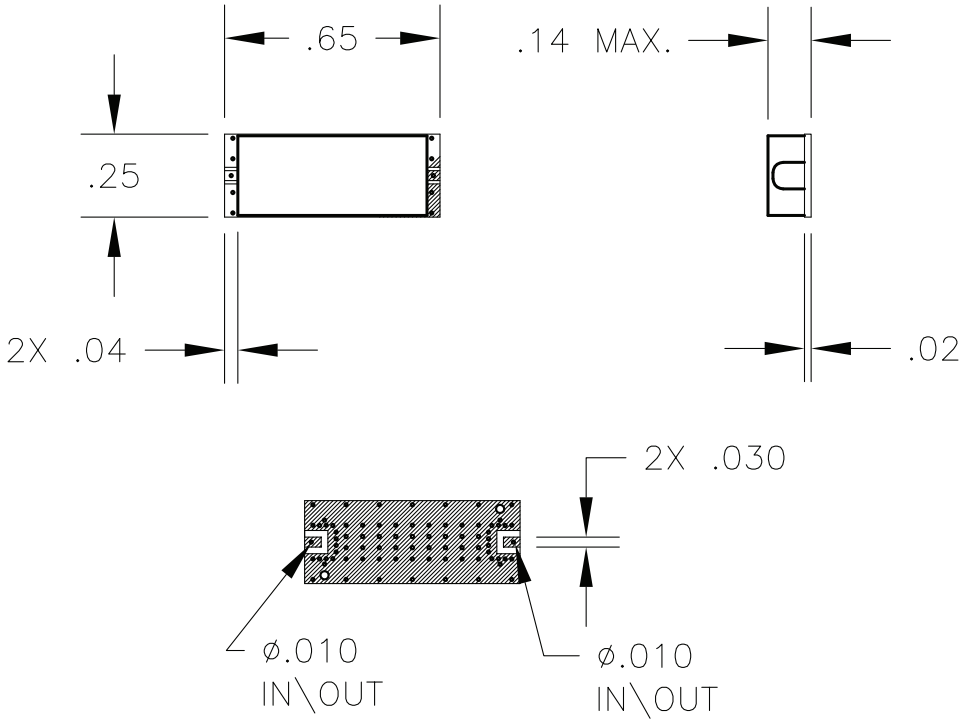
5 UB 20-310 / T 30 - SM/SM
1 2 3 4 5 6 7

Code	Description
1	Number of Resonant Sections
2	Ultra-Miniature Bandpass Filter (UL for Lowpass, UH for Highpass, UN for Band Stop)
3	Package Designator
4	Center Frequency (MHz)
5	Supplemental Codes (See Page 13)
6	Bandwidth (MHz)
7	Input/Output Connector, Currently only Surface Mount Available

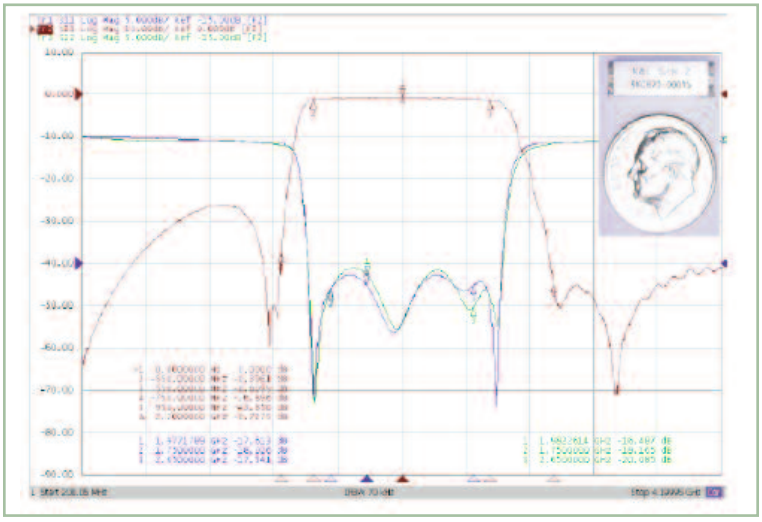
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Outline Drawings:



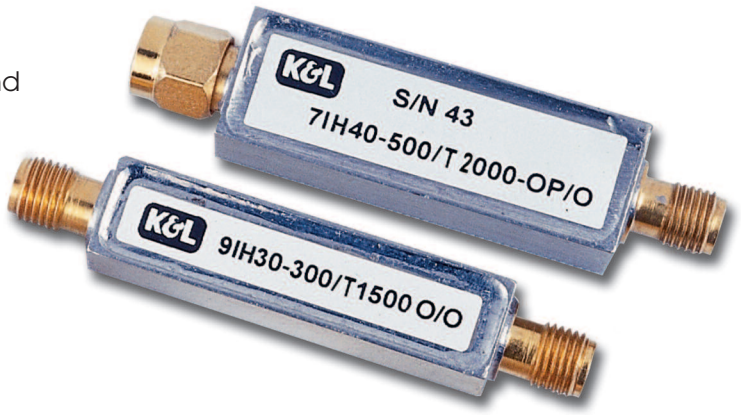
Sample Performance Data:



Microminiature Highpass — IH Series

Features:

- Covers the 30 MHz to 2 GHz Frequency Range
- Designed for Both Narrowband Low Frequency and Broadband High Frequency Applications
- 0.05 dB Chebyshev Design
- Ruggedized Package
- Custom Designs Available



Specifications:

Cutoff Frequency (MHz)	VSWR	Average Power (Watts)	Impedance (Ohms)	No. of Sections	Shock	Vibration	Temperature	Relative Humidity
30-2000	1.5:1 *Typ.	1	50	2-10	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%

* To Upper Passband Frequency

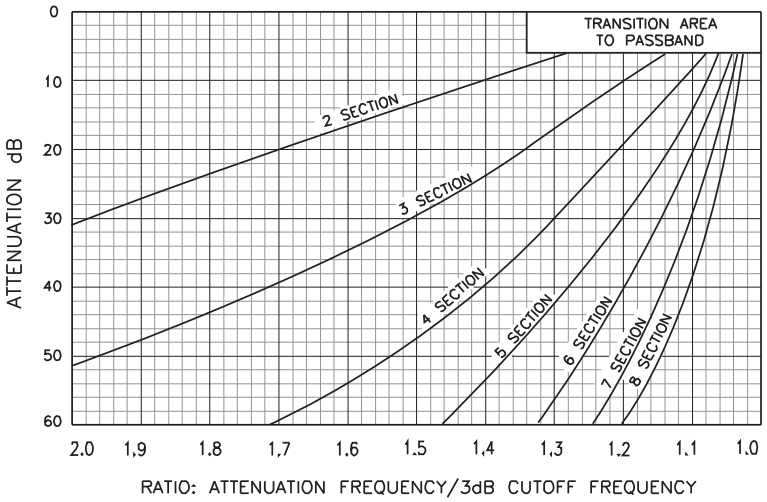
Attenuation:

This curve defines the out-of-band attenuation, in dB, for K&L standard highpass filters. The ratio is determined by dividing the out-of-band frequency by the 3 dB frequency. Once the ratio is determined, the attenuation versus the number of sections can be read directly from the curve.

Example:

Reject Frequency = 925 MHz
3 dB cut-off frequency = 1250 MHz
Number of Sections = 5
The ratio equals = $\frac{\text{3 dB cut-off frequency}}{\text{Reject Frequency}} = \frac{1250}{925}$
Ratio = 1.35

From the curve, a 5 section filter response equals 47 dB.



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Insertion Loss:

The insertion loss specification at 110% of the 3 dB cut-off frequency is determined by the formula:

Loss = (Loss Constant) x (Number of Sections)

For specification purposes, the result is always rounded up to the next tenth of a dB.

Example:
Highpass Model = 5IH30-1250/T3750-O/O
Insertion Loss = (0.10)(5) = 0.5 dB

Loss Constant:

Center Frequency (MHz)	Constant
10-499	0.25
500-999	0.15
1000-2000	0.10

To Order:

5 I H 30 — 1250 / T 3750- O / O
1 2 3 4 5 6 7 8 9

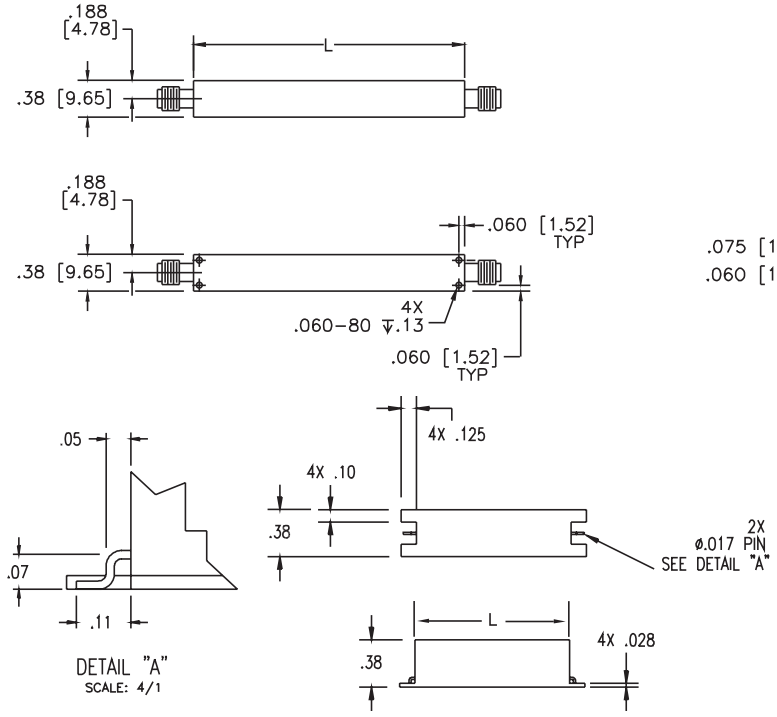
Code	Description
1	Number of Sections
2	Series (I - Microminiature)
3	H-Highpass
4	Package Designator - Style 3
5	Cut-off Frequency (MHz)
6	Supplemental Codes (See Page 13)
7	Upper Passband Frequency (MHz)
8	Input Connector
9	Output Connector

Connectors:

Connector	Code
SMA Female	O
SMA Male	OP
PC Pins	P

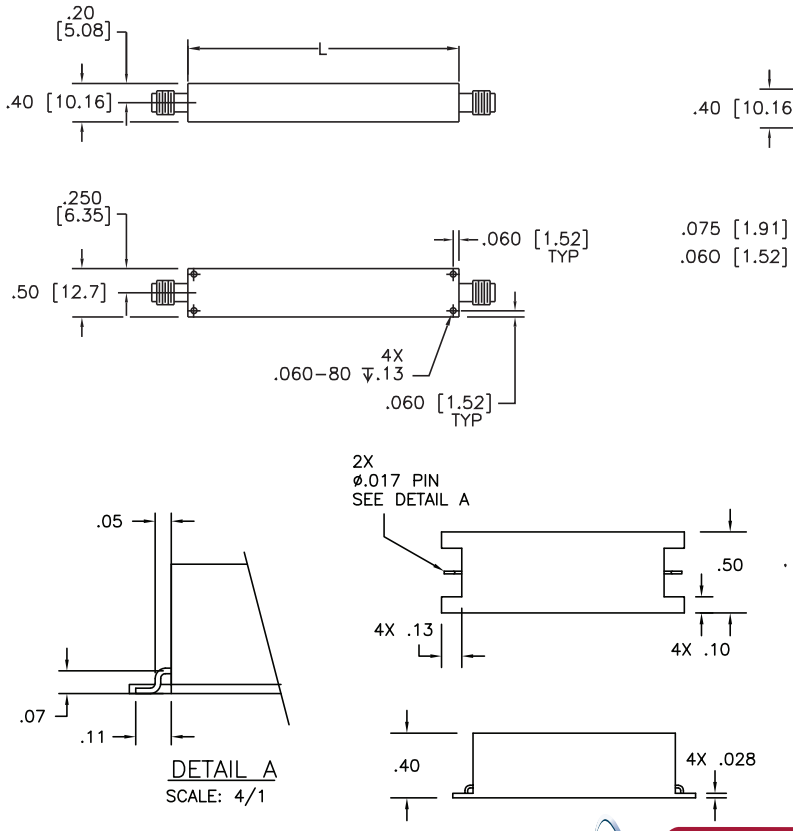
Microminiature Highpass — IH Series

Package Style 3:



Section	L-Inches	L-mm
2-3	.75	19.05
4-5	1.0	25.40
6-7	1.50	38.10
8-9	1.75	44.45
10	2.0	50.80

Package Style 4:



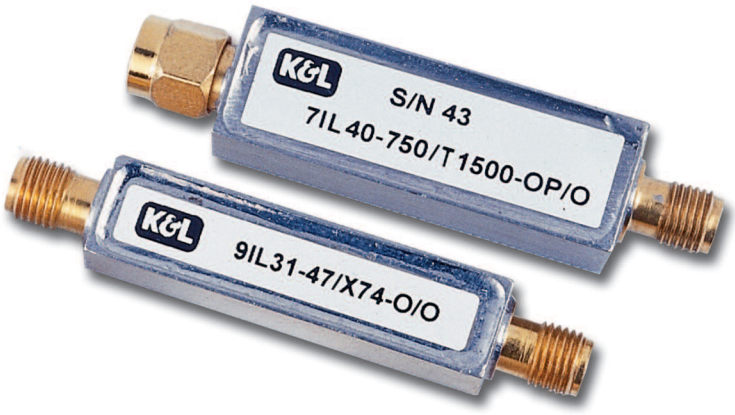
Section	L-Inches	L-mm
2-3	.75	19.05
4-5	1.0	25.40
6-7	1.50	38.10
8-9	1.75	44.45
10	2.0	50.80

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Features:

- Small, Compact Package
- Covers the 10 MHz to 6 GHz Frequency Range
- Designs Available in 2-10 sections
- 0.05 dB Chebyshev Design Response
- Ruggedized Package Design
- Custom Package Designs Available



Specifications:

Frequency (MHz)	VSWR	Average Power (Watts)	Impedance (Ohms)	No. of Sections	Shock	Vibration	Temperature	Relative Humidity
10-6000	1.5:1	1	50	2-10	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%

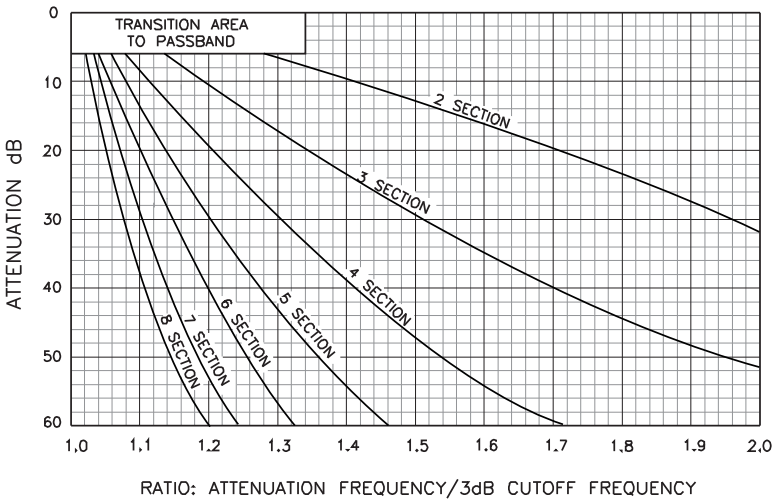
Attenuation:

This curve defines the out-of-band attenuation, in dB, for K&L standard lowpass filters. The ratio is determined by dividing the out-of-band frequency by the 3 dB frequency. Once the ratio is determined, the attenuation versus the number of sections can be read directly from the curve.

Example:

Reject Frequency = 3000 MHz
3 dB cut-off frequency = 2250 MHz
Number of Sections = 5
The ratio equals = $\frac{\text{Reject Frequency}}{\text{3 dB cut-off frequency}} = \frac{3000}{2250}$
Ratio = 1.33

From the curve, a 5 section filter response equals 47 dB.



Microminiature Lowpass — IL Series

Insertion Loss:

The insertion loss specification at 90% of the 3 dB cut-off frequency is determined by the formula:

Loss = (Loss Constant) x (Number of Sections)

For specification purposes, the result is always rounded up to the next tenth of a dB.

Example:
Lowpass Model = 5IL31-2250/T3000-O/O
Insertion Loss = (0.10)(5) = 0.5 dB

Loss Constant:

Center Frequency (MHz)	Constant
10-499	0.25
500-999	0.15
1000-6000	0.10

To Order:

5 I L 30 — 2250 / T 3000- O / O
1 2 3 4 5 6 7 8 9

Code	Description
1	Number of Sections
2	Series (I - Microminiature)
3	L-Lowpass
4	Package Designator - Style 3
5	Cut-off Frequency (MHz)
6	Supplemental Codes (See Page 13)
7	Upper Frequency Stopband Limit
8	Input Connector
9	Output Connector

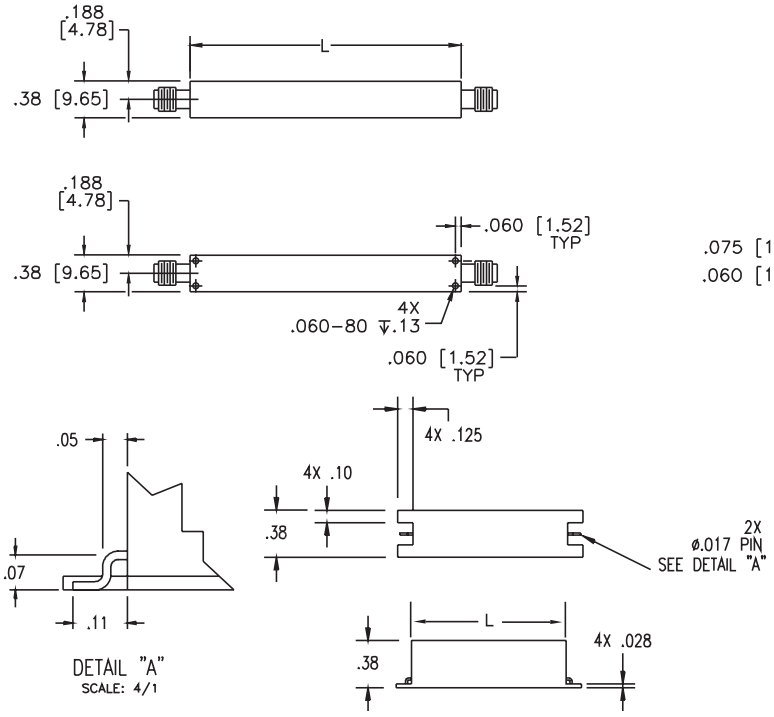
Connectors:

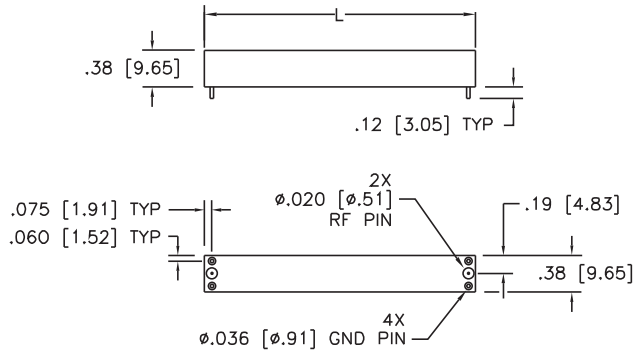
Connector	Code
SMA Female	O
SMA Male	OP
PC Pins	P

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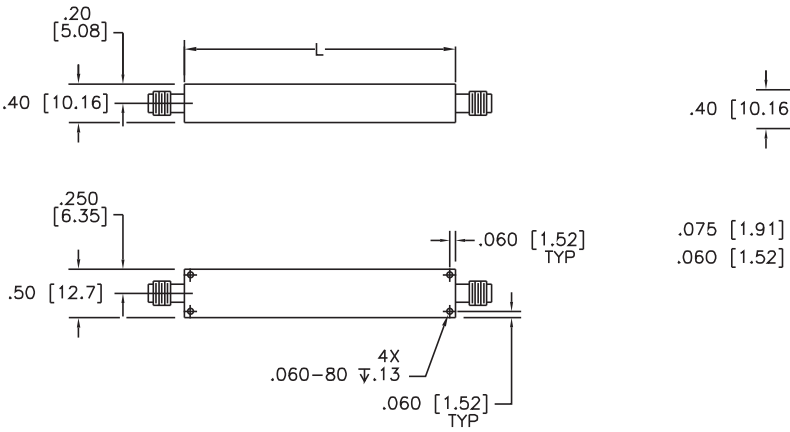
Package Style 3:

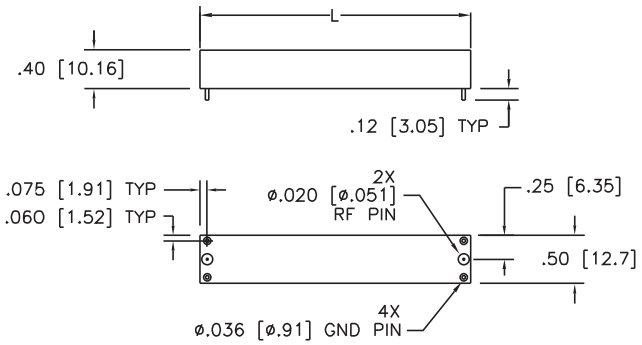


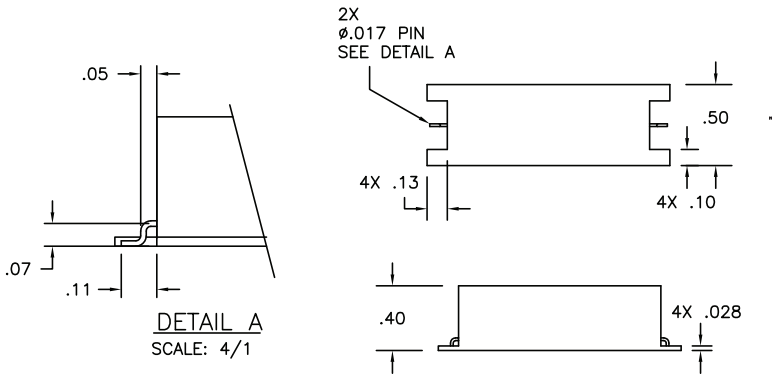


Section	L-Inches	L-mm
2-3	.75	19.05
4-5	1.0	25.40
6-7	1.50	38.10
8-9	1.75	44.45
10	2.0	50.80

Package Style 4:





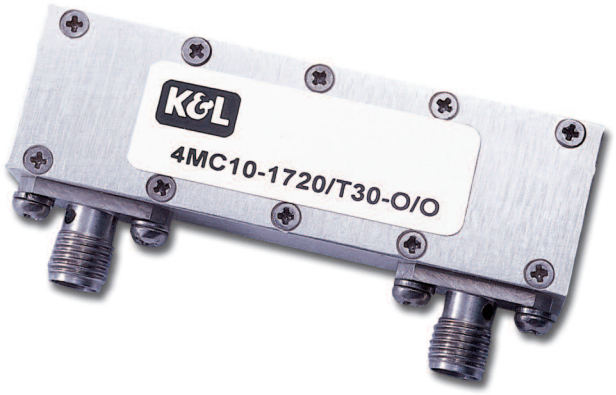


Section	L-Inches	L-mm
2-3	.75	19.05
4-5	1.0	25.40
6-7	1.50	38.10
8-9	1.75	44.45
10	2.0	50.80

Low Frequency, Narrow Bandwidth — MC Series

Features:

- Miniature Package Design Yielding State of the Art Performance
- Ruggedized Package to Withstand Severe Environmental Stress
- Covers the 160 to 3000 MHz Frequency Range
- 0.05 dB Chebyshev Design
- Custom Designs Available



Specifications:

Frequency (MHz)	3 dB % BW	VSWR	Average Power (Watts)	Impedance (Ohms)	No. of Sections	Shock	Vibration	Temperature	Relative Humidity
160-3000	1-15 15-70*	1.5:1	2	50	3-8	30 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%

* Bandwidth may be extended above 15% to 70% through the use of Microminiature Topology.

Insertion Loss:

The following formula is used to determine the insertion loss at the center frequency:

$$\text{Insertion Loss} = \left(\frac{(\text{Loss Constant})(\text{Number of Sections} + 0.5)}{\%\ 3\ \text{dB BW}}\right) + 0.5$$

Example:
Center Frequency = 500 MHz
3 dB Bandwidth = 10 MHz
Number of Sections = 6

Loss Constant from the Table = 2.0

$$\text{Insertion Loss} = \left(\frac{(2.0)(6.5)}{2}\right) + 0.5 = 7.0\ \text{dB}$$

Loss Constant:

Center Frequency (MHz)	Constant
160-200	3.0
201-400	2.5
401-3000	2.0

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Attenuation:

This series of curves is used to determine the out-of-band or stopband attenuation for K&L's miniature cavity filters. These curves show the attenuation as multiples of the 3 dB bandwidth for filters with 2-8 sections. The formula for stopband attenuation:

$$\text{3 dB BW from } f_0 = \frac{\text{Reject Frequency - Center Frequency}}{\text{3 dB BW}}$$

Example:

Center Frequency = 500 MHz
3 dB Bandwidth = 10 MHz
Number of Sections = 6

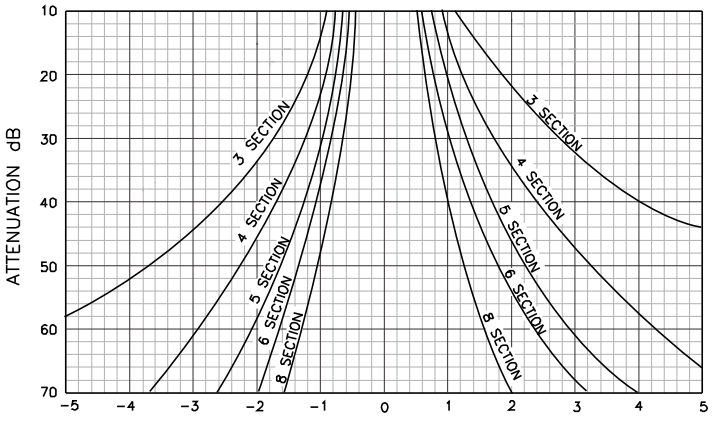
Find the attenuation at 480 MHz and 520 MHz by substituting in the formula:

$$\text{3 dB BW from } f_0 = \frac{520-500}{10} = +2$$

$$\text{3 dB BW from } f_0 = \frac{480-500}{10} = -2$$

Referring to the attenuation curves, we find the attenuation in dB for a 6-section response +2 bandwidths from f_0 to yield 54 dB and -2 bandwidths from f_0 to yield 70 dB.

For Bandwidths 1 to 15%



To Order:

5	MC	10	—	2250	/	H	50-	O	/	O	-	ALT
1	2	3		4		5	6	7		8		9

Code	Description
1	Number of Sections
2	Series
3	Design type note: Enter "10" in all cases, factory will verify and change if necessary.
4	Center Frequency (MHz)
5	Supplemental Codes (See Page 13)
6	Bandwidth (MHz)
7	Input Connector
8	Output Connector
9	Alternate Configuration

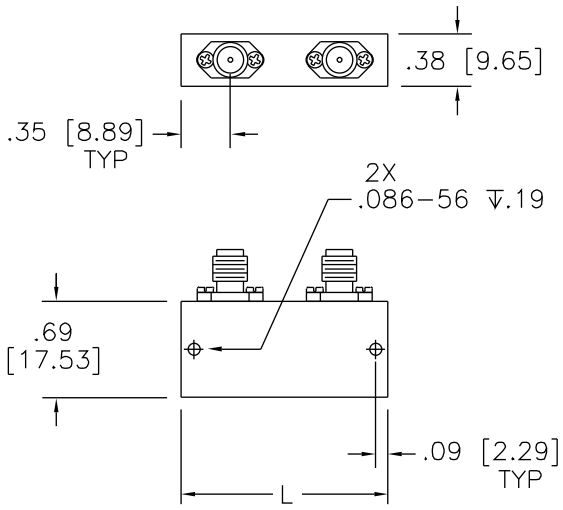
Connectors:

Connector	Code
SMA Female	O
SMA Male	OP
Cables, 6" RG 188	C
RF Pins	P

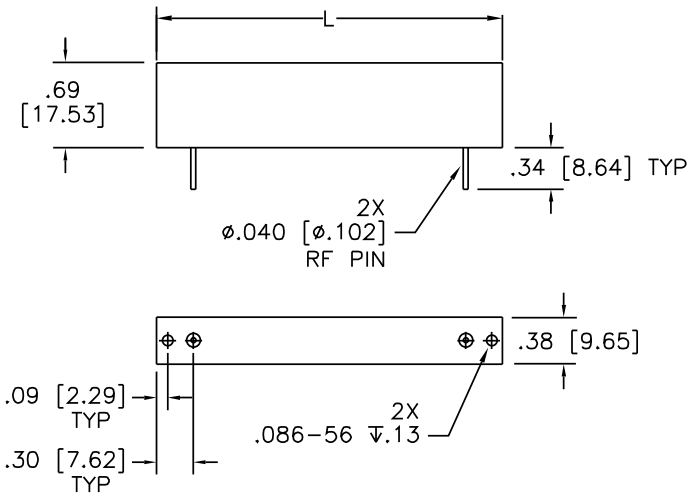
Most connector types can be supplied on cable: Contact factory

Low Frequency, Narrow Bandwidth — MC Series

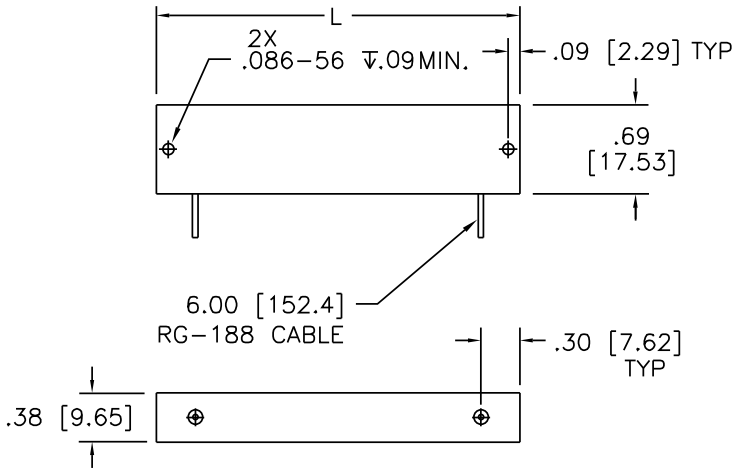
SMA Female Connectors:



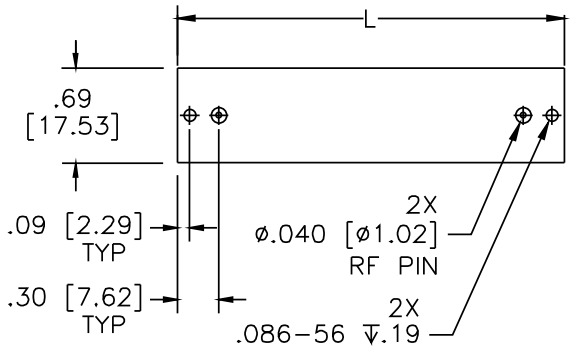
PCB Application:



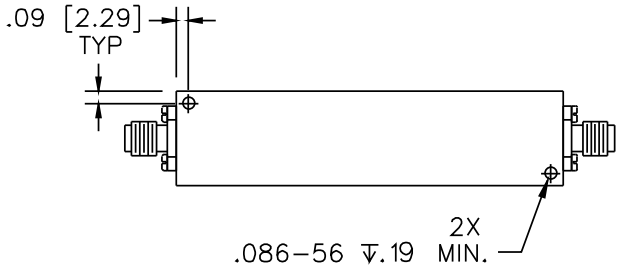
RG - 188 Cable:



Alternate Pin Location:



Alternate Connector Location:



Approx. Length (L) vs. Number of Sections (N)							
N	2	3	4	5	6	7	8
L	1.75/44.45	2.0/50.8	2.25/57.15	2.5/63.5	2.75/69.85	3.0/76.2	3.25/82.55

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Tubular Bandpass Filters — B Series

Features:

- Economical Design Yields High Performance Results
- 100 MHz to 6000 MHz Frequency Range*
- 3 dB BW; 4-40%
- Design Available in 3-8 Sections
- 0.05 dB Chebychev Design Response
- Ruggedized Package Designs



Specifications:

Model	Diameter (Inches/mm)	Frequency (MHz)	3 dB % BW	VSWR	Average Power (Watts)	Impedance (Ohms)	No. of Sections	Shock	Vibration	Temp.	Relative Humidity
B250	.25/6.35	1000-6000	4-40	1.5:1	2	50	3-8	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%
B120**	.50/12.7	100-2500	4-40	1.5:1	18						
B340	.75/19.05	100-1000	4-40	1.5:1	40						
B110	1.25/31.7	70-600*	4-40	1.5:1	200						

** Model B120 fits most applications and is the most cost effective choice.

Attenuation:

The following curves are used in determining the out-of-band attenuation. The curves show minimum stopband in dB as multiples of the 3 dB bandwidth.

To determine which series of curves to use, first calculate the percentage 3 dB bandwidth from the following formula:

$$\% \text{ BW} = \left(\frac{\text{3 dB BW}}{\text{Center Frequency}} \right) \times 100$$

To determine the number of bandwidths (3 dB) from center frequency, use the following formula:

$$\text{No. \% BW} = \frac{\text{Reject Frequency-Center Frequency}}{\text{3 dB BW}}$$

Example:

Center Frequency = 300 MHz
3 db Bandwidth = 50 MHz
Number of Sections = 6

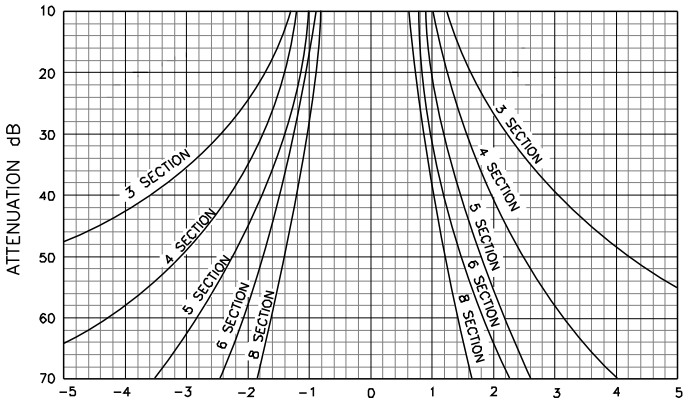
Determine attenuation at 200 MHz and 400 MHz:

1. Calculate % BW = $\frac{50 \times 100}{300}$ = 17%
2. -3 dB BW = $\frac{200-300}{50}$ = -2 BW's
3. +3 dB BW = $\frac{400-300}{50}$ = +2 BW's

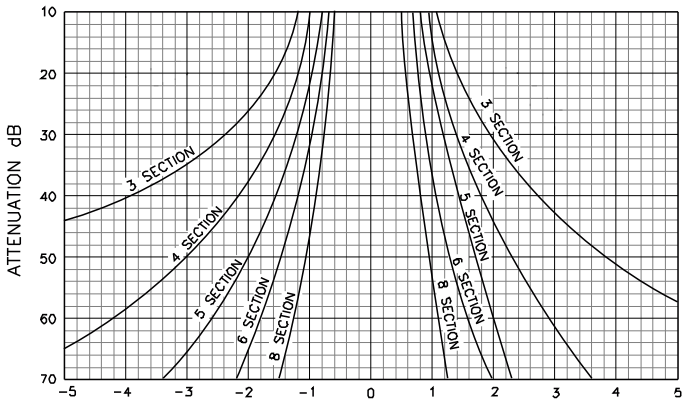
Referring to the curve for a 15%-30% bandwidth, a 6 section response -2 BW yields 64 dB, and +2 BW yields greater than 70 dB.

Tubular Bandpass Filters — B Series

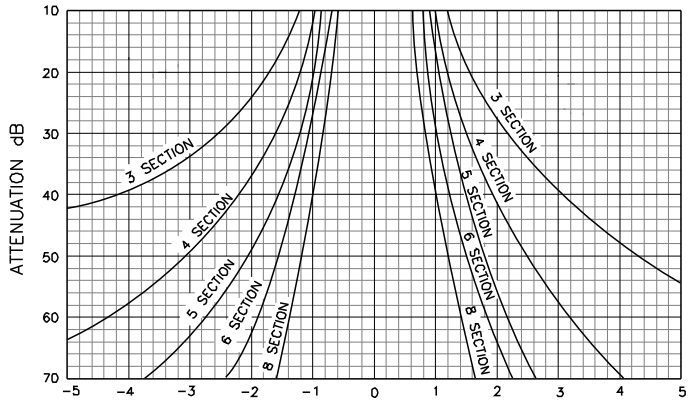
For Bandwidths 4 to 5%



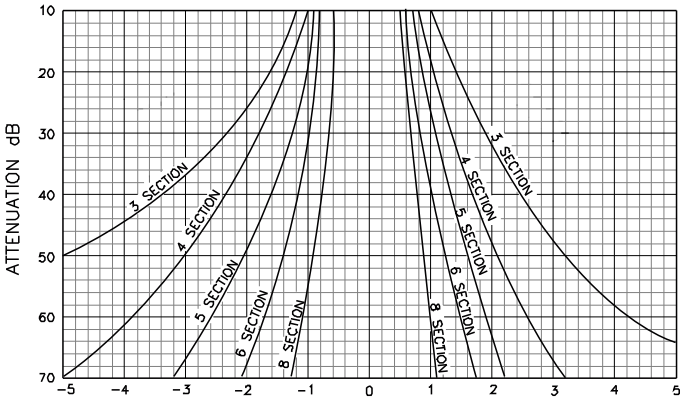
For Bandwidths 15 to 30%



For Bandwidths 5 to 15%



For Bandwidths 30 to 40%



Mechanical/Connectors- See page 44.

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Insertion Loss:

The maximum insertion loss at center frequency can be determined by using the following formula:

$$\text{Insertion Loss at Center Frequency} = \left(\frac{(\text{Loss Constant})\ (\text{No. of Sections} + 1/2)}{\%\ 3\ \text{dB BW}}\right) + 0.2$$

Example:

Filter Model = B120
Center Frequency = 500 MHz
3 dB Bandwidth = 80 MHz
Number of Sections = 5

Determine the insertion loss at center frequency:
From the table, the loss constant is shown to be 2.0.

$$\%\ 3\ \text{dB BW} = \frac{(3\ \text{dB BW})\ (100)}{\text{Center Frequency}} = \frac{80 \times 100}{5000} = 16\%$$

By substituting in the formula we find the insertion loss =

$$\left(\frac{(2)\ (5+1/2)}{16}\right) + 0.2 = 0.9\ \text{dB}$$

Loss Constant vs. Frequency vs. Model:

Model	Center Frequency (MHz)						
	100	101 200	201 400	401 1000	1001 2000	2001 4000	4001 6000
B250					3.5	3.0	2.5
B120		3.0	2.5	2.0	1.8	1.6	
B340	2.2	2.0	1.6	1.4	1.2		
B110	1.8	1.6	1.3	1.2			

To Order:

5 B 120 — 500 / T 80 — O / O
1 2 3 4 5 6 7 8

Code	Description
1	Number of Sections
2	B- Bandpass
3	Model 250-.25"- 6.35mm 120-.50" - 12.7mm 340-.75" - 19.05mm 110-1.25" - 25.4mm
4	Center Frequency (MHz)
5	Supplemental Codes (See Page 13)
6	Bandwidth (MHz)
7	Input Connector
8	Output Connector

Tubular Lowpass Filters — L Series

Features:

- Economical Design Yields High Performance Results
- Covers the 100 MHz to 20000 MHz Frequency Range
- Design Available in 2-8 Sections
- 0.05 dB Chebychev Design Response
- Ruggedized Package Design



Specifications:

Model	Diameter (Inches/mm)	Frequency (MHz)	VSWR	Average Power (Watts)	Impedance (Ohms)	No. of Sections	Shock	Vibration	Temp.	Relative Humidity
L250	.25/6.35	400-20000	1.5:1	2	50	2-8	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%
L120**	.50/12.7	100-3000	1.5:1	18						
L340	.75/19.05	100-2000	1.5:1	40						
L110	1.25/31.7	100-1000*	1.5:1	200						

** Model L120 fits most applications and is the most cost effective choice.

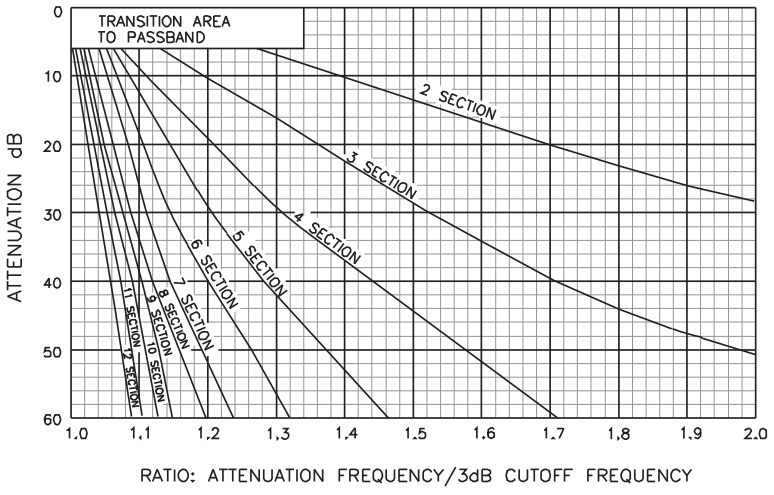
Attenuation:

The following curves are used in determining the out-of-band attenuation. This is determined by first finding the ratio of attenuation frequency / 3 dB cut-off frequency. Once the ratio is determined, the attenuation versus number of sections can be read directly from the curve.

Example:

Reject Frequency = 200 MHz
3 dB Cut-off Frequency = 125 MHz
Number of Sections = 4
The Ratio of Attenuation Freq./3 dB Cut-off Freq. =
Reject Frequency = 200
3 dB Cut-off Freq. 125

Ratio = 1.6
From the curve, a 4 section response = 52 dB



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Insertion Loss:

The insertion loss specification at 90% of the 3 dB cut-off frequency can be determined by using the following formula:

Insertion Loss = (Loss Constant x No. of Sections)

The result is always rounded up to the next 1/10th of a dB.

Example:
Part Number = 5L121-2250/T3000-O/O
Insertion Loss = 0.10 x 5 =0.5 dB

Loss Constant vs. Frequency vs. Model

	Frequency (MHz)					
Model	100	101 400	401 1000	1001 2000	2001 4000	4001 20000
L250			.25	.20	.18	.1
L120	.18	.16	.13	.11	.1	
L340	.14	.13	.12	.11		
L110	.09	.08	.07			

Mechanical/Connectors- See page 44.

To Order:

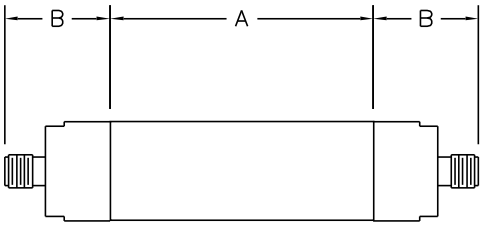
5 L 120 — 350 / E 3000 — O / OP
1 2 3 4 5 6 7 8

Code	Description
1	Number of Sections
2	L-Lowpass
3	Model 250-.25″- 6.35mm 120-.50″ - 12.7mm 340-.75″ - 19.05mm 110-1.25″ - 25.4mm
4	Cut-off Frequency (MHz)
5	Supplemental Codes (See Page 13)
6	Upper Frequency Stopband Limit (MHz)
7	Input Connector
8	Output Connector

Tubular Mechanical

The length of a tubular filter is determined by adding the "A" and "B" dimensions. The "B" dimension is obtained from the table below, and the " A" dimension is obtained from the Length vs. Frequency tables on the following page.

Example:
A 3-section bandpass filter Model B120 with a center frequency of 300 MHz and with SMA connectors has an "A" dimension of 2 inches and a "B" dimension of 0.8 inches. The total length is 3.6 inches.



Connector Style	Connector Code	"B" Dimension (Inches)			
		.25 Diameter	.50 Diameter	.75 Diameter	1.25 Diameter
"N" Female	N	NR*	1.28	1.4	1.7
"N" Male	NP	NR*	1.23	1.31	1.65
BNC Female	B	NR*	1.0	1.35	1.42
BNC Male	BP	NR*	.93	1.45	1.35
TNC Female	T	NR*	1.0	1.35	1.42
TNC Male	TP	NR*	.93	1.45	1.35
SMA Female (Standard)	O	.6	.8	.8	.8
SMA Female (Right Angle)	DO	NR*	.6	.6	.6
SMA Female (Right Angle Square)	EO	.55	.65	.65	.65
SMA Male (Standard)	OP	.73	.85	.85	.85
SMA Male (Right Angle)	DP	NR*	.6	.6	.6
SMA Male (Right Angle Square)	EP	.55	.65	.65	.65

NR*- Not recommended
For PC mount, contact factory
Standard connector dimensions are in inches, please use 25.4 to convert to metric.

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Approximate* Dimension "A" (Inches) - Length vs. Frequency

B250

No. of Sections	Frequency (MHz)			
	400-1000	1000-3000	3000-4000	4000-6000
2	.90	.80	.70	.50
3	1.40	1.20	1.00	.70
4	1.90	1.70	1.30	.90
5	2.40	2.10	1.60	1.10
6	2.90	2.5	1.90	1.30
7	3.40	2.90	2.20	1.60
8	3.90	3.30	2.50	1.90

B120

No. of Sections	Frequency (MHz)				
	100-130	130-180	180-350	350-700	700-2500
2	2.00	1.60	1.30	1.10	.90
3	3.15	2.60	2.00	1.65	1.40
4	4.30	3.60	2.70	2.20	1.95
5	5.45	4.55	3.40	2.70	2.45
6	6.60	5.55	4.10	3.25	3.00
7	7.75	6.55	4.80	3.80	3.50
8	8.90	7.55	5.50	4.35	4.00
9	-	8.55	6.20	4.90	4.55
10	-	9.50	6.90	5.40	5.00

B340

No. of Sections	Frequency (MHz)			
	100-140	140-230	230-500	500-1700
2	2.00	1.50	1.30	1.10
3	3.00	2.25	1.85	1.60
4	3.95	3.00	2.40	2.10
5	4.90	3.75	2.95	2.60
6	5.90	4.50	3.50	3.10
7	6.85	5.25	4.10	3.60
8	7.80	6.00	4.60	4.10
9	8.80	6.75	5.15	4.60
10	-	7.50	5.70	5.10

B110

No. of Sections	Frequency (MHz)		
	100-200	200-400	400-600
2	2.40	2.00	1.60
3	3.20	2.80	2.30
4	4.00	3.60	3.00
5	5.20	4.40	3.80
6	5.60	5.20	4.60
7	6.40	6.00	5.40
8	7.20	6.80	6.20
9	8.60	7.60	7.00
10	-	8.50	7.80

* Length shown at left is less connectors. Dimensions and weight are approximate.

L250

	400-600	600-1000	1000-1300	1300-1700	1700-2300	2300-3000	3000-5000	5000-20000
2	.65	.55	.40	.50	.45	.40	.40	Contact factory for exact size at higher frequencies.
3	1.00	.90	.70	.85	.75	.70	75	
4	1.45	1.25	1.00	1.20	1.10	1.00	1.50	
5	1.90	1.65	1.30	1.55	1.40	1.30	1.40	
6	2.30	2.00	1.60	1.95	1.70	1.55	1.75	
7	2.75	2.40	1.90	2.30	2.00	1.85	2.10	
8	3.20	2.75	2.20	2.65	2.35	2.15	2.45	
9	3.65	3.10	2.50	3.00	2.70	2.45	2.80	
10	4.10	3.50	2.80	3.35	3.00	2.75	3.10	

L120

No. of Sections	Frequency (MHz)				
	100-150	150-200	200-400	400-800	800-3000
2	1.80	1.55	1.10	.75	.65
3	2.80	2.45	1.80	1.20	1.10
4	3.85	3.40	2.55	1.70	1.50
5	4.85	4.30	3.25	2.15	1.95
6	5.90	5.20	3.95	2.60	2.40
7	6.95	6.15	4.70	3.00	2.80
8	7.95	7.00	5.40	3.50	3.25
9	8.95	8.00	6.10	3.95	3.70
10	-	8.90	6.80	4.40	4.10

L340

No. of Sections	Frequency (MHz)				
	100-200	200-400	400-600	600-1000	1000-2000
2	2.00	1.20	1.00	.90	.80
3	3.15	2.00	1.60	1.35	1.25
4	4.30	2.70	2.15	1.80	1.65
5	5.40	3.40	2.70	2.25	2.00
6	6.50	4.10	3.25	2.70	2.45
7	7.65	4.90	3.85	3.15	2.85
8	8.75	5.55	4.40	3.60	3.30
9	-	6.40	5.00	4.00	3.70
10	-	7.00	5.50	4.50	4.10

L110

No. of Sections	Frequency (MHz)		
	100-200	200-600	600-1000
2	2.00	1.30	1.00
3	2.85	2.00	1.55
4	3.70	2.60	2.00
5	4.55	3.25	2.60
6	5.40	3.90	3.10
7	6.25	4.55	3.65
8	7.10	5.20	4.20
9	7.95	5.85	4.70
10	8.80	6.50	5.20

Weight (Ounces)

B250	B120	B340	B110
1/4 oz. per inch	3/4 oz. per inch	3/4 oz. per inch	1 1/2 oz. per inch

Weight (Ounces)

L250	L120	L340	L110
1/4 oz. per inch	3/4 oz. per inch	3/4 oz. per inch	1 1/2 oz. per inch

Mini-Max® Series of Microminiature Filters

Features:

- Miniature Size — Maximum Performance
- Low Package Height (.24 inch)
- Ceramic or Lumped Component Chip and Wire Technology
- High Performance Applications
- Leaded Surface Mount Configuration



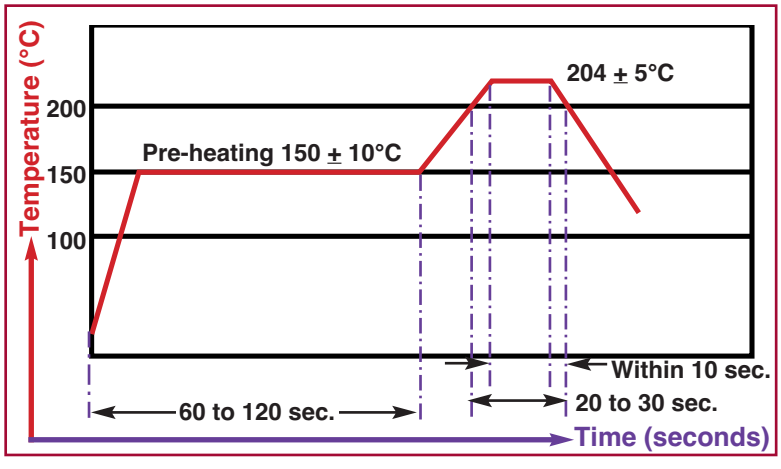
Specifications:

Frequency Range	3 dB % BW	VSWR	Attenuation	Impedance (Ohms)	Number of Sections	Temperature	Packaging
20 MHz-3 GHz	2-20%*	1.5:1 Max	60 dBc	50	3-6*	-40 to +85°C (Operating) -50 to +110°C (Non-Operating)	See Outline Drawings

Vibration:	MIL-STD 202	204A
Shock:	MIL-STD 202	213A
Humidity:	MIL-STD 202	103B
Thermal Shock:	MIL-STD 202	107A
Solderability:	MIL-STD 202	Method 208

• Contact factory for > 6 sections and > 20% bandwidth.

Typical Reflow Profile / Installation Notes For Mini-Max, KeL-Fil and KeL-Com Products:



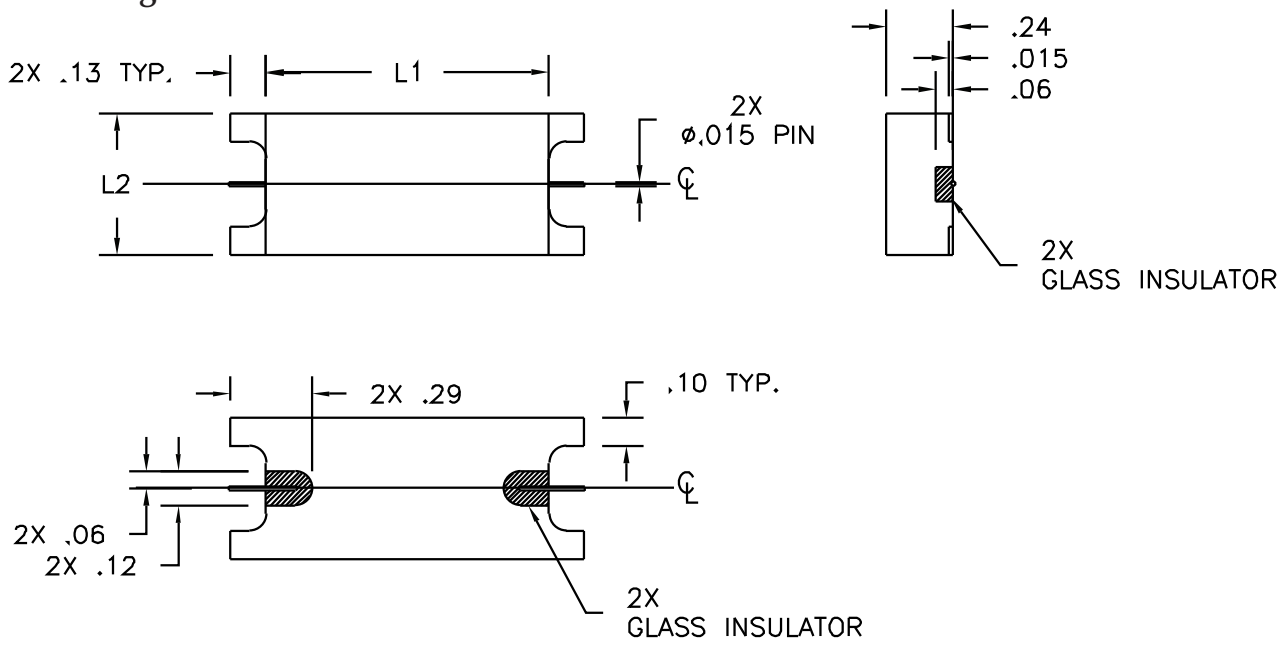
* The rate of heating and cooling must be controlled to preclude thermal cracking of the devices. Processes, heating or cooling, should not exceed a rate of 200°C per min. Spikes must not exceed 100°C max. for any solder operation. Avoid forced cooling or contact with heat sinks, such as conveyor belts, metal tables or cleaning solutions, before the units reach ambient temps.

* When handling K&L products, avoid touching any solderable surface with bare hands or other contaminants as solderability may be reduced.
* Filters are made of very durable materials. However, mishandling of the product (especially RF leads) will damage the device. Avoid forcing the product into place by any means.
* K&L products can be cleaned via solvent- based, aqueous, semi-aqueous, and alcohol- based systems. Be sure to completely dry the units; any entrapped moisture will cause erroneous electrical performance.
* A typical reflow profile is provided. When establishing a reflow procedure, be sure to consider the higher relative mass of components, as the units will take longer to achieve reflow temps.
* Take special care to ensure the input trace is not smaller than the RF trace on the filter. This will eliminate an impedance mismatch which would cause the filter to appear to have a high ripple content.
* All K&L ceramic filters are assembled using SN96 high temp. solder. K&L recommends that customers use SN60 or SN63, or an equivalent, during installation for signal and ground connections.
* Recommended procedure for hand soldering (Not recommended for Series 5 packages):

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Outline Drawings:



L1	L2
1.00	.50
1.00	.75
1.50	.50
1.50	.75
2.00	.50
2.00	.75

SECTIONS	LENGTH
3	1.0"
4–5	1.5"
6	2.0"

To Order:

3 MM B 7 - 1000 / U 50 - 1.1
1 2 3 4 5 6 7 8

1. Number of Sections
2. *Mini-Max*® Series
3. Filter Type
4. Package Width
   5 = .5"
   7 = .75"
5. Center Frequency in MHz
6. Supplemental Codes (see page 13)
7. Bandwidth in MHz
8. Current Version

KEL-com® Commercial Bandpass

Features:

- Ideal for High Volume, Short Lead Time Requirements
- Designed for Low Cost Applications
- Covers the 10 MHz to 3000 MHz Frequency Range
- 3 dB BW Available 5 to 15%
- Designs Available in 3 - 6 Sections
- Chebyshev Design Response
- See page 46 for Reflow Profile and Suggested Mounting Information.



Specifications:

Center Frequency (MHz)	3 dB % BW	VSWR	Attenuation	Impedance (Ohms)	Number of Sections	Temperature	Package Style
10-3000	*5 to 15%	2.0:1 Max	- 60 dBc	50	3-6	-40 to +85 °C	Open frame, leadless surface mount. See page 49.

* Different circuit topologies available for non-standard bandwidth
• For more complete specifications please visit us at **www.klfilterwizard.com.**
• Lowpass and Highpass filters also available. Contact factory for details.

Filter Wizard®

To Order:

3 KC B 10 - 1000 / U 50 - 1.1
1 2 3 4 5 6 7 8

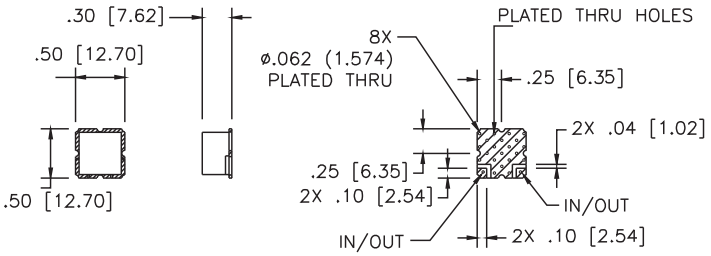
1. Number of Sections
2. KEL-com® Series
3. Bandpass
4. Package Style - Open frame, leadless surface mount
   - 10 = 0.5" x 0.5" (12.7mm x 12.7mm)
   - 20 = 1.0" x 0.5" (25.4mm x 12.7mm)
   - 30 = 1.5" x 0.5" (38.1mm x 12.7mm)
   - 40 = 1.5" x 0.6" (38.1mm x 15.24mm)
5. Center Frequency in MHz
6. Supplemental Codes (see page 13)
7. Bandwidth in MHz
8. Version Number

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Email: sales@klmicrowave.com

K&L MICROWAVE A DOVER COMPANY

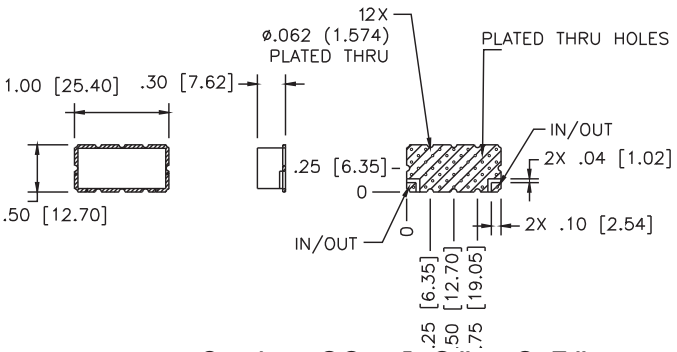
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Salisbury, MD 21801

Mechanical:



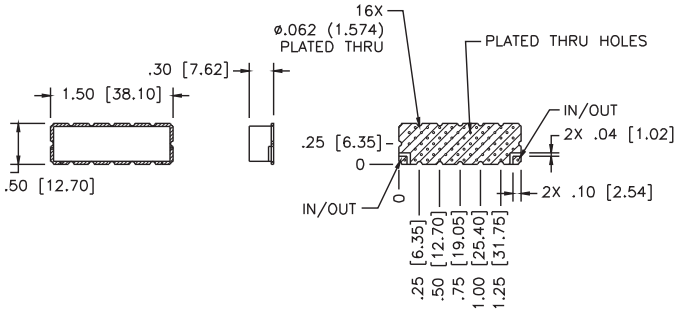
KEL-com®: Series 10 - 0.5" x 0.5"
(12.7mm x 12.7mm)

Open frame, Leadless Surface Mount



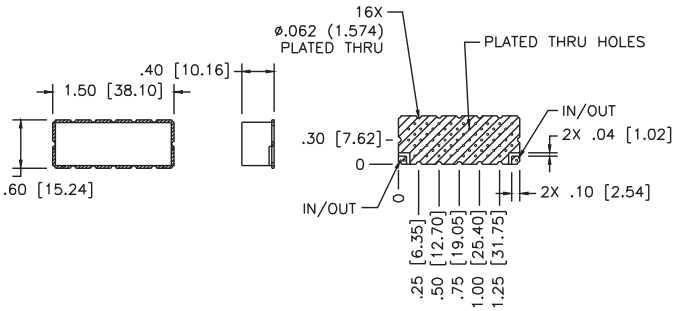
KEL-com®: Series 20 - 1.0" x 0.5"
(25.4mm x 12.7mm)

Open frame, Leadless Surface Mount



KEL-com®: Series 30 - 1.5" x 0.5"
(38.1mm x 12.7mm)

Open frame, Leadless Surface Mount

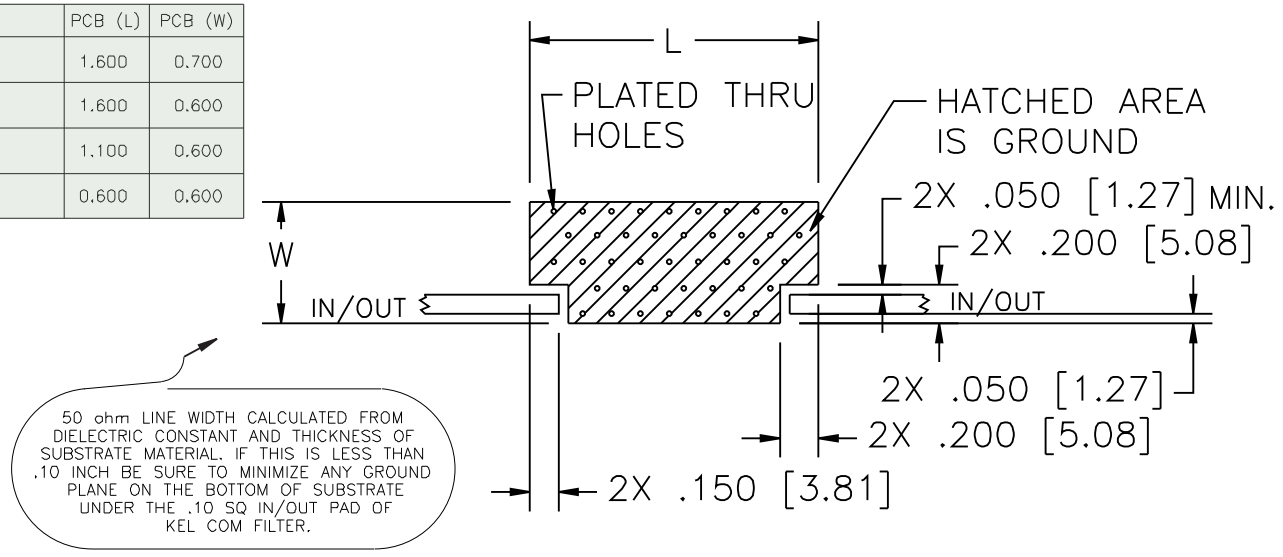


KEL-com®: Series 40 - 1.5" x 0.6"
(38.1mm x 15.24mm)

Open frame, Leadless Surface Mount

Recommended PCB Layout:

PACKAGE	PCB (L)	PCB (W)
SERIES 40 1.5 X 0.6	1.600	0.700
SERIES 30 1.5 X 0.5	1.600	0.600
SERIES 20 1.0 X 0.5	1.100	0.600
SERIES 10 0.5 X 0.5	0.600	0.600



Cavity Filters

K&L Microwave's series of cavity filters covers the frequency range from 30 MHz to 40 GHz. These filters are available with 2 to 17 resonant sections and bandwidths from 0.2% to 50%. Although standard designs offer VSWR specifications of 1.5:1 maximum, the series lends itself to specifications as low as 1.2:1.

While the standard product offers excellent characteristics, K&L can enhance parameters such as insertion loss and power handling capacity (both peak and average) through special package design. As seen with the examples below, K&L's design engineers work with our customers to meet specialized package configurations.

The combline filter series provides an extremely small high "Q" device suitable for rugged environmental requirements in a practically unlimited range of applications. As a result of computer aided design and computerized machining equipment, the package size for this series can be optimized for performance requirements; therefore, there are no limitations of fixed package size.

Waveguide Filters

K&L Microwave offers as many solutions to customer requirements as there are applications. We have several state-of-the art design packages that can meet the most stringent customer demands as well as custom designs to fit the needs of the point-to-point radio market, which requires high volume product at competitive pricing. K&L also offers waveguide solutions for lower quantities with specialized applications.

K&L will quote the right solution to meet your company's waveguide requirements. Call our factory today and discuss your specific application with our technical sales staff.

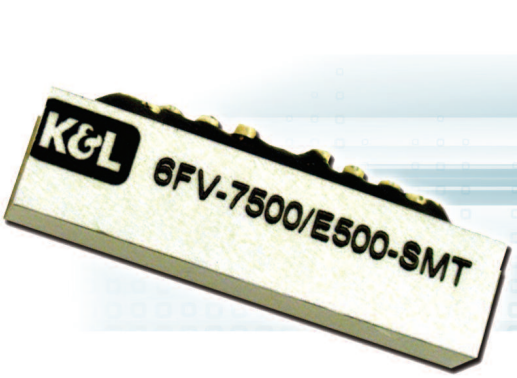
Rectangular Mode

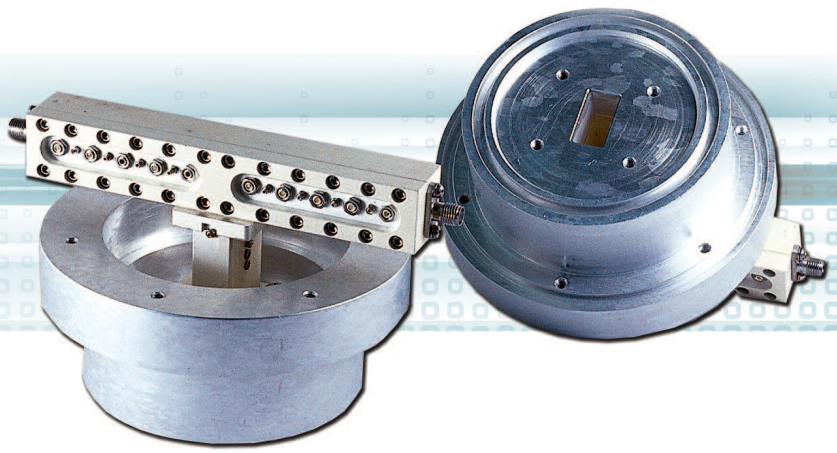
K&L offers rectangular waveguide in the TE 101 mode from 2.5 to 94 GHz. Types of filters offered include bandpass filters, diplexers and lowpass filters. K&L utilizes high performance proprietary and purchased software that minimizes tuning time and maximizes performance. K&L offers multiple diplexer configurations including "Tee" and "Y" junctions as well as rectangular transmit and receive ports with circular antenna ports. Rectangular waveguides are available from 1 to 20 % bandwidth with 2 to 20 sections.

Waveguide filters come with any choice of connectors or flange mounts available for your frequency range. K&L will create customer specific mounting applications to ensure mechanical fit to your special requirements.

Circular Mode

K&L offers circular mode waveguide filters that are Te111 mode filters available from .1 to 1.8 % bandwidth. These circular filters are offered from 2 to 6 sections and are part of K&L's C60 series products.





High Frequency, Medium Bandwidth — FV Series

Features:

- Small Package Design, High "Q" Response
- Ruggedized Package Design
- Covers the 500 MHz to 40 GHz Frequency Range
- Combline Design Results in Low Insertion Loss Performance
- 3 dB BW Available from 3-18%
- Designs Available in 3-17 Sections
- Custom Package Designs Available



Specifications:

Model	Frequency (GHz)	3 dB % BW	VSWR	Insertion Loss	Passband Return	Impedance (Ohms)	No. of Sections	Shock	Vibration	Temperature	Relative Humidity
FV-50	.5-2	3-18	1.5:1	0.1 dB per section @ BW ≥ 5%	≥ 3.5 X f_0	50	3-17	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%
FV-40	2-5										
FV-30	3-8										
FV-20	4-10										
FV-10	7-18										

To Order:

5 FV 20 — 6575 / T 750 - O / O
1 2 3 4 5 6 7 8

Code	Description
1	Number of Sections
2	Series (FV-Combline)
3	Package Designator 20 Series
4	Center Frequency (MHz)
5	Supplemental Codes (See Page 13)
6	Bandwidth (MHz)
7	Input Connector
8	Output Connector

Connectors:

Connector	Code
SMA Female	O
SMA Male	OP
N Female	N*
N Male	NP*
TNC Female	T*
TNC Male	TP*
RF Pins	P
Removable SMA	RO
Blind Mate	OB

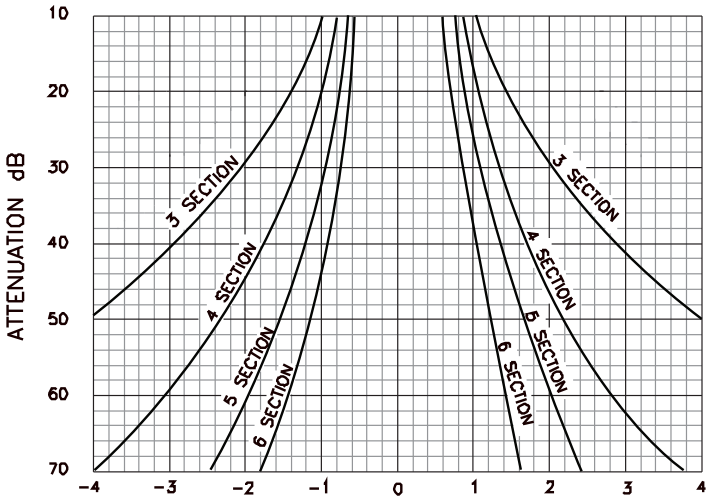
*Requires .75 W and .75 H

High Frequency, Medium Bandwidth — FV Series

Attenuation:

The adjacent curve is used to determine the out-of-band or stopband attenuation for K&L's combline filters. This curve shows the attenuation as multiples of the 3 dB bandwidth for filters up to 13 sections. The formula for approximate stopband attenuation:

$$\text{3 dB BW from } f_0 = \frac{\text{Reject Frequency-Center Frequency}}{\text{3 dB BW}}$$



Note: For more stringent rejection requirements, contact the factory.

Example:

Center Frequency = 6575 MHz
3 dB Bandwidth = 750 MHz
Number of Sections = 6

Find the attenuation at 5600 MHz and 7550 MHz by substituting in the formula:

$$\text{3 dB BW from } f_0 = \frac{5600-6575}{750} = -1.3 \text{ BW}$$

$$\text{3 dB BW from } f_0 = \frac{7550-6575}{750} = +1.3 \text{ BW}$$

From the 6 section curves -1.3 BW and +1.3 BW yield approximately 54 dB.

Mechanical:

The mechanical dimensions and mounting hole locations are dependent upon the design parameters specified by the customer. Contact K&L Microwave for details.

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Email: sales@klmicrowave.com

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2250 Northwood Drive
Salisbury, MD 21801

High Frequency, Broadband — ED Series

Features:

- High "Q" Design Allows Small Package Size While Offering Low Loss
- Covers the 1 GHz to 18 GHz Frequency Range
- 3 dB BW Available from 5-50% (f_0)
- Designs that Cover up to 40 GHz Also Available



Specifications:

Model	Frequency (GHz)	8 dB % BW	VSWR	Passband Return	Impedance (Ohms)	No. of Sections
ED50	1-3	5-50%	1.5:1	≥ 2.1 X f_0	50	3-15
ED40	3-5	5-50%	1.5:1			
ED30	5-7	5-50%	1.7:1			
ED20	7-10	5-50%	1.7:1			
ED10	10-18	5-50%	1.7:1			

Mechanical:

The mechanical dimensions and mounting hole locations are dependent upon the design parameters specified by the customer. Contact K&L Microwave for details.

To Order:

7	ED	50	—	2500	/	E	500	-	O	/	O
1	2	3		4		5	6		7		8

Code	Description
1	Number of Sections
2	Series (Interdigital)
3	Package Designation
4	Center Frequency (MHz)
5	Supplemental Codes (See Page 13)
6	Bandwidth (MHz)
7	Input Connector
8	Output Connector

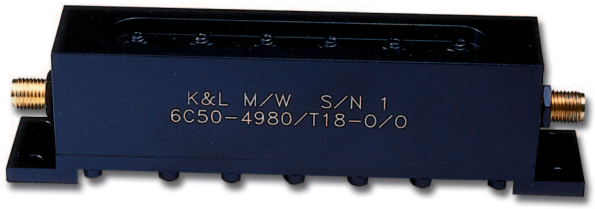
Connectors:

Connector	Code
SMA Female	O
SMA Male	OP
N Female	N
N Male	NP
TNC Female	T
TNC Male	TP
RF Pins	P
Removable SMA	RO
Blind Mate	OB

Narrow Bandwidth — C Series

Features:

- High "Q" Design Allows Narrow Bandwidth While Offering Low Loss
- "Q" Values of up to 10,000
- 3 dB BW Available from 0.1% to 3.5% (f_0)
- Covers the 60 MHz to 30 GHz Frequency Range
- Low Ripple Chebyshev Response
- Ruggedized Package to Withstand Severe Environmental Stress



Specifications:

Model	Frequency (MHz)	3 dB % BW	VSWR	Passband Return	Avg. Power (Watts)	Impedance (Ohms)	No. of Sections	Shock	Vibration	Temperature	Relative Humidity
C20	30-140	.2-3.5	1.5:1	≥ 3.5 X f_0	5	50	3-6	Contact Factory			
C30	141-450	.2-3.5	1.5:1	≥ 3.5 X f_0	5	50	3-6				
C40	451-2000	.2-3.5	1.5:1	≥ 1.5 X f_0	5	50	3-6				
C42	800-2500	.2-3.5	1.5:1	≥ 1.5 X f_0	5	50	3-7	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-20 to +50 °C	0-95%
C45	1000-3000	.2-3.5	1.5:1	≥ 1.5 X f_0	5	50	3-7				
C50	2000-10000	.2-3.0	1.5:1	≥ 2.1 X f_0	5	50	3-9				
C52	8000-12000	.2-3.0	1.5:1	≥ 2.1 X f_0	5	50	3-9				
C60	6000-30000	.1-1.8	1.5:1	≥ 1.6 X f_0	5	50	3-9				

Insertion Loss:

The following formula is used to determine the approximate insertion loss at center frequency:

$$\text{Loss at } f_0 = \left(\frac{(\text{Loss Constant})(\text{No. of Sections} + 0.5)}{\%\ 3\ \text{dB BW}}\right) + 0.2$$

Example:

Model = 6C40-1000/T20-O/O
Center Frequency = 1000 MHz
3 dB Bandwidth = 20 MHz
Number of Sections = 6

$$\text{The \% 3 dB BW} = \frac{20 \times 100}{1000} = 2\%$$

Loss constant from table = 0.35

$$\text{Insertion Loss} = \left(\frac{(0.35)(6+.50)}{2}\right) + 0.2 = 1.4 \text{ dB}$$

Loss Constant:

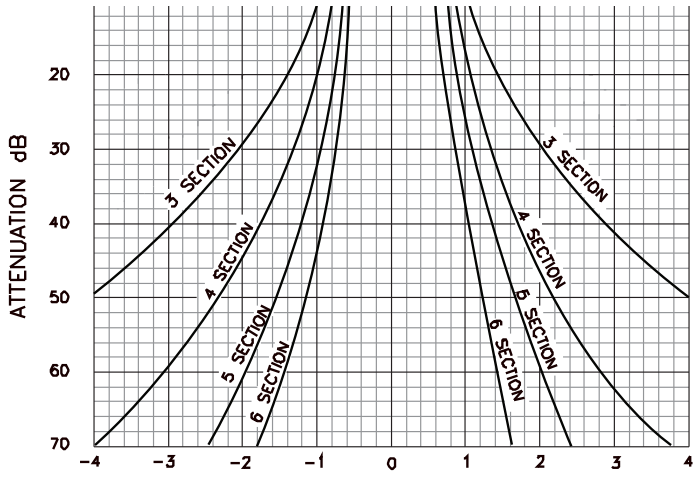
Center Frequency (MHz)	Series							
	C20	C30	C40	C42	C45	C50	C52	C60
30-50	1.7							
51-65	1.6							
66-100	1.5							
101-400	1.4	1.2						
401-600		1.0	0.70					
601-900			0.40	0.25				
901-1300			0.35	0.20	0.25			
1301-1800			0.30	0.20	0.22			
1801-3000			0.30	0.20	0.20	0.30		
3001-30000						0.25	0.27	0.10

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Attenuation

The adjacent curve is used to determine the out-of-band or stopband attenuation for K&L's cavity filters. This curve shows the attenuation as multiples of the 3 dB bandwidth for filters with 2 to 6 sections.



The following formula is used to determine the approximate stopband attenuation:

$$\text{3 dB BW from } f_0 = \frac{\text{Reject Frequency-Center Frequency}}{\text{3 dB BW}}$$

Center frequency = 300 MHz
3 dB Bandwidth = 6 MHz
Number of sections = 4

Find the attenuation at 288 MHz and 312 MHz by substituting in the formula:

$$\text{3 dB BW from } f_0 = \frac{288-300}{6} = -2 \text{ BW}$$

$$\text{3dB BW from } f_0 = \frac{312-300}{6} = +2 \text{ BW}$$

Referring to the attenuation curves, we find the attenuation in dB for a 4-section response +2 bandwidths from f_0 to yield 48 dB and -2 bandwidths from f_0 to yield 44 dB.

To Order:

5 C 20 — 140 / U 4 - N / NP
1 2 3 4 5 6 7 8

Code	Description
1	Number of Sections
2	Series
3	Package Designator
4	Center Frequency
5	Supplemental Codes (See Page 13)
6	Bandwidth (MHz)
7	Input Connector
8	Output Connector

Connectors:

Connector	Code	Length
SMA Female	O	.34-.38" / 8.64-9.65mm
SMA Male	OP	.51" / 12.95mm
N Female	N	.75" / 19.05mm
N Male	NP	.79" / 20.06mm
TNC Female	T	.75" / 19.05mm
TNC Male	TP	.85" / 21.59mm
BNC Female	B	.72" / 18.29mm
BNC Male	BP	.88" / 22.35mm
2.92 mm Female	K	
2.92 mm Male	KP	

Narrow Bandwidth — C Series

Mechanical:

Series	Frequency (MHz)	W Inches / mm	H- Max. Inches / mm	Length vs. Number of Sections (Inches / mm)				Fig.
				3	4	5	6	
C20	30-50	1.24 / 31.50	3.88 / 98.55	3.63 / 92.20	4.75 / 120.65	5.88 / 149.35	7.00 / 177.80	1
	51-65	1.24 / 31.50	2.88 / 73.15					
	66-100	1.24 / 31.50	2.38 / 60.45					
	101-140	1.24 / 31.50	1.88 / 47.75					
C30	141-450	1.24 / 31.50	1.88 / 47.75	3.63 / 92.2	4.75 / 120.65	5.88 / 149.35	7.00 / 177.8	1
C40	451-600	1.24 / 31.50	5.28 / 134.11	3.63 / 92.20	4.75 / 120.65	5.88 / 149.35	7.00 / 177.80	1
	601-900	1.24 / 31.50	4.28 / 108.71					
	901-1300	1.24 / 31.50	3.28 / 83.31					
	1301-1800	1.24 / 31.50	2.78 / 70.61					
	1801-2000	1.24 / 31.50	2.28 / 57.91					

Figure 1:

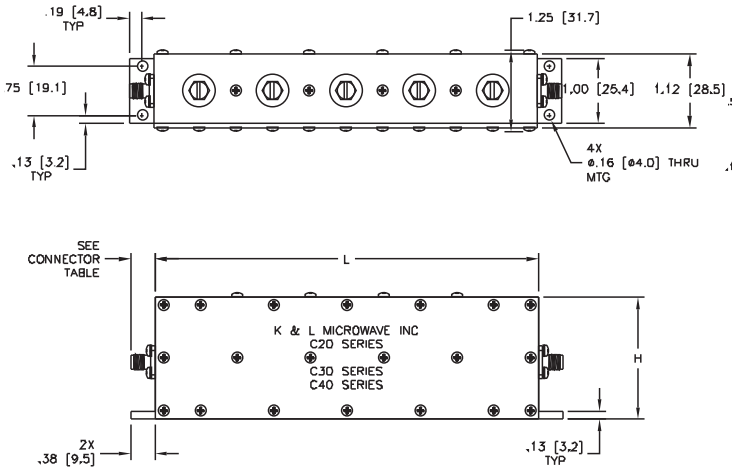
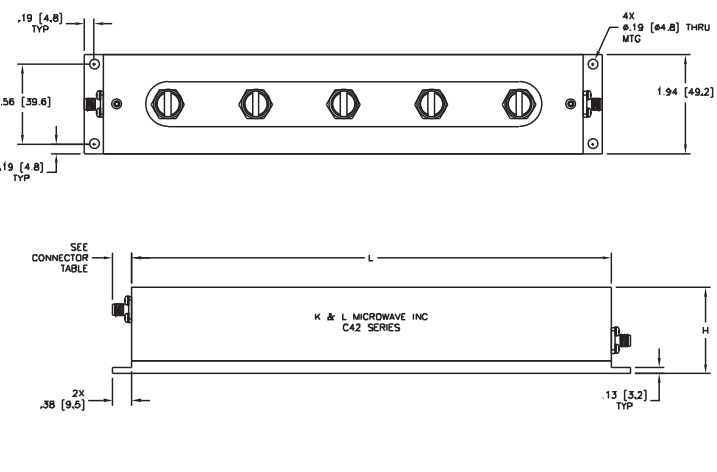


Figure 2:



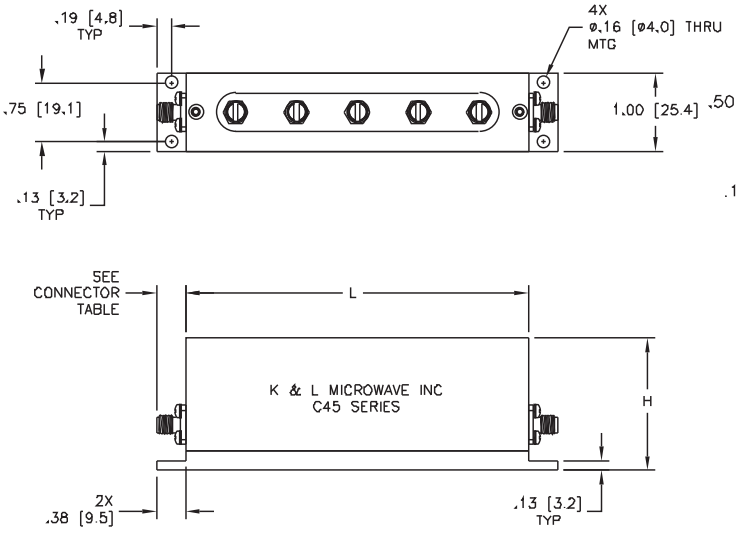
Series	Frequency (MHz)	W Inches / mm	H- Max. Inches / mm	Length vs. Number of Sections (Inches / mm)				Fig.
				3	4	5	6	
C42	801-1000	1.94 / 49.28	4.25 / 107.95	5.63 / 143.00	7.50 / 190.50	9.38 / 238.25	11.25 / 285.75	2
	1001-1300	1.94 / 49.28	3.5 / 88.90					
	1301-1600	1.94 / 49.28	2.8 / 71.12					
	1601-1900	1.94 / 49.28	2.4 / 60.96					
	1901-2300	1.94 / 49.28	2.1 / 53.34					
	2301-2500	1.94 / 49.28	1.85 / 46.99					

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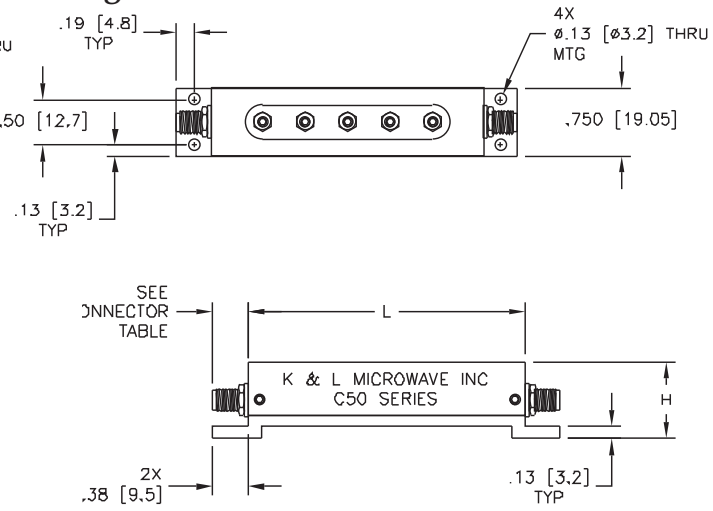
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Salisbury, MD 21801

Series	Frequency (MHz)	W Inches / mm	H- Max. Inches / mm	Length vs. Number of Sections (Inches / mm)				Fig.
				3	4	5	6	
C45	1000-1200	1.0 / 25.40	3.5 / 88.90	2.80 / 71.12	3.60 / 91.44	4.40 / 111.76	5.20 / 132.08	3
	1201-1500	1.0 / 25.40	2.95 / 74.93					
	1501-1800	1.0 / 25.40	2.5 / 63.50					
	1801-2100	1.0 / 25.40	2.2 / 55.88					
	2101-2400	1.0 / 25.40	1.95 /49.53					
	2401-2700	1.0 / 25.40	1.8 / 45.72					
	2701-3000	1.0 / 25.40	1.65 / 41.91					

◆ **Figure 3:**



◆ **Figure 4:**

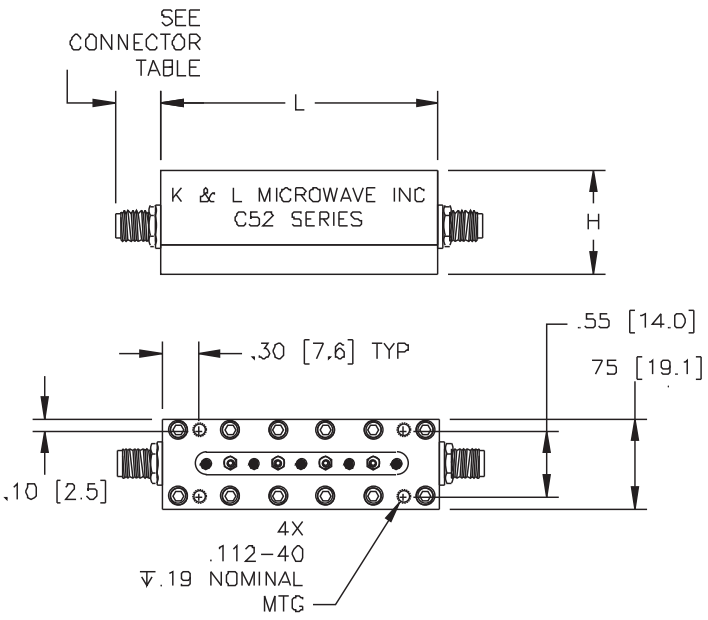


Series	Frequency (MHz)	W Inches / mm	H- Max. Inches / mm	Length vs. Number of Sections (Inches / mm)				Fig.
				3	4	5	6	
C50	2000-2500	0.75 / 19.05	2.0 / 50.80	2.00 / 50.80	2.50 / 63.50	3.00 / 76.20	3.50 / 88.90	4
	2501-3000	0.75 / 19.05	1.7 / 43.18					
	3001-4000	0.75 / 19.05	1.5 / 38.10					
	4001-6000	0.75 / 19.05	1.25 / 31.75					
	6001-10000	0.75 / 19.05	1.0 / 25.40					

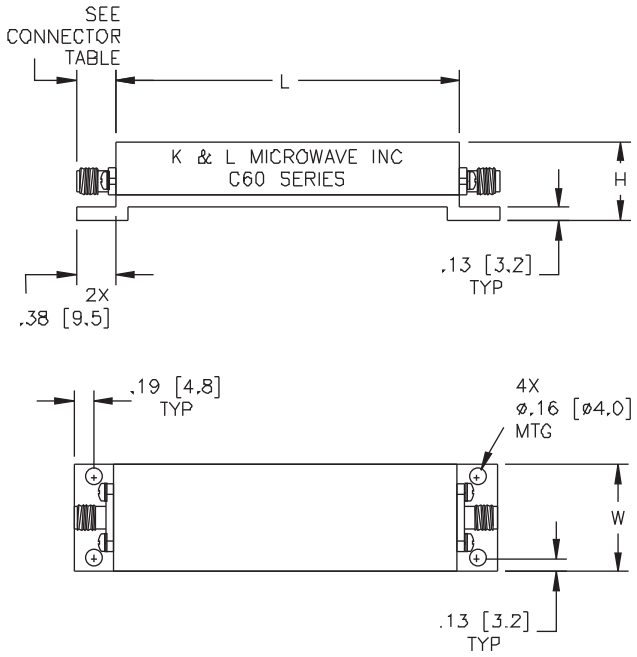
Narrow Bandwidth — C Series

Series	Frequency (MHz)	W Inches / mm	H- Max. Inches / mm	Length vs. Number of Sections (Inches / mm)				Fig.
				3	4	5	6	
C52	8000-10000	0.75 / 19.05	0.87 / 22.10	1.50 / 38.10	1.90 / 48.26	2.30 / 58.42	2.70 / 68.58	5
	10000-12000	0.75 / 19.05	0.8 / 20.32					

◆ **Figure 5:**



◆ **Figure 6:**



Series	Frequency (MHz)	W Inches / mm	H- Max. Inches / mm	Length vs. Number of Sections (Inches / mm)				Fig.
				3	4	5	6	
C60	6000	1.742 / 44.25	1.0 / 25.40	5.04 / 128	6.56 / 166.6	8.09 / 205.5	9.61 / 244.1	6
	8000	1.369 / 34.77	0.85 / 21.59	3.92 / 99.6	5.07 / 128.7	6.22 / 158	7.37 / 187.2	
	10000	1.145 / 29.08	0.75 / 19.05	3.25 / 82.6	4.18 / 106.1	5.10 / 129.4	6.03 / 153.1	
	12000	0.996 / 25.3	0.75 / 19.05	2.80 / 71.1	3.58 / 90.9	4.36 / 110.7	5.14/ 130.6	
	14000	0.889 / 22.58	0.75 / 19.05	2.48 / 63.0	3.15 / 80.0	3.82 / 97.0	4.49 / 114.1	
	18000	0.747 / 18.97	0.75 / 19.05	2.06 / 52.3	2.58 / 65.5	3.11 / 79.0	3.64 / 92.5	
	22000	0.657 / 16.69	0.75 / 19.05	1.79 / 45.5	2.22 / 56.4	2.66 / 67.6	3.10 / 78.7	
	30000	0.52 / 13.20	0.52 / 13.21	Contact Factory				

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Features:

- Covers the 30 to 10000 MHz Frequency Range
- Low Passband Insertion Loss
- High Notch Attenuation
- 3 dB BW Available from 0.5% to 5% (f_0)
- Low Ripple Chebyshev Design Response



Specifications:

Model	Frequency (MHz)	3 dB % BW	VSWR	Average Power (Watts)	Impedance (Ohms)	No. of Sections	Shock	Vibration	Temp.	Rel. Humidity	Mechanical
N30	30-450	1-5	1.5:1	1.5	50	3-6	Contact Factory			0-95%	Fig. 1
N40	451-800	1-5	1.7:1	10	50	3-6					Fig. 2
N45	801-3000	0.5-5	1.7:1	10	50	3-6					Fig. 3
N50	3001-10000	0.5-5	1.7:1	10	50	3-6					Fig. 4

Figure 1:

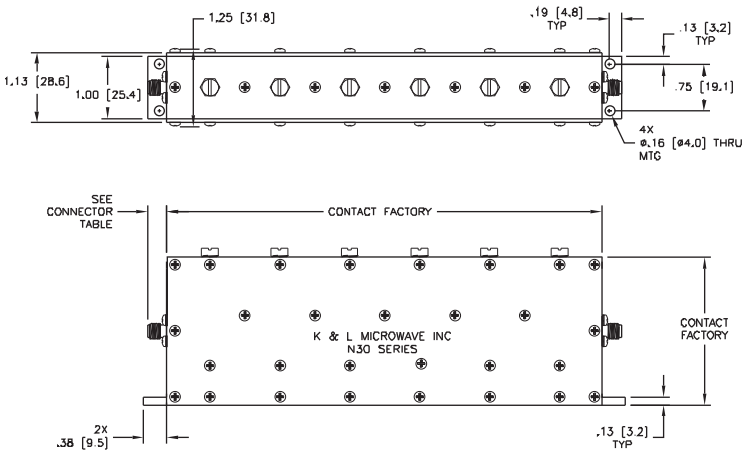
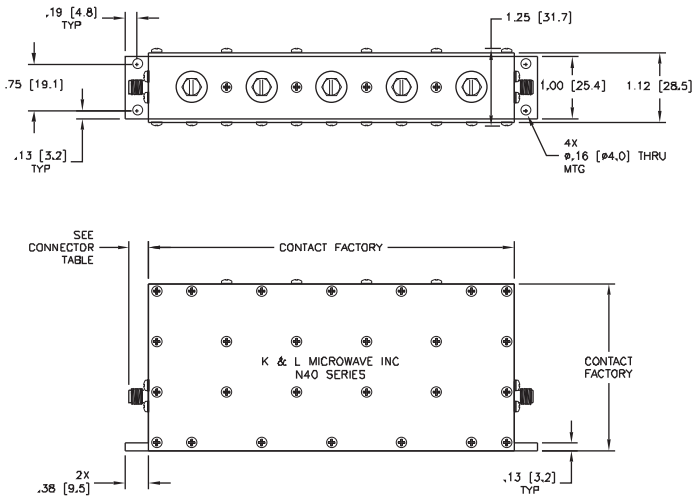


Figure 2:



Bandreject — N Series

Figure 3:

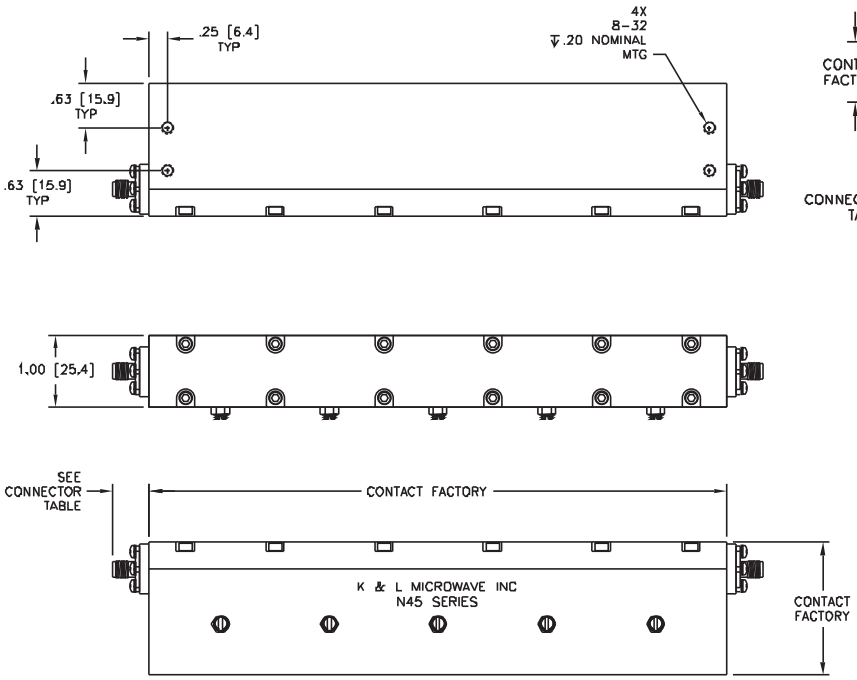
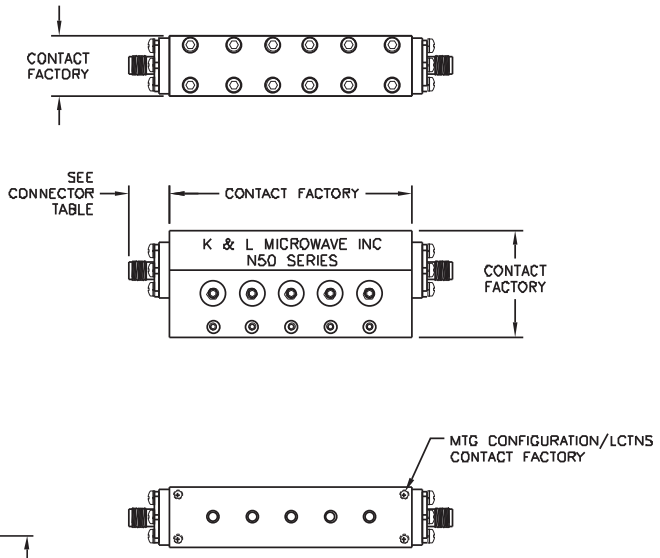


Figure 4:



To Order:

5 N 30 — 162 / E 3 - O / O
1 2 3 4 5 6 7 8

Code	Description
1	Number of Sections
2	Series (Notch)
3	Package Designator
4	Center Frequency (MHz)
5	Supplemental Codes (See Page 13)
6	Bandwidth (MHz)
7	Input Connector
8	Output Connector

Connectors:

Connector	Code	Length
SMA Female	O	.34-.38" / 8.64-9.65mm
SMA Male	OP	.51" / 12.95mm
N Female	N	.75" / 19.05mm
N Male	NP	.79" / 20.06mm
TNC Female	T	.75" / 19.05mm
TNC Male	TP	.85" / 21.59mm
BNC Female	B	.72" / 18.29mm
BNC Male	BP	.88" / 22.35mm

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Features:

- Radar and Airborne Applications
- Meets Military Environmental Requirements
- Weight Reduction—Reduced up to 80%
- Volume Reduction—Reduced up to 75%
- Surface Mount Package
- Exceptional Ultimate Attenuation
- Low Loss



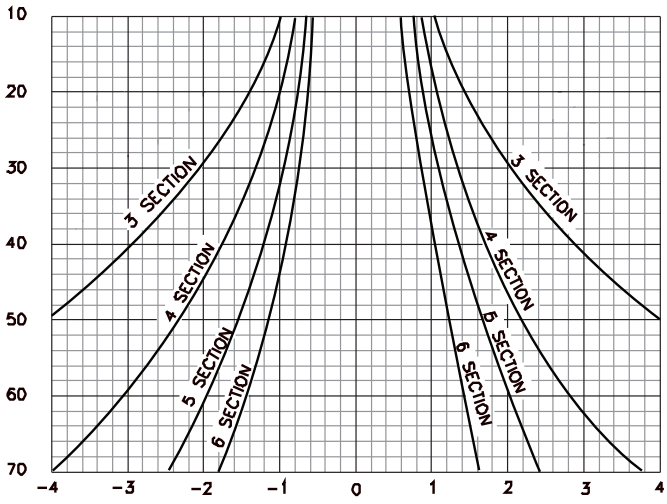
Specifications:

Frequency (GHz)	No. of Sections	3 dB % BW	VSWR	Impedance (Ohms)	Shock	Vibration	Temperature	Relative Humidity
6-18	4-10	3-10%	1.5:1 Max	50	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%

Attenuation:

The adjacent curve is used to determine the out-of-band or stopband attenuation for K&L's combline filters. This curve shows the attenuation as multiples of the 3 dB bandwidth for filters up to 13 sections. The formula for approximate stopband attenuation:

3 dB BW from f_0 = Reject Frequency-Center Frequency / 3 dB BW



Note: For more stringent rejection requirements, contact the factory.

To Order:

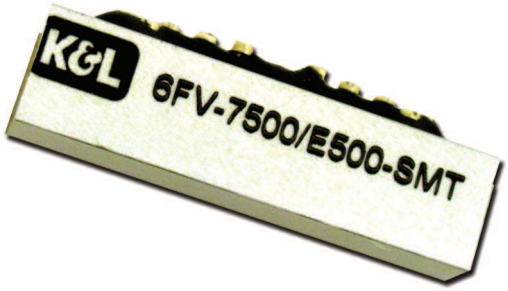
8 MP 20 — 7410 / H 500 - PX/PX
1 2 3 4 5 6 7

Code	Description
1	Number of Sections
2	Mini-Pack®
3	Package Designator
4	Center Frequency (MHz)
5	Supplemental Codes (See Page 13)
6	Bandwidth (MHz)
7	Connectors

Surface Mount High Frequency

Features:

- Leadless - Designed to Mount on RO4003, .012" Thick, with 50-ohm Line .026" Wide (Other Types of Printed Wiring Board are Available upon Request.)
- Cavity (TEM) Combline: High Q, Low Loss, Excellent Ultimate Rejection
- Option to Hermetically Seal
- Up to 18 GHz and Relative Bandwidths up to 8%
- Mechanical Configuration can Support All Types of Filters



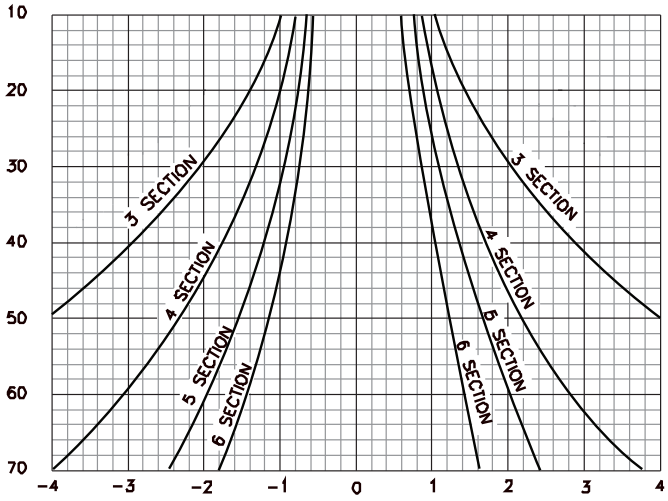
Specifications:

Frequency (GHz)	No. of Sections	3 dB % BW	VSWR	Impedance (Ohms)	Shock	Vibration	Temperature	Relative Humidity
2-20	3-10	3-10%	1.5:1 Max	50	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-55 to +85 °C	0-95%

Attenuation:

The adjacent curve is used to determine the out-of-band or stopband attenuation for K&L's combline filters. This curve shows the attenuation as multiples of the 3 dB bandwidth for filters up to 13 sections. The formula for approximate stopband attenuation:

3 dB BW from f_0 = Reject Frequency-Center Frequency / 3 dB BW



Note: For more stringent rejection requirements, contact the factory.

Part Numbering:

6FV-7500/E500 - SMT
1 2 3 4 5

1: Number of Sections: from 2 to 9
2: Center Frequency: from 2000 - 18000 MHz
3: Pass-Band Definition:
E: Equal-Ripple; H: 0.5dBc; U: 1.0dBc; T: 3.0dBc; X: Special
4: Band-Width: from 0.5% to 8% of center frequency
5: Leadless, Surface Mount Technology

Reflow Profile:

Please refer to page 46 in the catalog or to http://www.klmicrowave.com/minimax.php.

www.klmicrowave.com
Phone: 410-749-2424 • FAX: 443-260-2268
Email: sales@klmicrowave.com

www.klfilterwizard.com
2250 Northwood Drive
Salisbury, MD 21801

Features:

- Custom mechanical packages designed for customer specific requirements
- Higher "Q" with less insertion loss
- Higher power handling capabilities
- Versatile choice of connectorized ports
- Flanges have less insertion loss than connectors
- Custom flanges manufactured to customer requirements

38 GHz Bandpass Filter:

The 6WP01-38775-E350-K/V is a 6 section 38 GHz design that requires WR-28 Flanges on the input port and K-Connectors on the output port. This design also requires an angled bend to meet the customer's mounting configuration.



11 GHz Tunable Bandpass Filter:

The IT5C50-10700/11700-E24-O/O is a tunable waveguide bandpass filter that maintains a constant bandwidth of 24 MHz with minimal insertion loss degradation over a 1 GHz band.



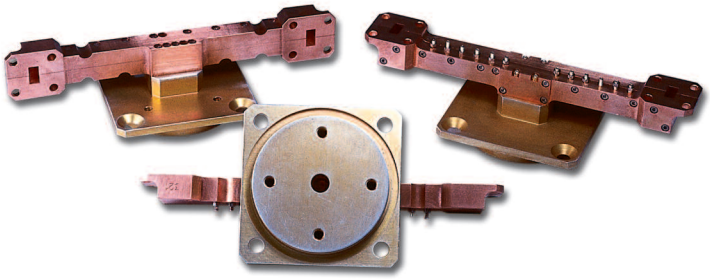
11 GHz Tunable Diplexer:

The 5WZ02-10700/11700-E24-O/O/V is a tunable diplexer for the point-to-point radio market. The diplexer maintains a constant bandwidth over the 10.7 to 11.7 GHz band. This product has 1.5 dB insertion loss and 85 dB Tx/Rx isolation.



38 GHz Diplexer:

The 6WZ01-39475/38775-E350-V/V is a 38 GHz short haul waveguide point-to-point radio diplexer. This unit has WR-28 Tx/Rx flanges with a customer specified circular antenna port for easy mounting.



6 GHz Diplexer:

The 5WZ02-6400/7100-E28-O/O/V is a 6 GHz long haul point-to-point radio diplexer. This product is tunable over the 6.4 to 7.1 GHz band and maintains a constant bandwidth over the full band. This product has 1.5 dB insertion loss and 85 dB Tx/Rx isolation.



21 GHz Antenna Lowpass:

The 7WZ/C/L/P-22400/E2400-V/V is a 21-23 GHz antenna connection with a harmonic rejection lowpass, a 90 degree twist and a circulator for Tx/Rx isolation.



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Waveguide - mm-Wave Filters & Couplers for V&W Bands

Features:

- High "Q" from 0.2% to 5% Relative Bandwidths
- Elliptic Response with Mixed and By-passed Modes
- "No Tune" Filters are Available
- Custom Solutions



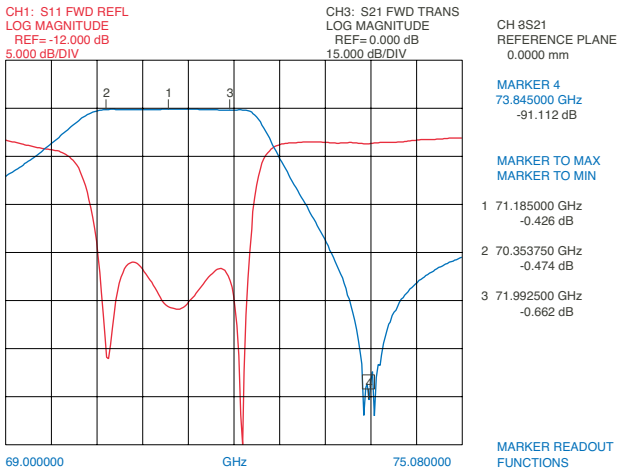
Bandpass Filters - Typical Performance

Center Frequency (GHz)	B.W. (3 dB) (GHz)	I.L. (dB) @ $f0$	R.L. (dB) min.	Rejection min.	Flange Type	Size
58.7	1.4	1.5	14	50 dB @ 60.2 GHz	WR-15	1.925" x .75" x .75"
62.3	1.4	1.5	14	50 dB @ 60.8 GHz	WR-15	1.925" x .75" x .75"
62.175	0.16	2.5	15	40 dB @ 61.9 GHz	WR-15	2.23" x .75" x .75"
73.5	5	0.4	12	70 dB @ 81 GHz	WR-12	1.0" x .75" x .75"
83.5	5	0.4	12	70 dB @ 76 GHz	WR-12	1.0" x .75" x .75"
72	1.6	2.0	14	90 dB @ 75 GHz	WR-12	1.925" x .75" x .75"
75	1.6	2.0	14	90 dB @ 72 GHz	WR-12	1.925" x .75" x .75"
71.175	1.65	0.5	14	30 dB @ 73.3 GHz	WR-12	1.02" x .75" x .75"
75.425	1.65	0.5	14	40 dB @ 73.3 GHz	WR-12	1.02" x .75" x .75"

To Order:

N W P - $f0$/ X BW - V / V
1 2 3 4 5

Code	Description
1	Number of Sections (TBO by factory)
2	Type of Filter P = Bandpass L = Lowpass H = Highpass
3	Center Frequency in GHz for Bandpass Cut-off Frequency for Lowpass/Highpass
4	Passband Definition E = Equal Ripple H = 0.5 dB U = 1.0 dB T = 3.0 dB
5	Bandwidth in GHz



	Cutoff Frequency (GHz)	I.L. (dB)	R.L. (dB)	Rejection	Flange Type	Size
Lowpass Filters Typical Performance	76	0.2	14	70 dB @ 81 GHz	WR-12	1.3" x .5" x .75"
Highpass Filters Typical Performance	92 81	0.5 0.4	14 14	25 dB @ 76 GHz 70 dB @ 76 GHz	WR-10 WR-10	1.0" x .75" x .75" 1.3" x .5" x .75"

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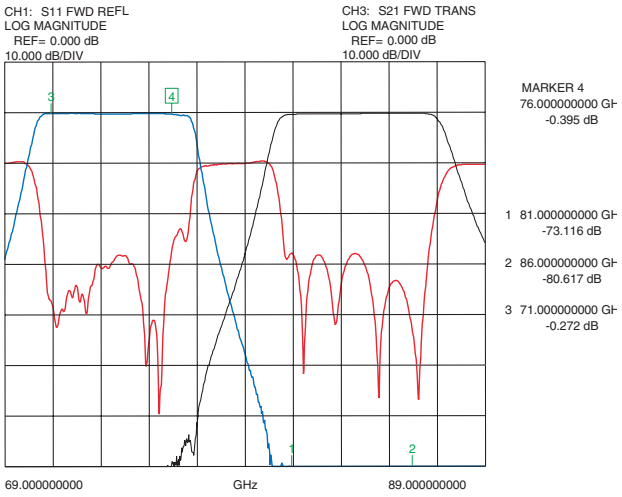
Waveguide - mm-Wave Filters & Couplers for V&W Bands

Diplexers	Frequency Range (GHz)	I.L. (dB)	R.L. (dB)	Rejection (dB) at (GHz)	Flange Type	Size
Channel 1 Channel 2	71 to 76 81 to 86	0.4 0.4	14 14	60 dB @ 81 GHz 60 dB @ 76 GHz	WR-12 WR-12	1.925" x .75" x .75"
Channel 1 Channel 2	71 to 76 81 to 86	0.5 0.5	14 14	75 dB @ 81 GHz 75 dB @ 76 GHz	WR-12 WR-12	1.925" x .75" x .75"
Channel 1 Channel 2	71.2 to 72.8 74.2 to 75.8	2.0 2.0	14 14	90 dB @ 75 GHz 90 dB @ 72 GHz	WR-12 WR-12	3.5" x .75" x .75" .925 @ center port
Channel 1 Channel 2	58 to 59.4 61.6 to 63	1.5 1.5	14 14	50 dB @ 60.2 GHz 50 dB @ 60.8 GHz	WR-15 WR-15	3.5" x .75" x .75" .95 @ center port

◆ To Order:

NWZ - f_1/ f_2/X BW - V / V
1 2 3 4 5

Code	Description
1	Number of Sections (TBO by factory)
2	Center Frequency of Channel 1
3	Center Frequency of Channel 2
4	Passband Definition E = Equal Ripple H = 0.5 dB U = 1.0 dB T = 3.0 dB
5	Bandwidth in GHz



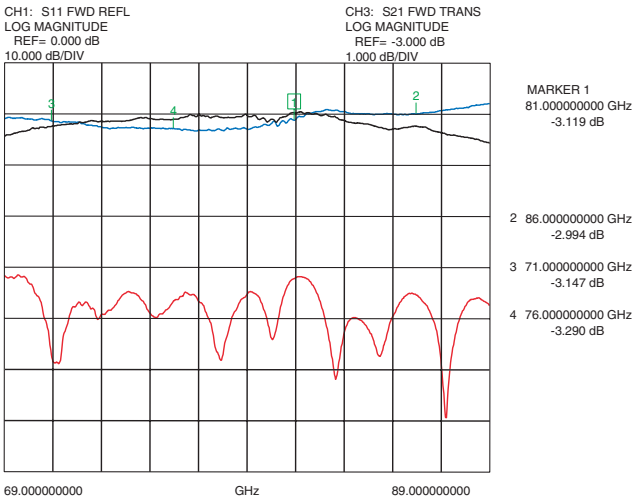
mm Wave Couplers

Frequency Range (GHz)	Coupling Value (dB) nom.	Coupling Var. +- (dB)	R.L. (dB) min.	Isolation (dB) min.	Flange Type	Size
71 to 86	-3	0.3	15	25	WR-12	1.59" x 1.56" x .73"

◆ To Order:

WDC - BW / C - V / V
1 2

Code	Description
1	Bandwidth of Operation Between f_L & f_H
2	Coupling Value in dB

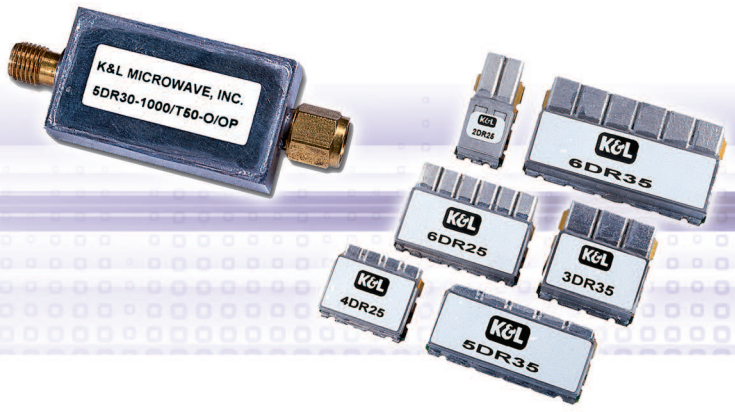


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Ceramics

K&L's dielectric resonator filters, in both packaged and open frame designs, offer high unloaded Q for their size allowing narrow bandwidths with low insertion loss. Open frame ***K&L-fil***® designs, available in surface mount configuration only, that minimize size and cost. Packaged filters can be sealed to gross or fine leak specifications and are available in connectorized or with gull-wing or flat pack hermetic pins for input and output connections.



Dielectric Resonators

◆ Description:

K&L's Dielectric Resonator Bandpass Filters are available in standard packages with a basic Chebychev design. Connectors available are SMA and RF pins. Through the use of ceramic technology, this filter series offers superior temperature stability and low insertion loss.



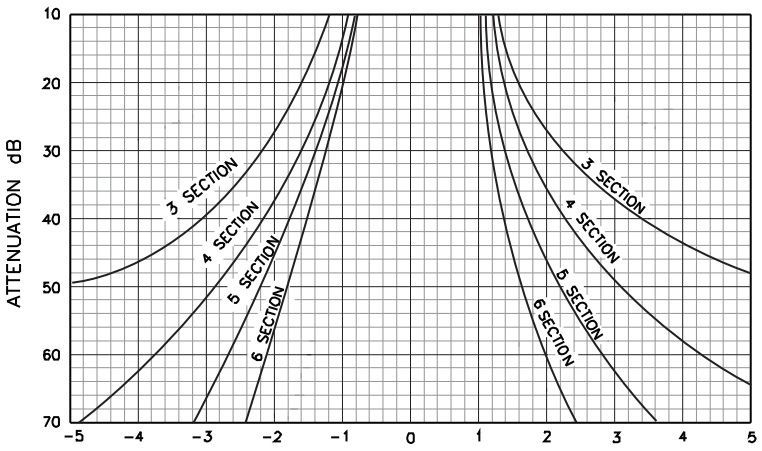
◆ Specifications:

Frequency (MHz)	3 dB % BW	VSWR	Impedance (Ohms)	No. of Sections	Shock	Vibration	Temperature	Temp. Stability	Relative Humidity
500-3000	1.0-10	1.5:1	50	3-6	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 Hz-2000 Hz	-40 to +85 °C (Operating) -50 to +125 °C (Non-Operating)	+2 to +11 ppm/°C	0-95%

◆ Attenuation:

The adjacent curve shows the attenuation as multiples of the bandwidth for filters with 2-6 sections. The following formula is used:
3 dB bandwidths from center frequency=

$$\frac{\text{Reject Frequency - Center Frequency}}{\text{3 dB Bandwidth}}$$



Example:

Center Frequency = 1000 MHz
3 dB Bandwidth = 50
Number of Sections = 5

Find the attenuation at 900 and 1100 MHz by substituting in the formula 3 dB bandwidth from center frequency = $\frac{900-1000}{50}$ = -2 BW's
and 3dB bandwidth from center frequency = $\frac{1100-1000}{50}$ = +2 BW's
From the curve, we find the attenuation in dB for a 5-section response -2 bandwidths from center frequency to yield 46 dB, and +2 bandwidths from center frequency to yield 44 dB.

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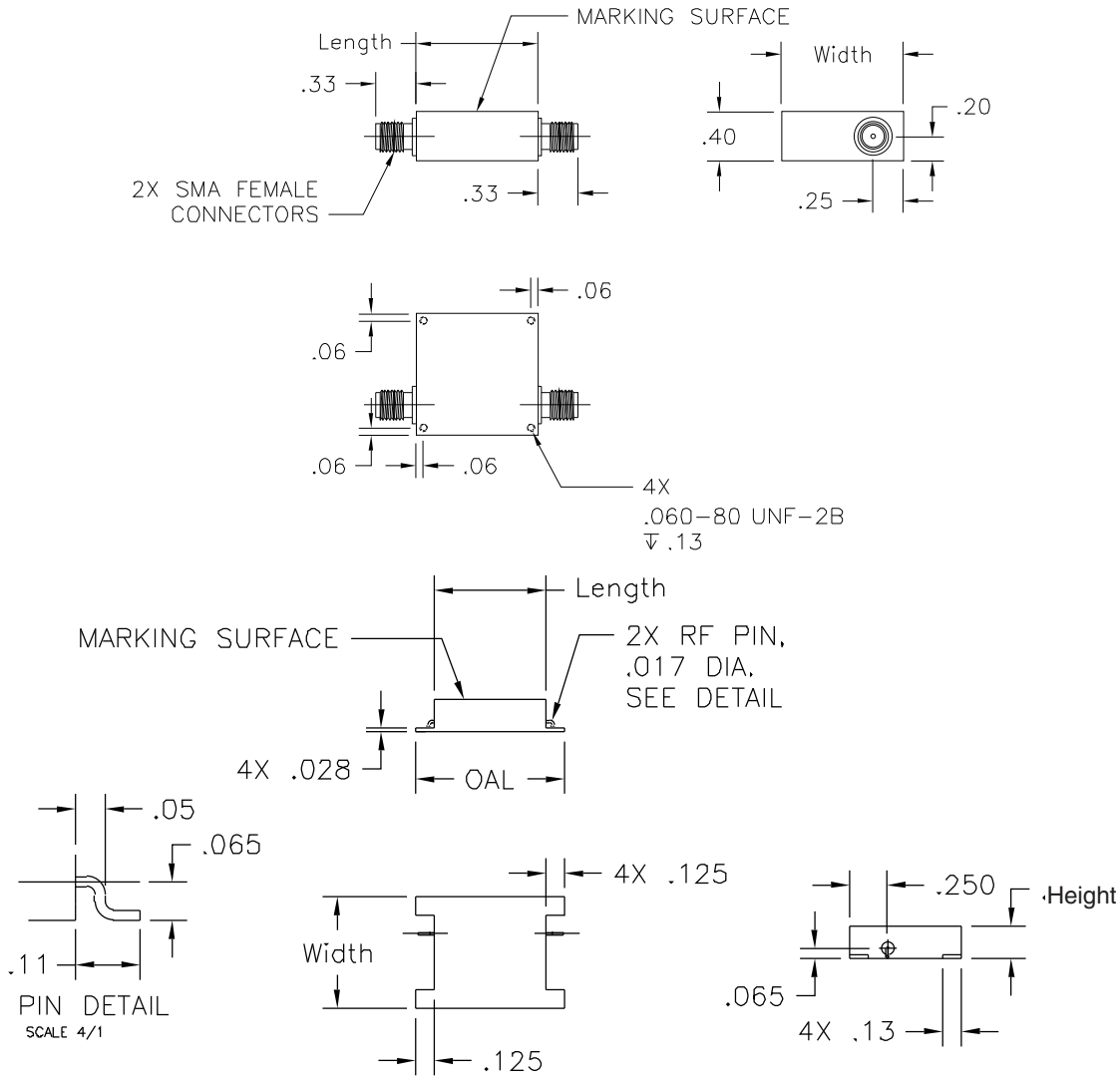
To Order:

3 DR 20 — 1000 / T 50 — O / O
1 2 3 4 5 6 7 8

Code	Description
1	Number of Sections
2	Series
3	Package/Resonator Designator
4	Center Frequency
5	Supplemental Codes (See Page 13)
6	Bandwidth
7	Input Connector
8	Output Connector

Connectors:

Connector	Code
SMA Female	O
SMA Male	OP
Gull Wing	PX



For Mechanical Definitions see www.klfilterwizard.com or contact our factory.

KEL-fil® — Bandpass Filters

Features:

- Designed for Low Cost While Providing High "Q" Response
- Extremely Temperature Stable
- Covers the 270 MHz to 3000 MHz Frequency Range
- 3 dB BW Available up to 30%
- Designs Available in 3-6 Sections
- Chebyshev Design Response
- Series 3 and 5 are ROHs compliant
- See page 46 for Reflow Profile and Suggested Mounting Information.



Specifications:

Center Frequency (MHz)	3 dB % BW	VSWR	Attenuation	Impedance (Ohms)	Number of Sections	Shock	Vibration	Temp.	Temp. Stability	Rel. Humidity
270-3000	Up to 30%	2.0:1	≥ 60 dBc (270-2000 MHz) ≥ 30 dBc (2001-3000 MHz)	50	3-6	20 G's 1/2 Sine, 11 Ms	10 G's 10 Hz - 2000 Hz	-40 to +85°C (Operating) -50 to + 125°C (Non-Operating)	+2 to +11 ppm/°C	0-95%

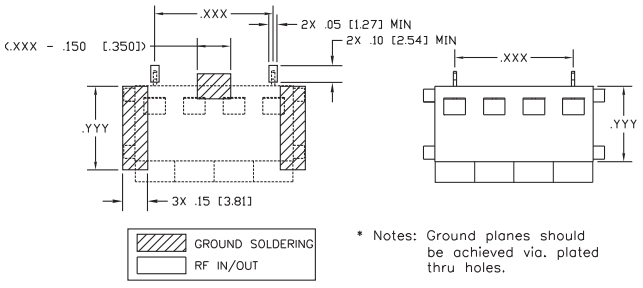
* For more complete specifications please visit us at **www.klfilterwizard.com**

Recommended PCB Layout:

DR 23, 33 Series Depicted

.xxx = Dim. A
.yyy = Dim. B

Dimensions are determined by Filter Wizard outline.

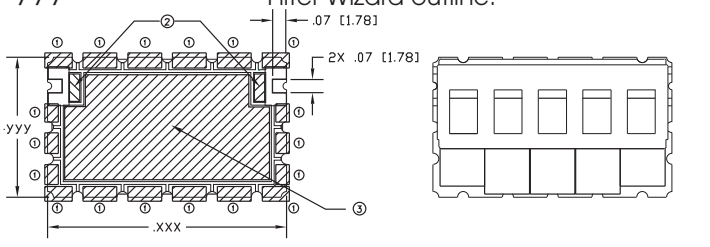


* Notes: Ground planes should be achieved via. plated thru holes.

DR 25, 35 Series Depicted

.xxx = Dim. A
.yyy = Dim. B

Dimensions are determined by Filter Wizard outline.



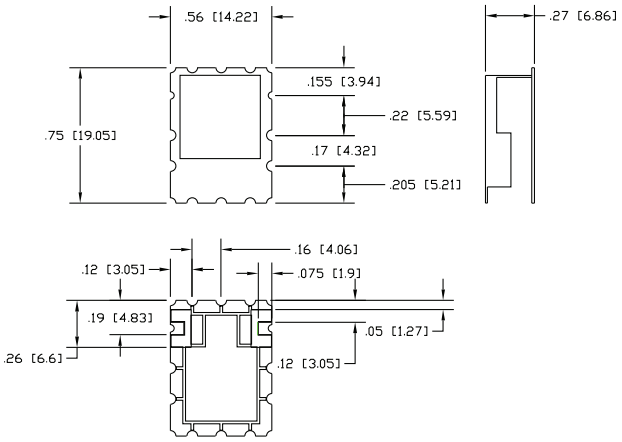
* Notes: Ground planes should be achieved via. plated thru holes.

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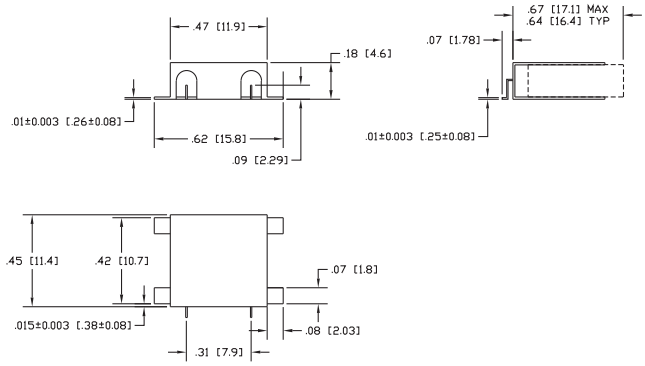
◆ Mechanical — Note: Dimensions for 1000 MHz filters shown



KEL-fil®: 3DR25-1000/U20-1.8

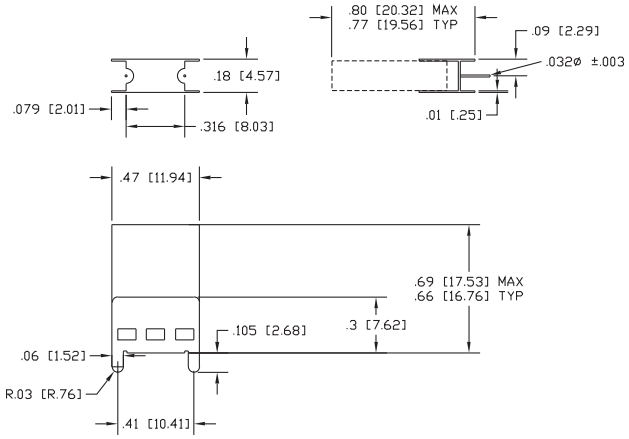
Leadless Surface Mount - Series 5

This mounting configuration offers best isolation.



KEL-fil®: 3DR23-1000/U20-1.8

Surface Mounting - Tab



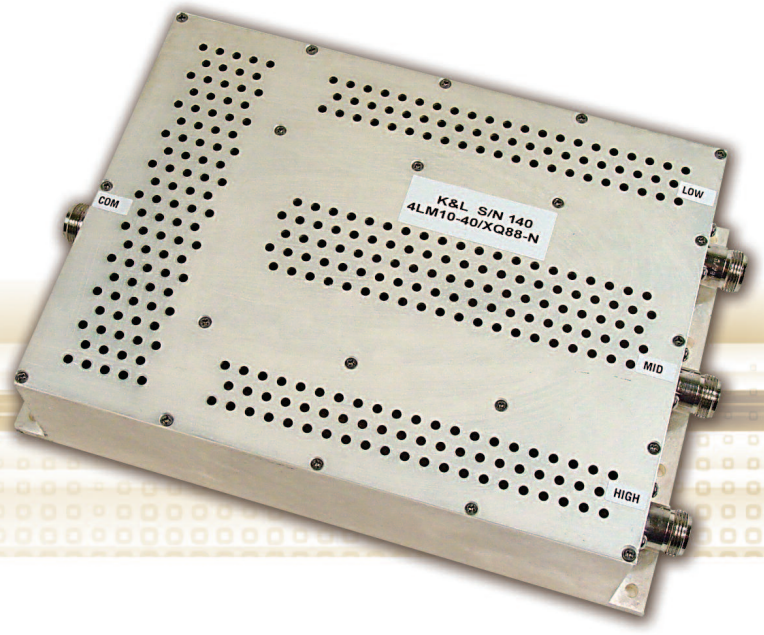
KEL-fil®: 3DR21-1000/U20-1.8

Drop in (PC) Mounting

Multiplexers

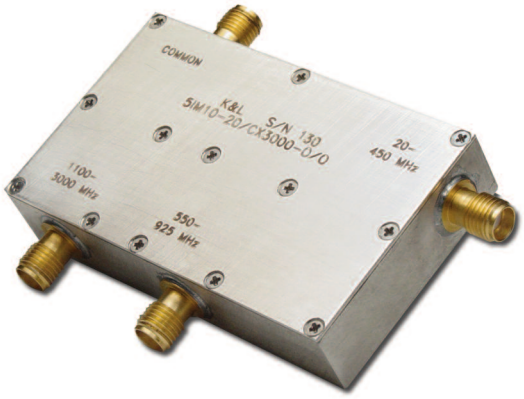
From low frequency highpass and lowpass multiplexers to high frequency multiple channel bandpass multiplexers, K&L Microwave has developed devices that satisfy a broad range of applications. Non-contiguous bandpass multiplexers with passbands from 1 to 18 GHz have been implemented using combline filters. In high frequency contiguous applications, K&L's range of broadband suspended substrate devices excel.

Through the use of Chebychev, elliptic, and pole-placed filters, in distributed or lumped form, many different types of responses can be integrated into multiplexers, thereby ensuring the best selectivity and lowest insertion loss possible. By using lumped (IB) technology, bandpass/ bandpass, highpass/lowpass, or bandpass/bandstop multiplexers can be implemented in relatively small packages, and still yield required performance, even at frequencies below 100 MHz.



Overview:

A microwave and RF multiplexer is a multi-channel module combining several filters to a common port, usually the antenna port. Its block diagram consists of two parts: a distribution system, called the manifold, and a group of filters, which may include lowpass, highpass, bandpass, and bandstop. A multiplexer must fulfill two main requirements. First, a multiplexer must exhibit each channel's transfer function as if it were a standalone device. Second, a multiplexer must preserve impedance matching at the common port over the bands of interest. While the second requirement is often straightforward for narrow-band applications, it becomes an art for many wide-band scenarios, given that wide-band manifolds may contain power-dividers and couplers, ferrites, and dummy filters, in addition to transmission lines. Software simulation is used to synthesize and analyze multiplexer designs prior to manufacture.

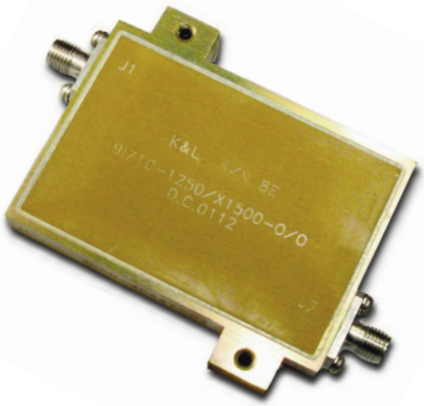


Multiplexer channel-to-channel behavior may be categorized as follows:

- ***Overlapping Channels,*** with some bandwidths shared by three ports.

- ***Contiguous Channels,*** with adjacent channels joined at their 3dBc point.

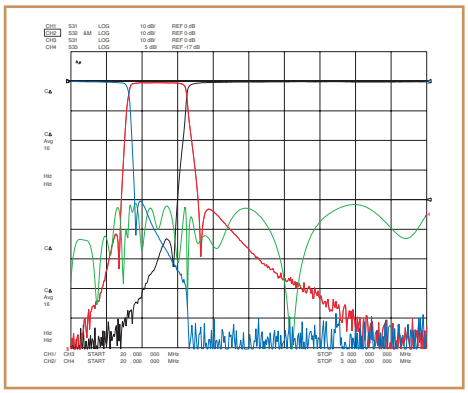
- ***Non-Contiguous Channels,*** with a separating spectrum, or "guard band," between adjacent channel pairs.



Through advanced synthesis, multiplexers are often made from a combination of technologies, such as lumped components, TEM (combline and interdigital), and suspended substrate, to name a few. These options are essential for size and weight reduction while maximizing performances.

5IM10-20/CX300-O/O Triplexer

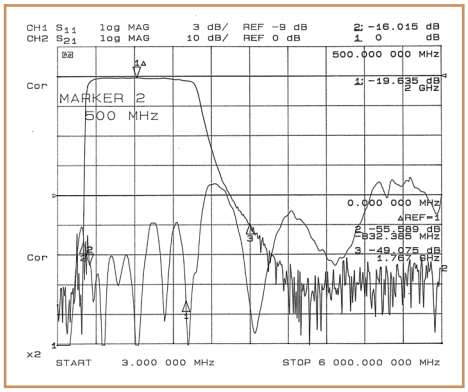
1.0 dB Loss:	@ 20-450 MHz
	@ 550-925 MHz
	@ 1100-300 MHz
VSWR:	
1.34:1	20-3000 MHz



All Passbands

9IZ10-00009 Phase Matched Military Triplexer

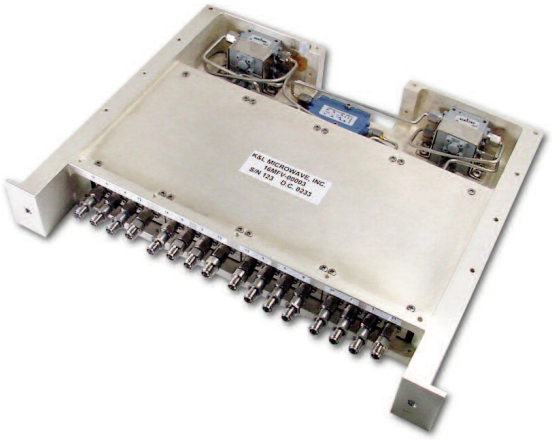
Insertion Loss:			
500-2000 MHz	2 dB Typical		
VSWR:		Rejection:	
200-500 MHz:	2.2:1 Typical	100-400 MHz:	40 dB
500-2000 MHz:	2.2:1 Typical	3000-18000 MHz;	40 dB
2000-6000 MHz:	3.0:1 Typical		



Output VSWR & Passband

16MFV-00003 Channelizing Filter Bank

Frequency Range:	2 to 4 GHz
Channel Spacing:	125 MHz
Amplitude Match	
Channel-to-Channel:	+/- 0.5 dB
1 dB Bandwidth:	125 MHz
Rejection:	
Fc +/- 125 MHz:	50 dB minimum
Insertion Loss:	Typically 8.5 dB per channel
VSWR:	1.5:1 Typical
Passband Ripple:	All Channels +/- 0.5 dB
Max Input Power:	+ 25 dBm
Connectors:	SMA
Temperature:	0° to 70°C (Operational and Non-Operational)
Vibrations:	MIL STD 202 204A
Shock:	MIL STD 202 213A
Humidity:	MIL STD 202 103A

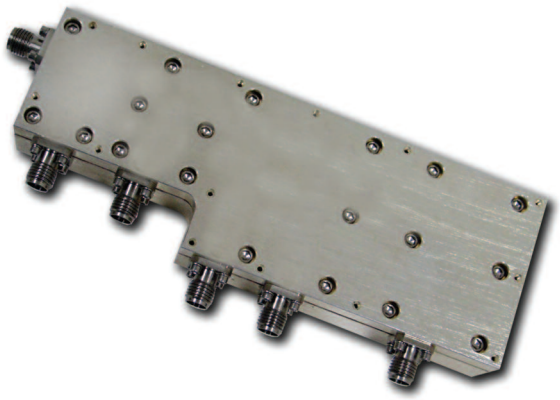


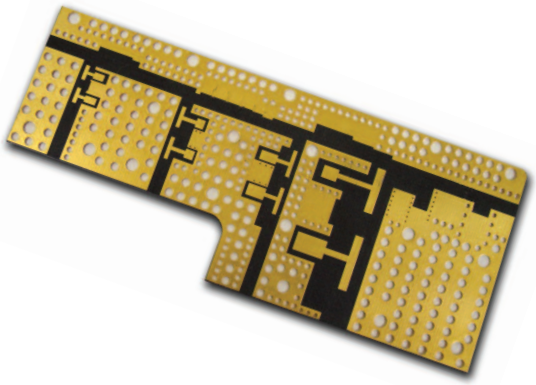
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Features - Suspended Substrate:

- Broadband (can be wider than a decade)
- Pseudo-elliptic transfer functions
- Printed circuit, therefore excellent reproducibility
- Individual highpass/lowpass diplexers can be cascaded to make n-channel multiplexers
- Minimal tuning
- All complexity is confined to printed circuit board and milled housing (CNC machines)





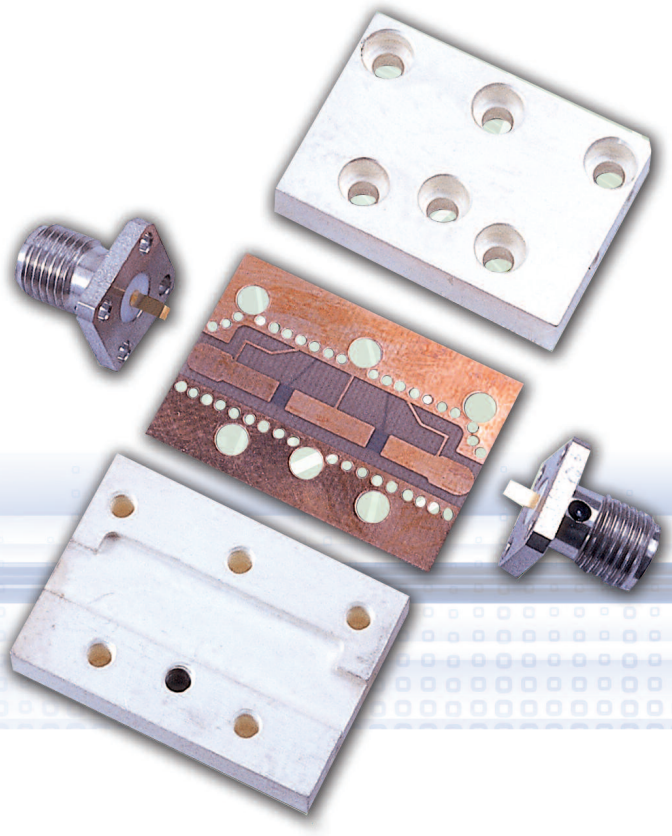
Specifications:

- Define crossover frequencies, actual crossover frequencies within ±1%
- Passband up to crossover ±5%
- Passband insertion loss < 1 dB
- Rejection loss > 10 dB
- Rejection > 60 dB with 15% of crossover
- Crossover insertion loss < 5 dB
- Good temperature stability

Suspended Substrate Filters

The suspended substrate medium is useful for realizing broadband, highly-selective filters. Its main advantages are small size, high "Q" and good temperature stability. Selectivity of 50 dBc at only 15% from the band edge is achievable. Highpass and lowpass filters can be interconnected to form broadband bandpass filters or diplexers. Several other structures can be printed on suspended substrate, including combline filters, interdigital filters, hairpin filters and bandstop (notch) filters. Initially, the dual-sided board is clad with copper and then the structure is photo-etched onto it. Since the filter characteristics are determined solely by the mechanical accuracy of the housing and the printed circuit board, excellent reproducibility can be achieved by using a suspended substrate approach.

Suspended substrate filters will meet all relevant military specifications, provided proper care is taken at the design stage. These designs exhibit better temperature stability than other printed circuit realizations since the fields are mainly in air rather than in a dielectric. Interior walls in the housing hold the circuit and prevent movement that could be caused by vibration or mechanical shock. K&L's suspended substrate filters complement existing product lines as a general purpose, and are a high performance alternative to traditional broadband component filters and multiplexers.



Features:

- Broadband Design
- Covers 3 GHz to 12 GHz Center Frequency Range
- IL Passband from 50 to 100%
  (See table below for examples)
- Excellent Environmental Performance
- Ruggedized Package Design
- Custom Designs Available*



Specifications:

Passband @ ≤1 dB (GHz)	VSWR	Avg. Power (Watts)	Shape Factor (3 dB-30 dB)	Impedance (Ohms)	**Dimensions Inches/mm		
					L	W	H
2 - 6	2:1	15	1.3:1*	50	2.1 / 53.3	1.4 / 35.6	0.5 / 12.7
2 - 8	2:1	15	1.3:1*	50	1.9 / 48.3	1.2 / 30.5	0.5 / 12.7
6 - 12	2:1	15	1.3:1*	50	2.0 / 50.8	0.9 / 22.9	0.5 / 12.7
6 - 18	2:1	15	1.3:1*	50	1.6 / 40.6	0.9 / 22.9	0.5 / 12.7

Shock:	20 G's, 1/2 Sine, 11 Ms
Vibration:	10 G's, 10 HZ - 2000 Hz
Temperature:	-55 to +85°C
Rel. Humidity:	0 — 95%

* Designs also available to offer 3 dB - 50 dB shape factor up to 1.15:1. Contact factory for details.
** Dimensions are determined with SMA connectors. Contact the factory for custom requirements.

To Order:

11	S	B	10	—	4000	/	T	4000	—	O	/	O
1	2	3	4		5		6	7		8		9

Code	Description
1	Number of Elements
2	Suspended Substrate
3	Series (Bandpass)
4	Package (Contact Factory)
5	Center Frequency
6	Supplemental Codes (See Page 13)
7	Bandwidth
8	Input Connector
9	Output Connector

Connectors:

Connector	Code
SMA Female	O
SMA Male	OP
N Female	N
N Male	NP

Highpass — SH Series

Features:

- Covers 2 GHz to 18 GHz Frequency Range
- Excellent Environmental Performance
- Ruggedized Package Design
- Custom Designs Available*



Specifications:

3 dB Cut Off (GHz)	Passband @ ≤ 1 dB (GHz)	VSWR	Avg. Power (Watts)	Shape Factor (3 dB-30 dB)	Impedance (Ohms)	**Dimensions Inches / mm		
						L	W	H
2	2.2 - 12	2:1	15	1.3:1*	50	1.5 / 38.1	1.3 / 33.0	0.5 / 12.7
3	3.3 - 12	2:1	15	1.3:1*	50	1.4 / 35.6	1.2 / 30.5	0.5 / 12.7
4	4.4 - 12	2:1	15	1.3:1*	50	1.25 / 31.8	1.1 / 27.9	0.5 / 12.7
5	5.5 - 16	2:1	15	1.3:1*	50	1.3 / 33.0	1.0 / 25.4	0.5 / 12.7
6	6.6 - 18	2:1	15	1.3:1*	50	1.3 / 33.0	1.0 / 25.4	0.5 / 12.7
7	7.7 - 18	2:1	15	1.3:1*	50	1.2 / 30.5	1.0 / 25.4	0.5 / 12.7
8	8.8 - 18	2:1	15	1.3:1*	50	1.2 / 30.5	1.0 / 25.4	0.5 / 12.7
9	9.9 - 18	2:1	15	1.3:1*	50	1.2 / 30.5	1.0 / 25.4	0.5 / 12.7
10	11 - 18	2:1	15	1.3:1*	50	1.1 / 27.9	0.9 / 22.9	0.5 / 12.7
11	12.1 - 18	2:1	15	1.3:1*	50	1.1 / 27.9	0.85 / 21.6	0.5 / 12.7
12	13.2 - 18	2:1	15	1.3:1*	50	1.0 / 25.4	0.85 / 21.6	0.5 / 12.7

Shock:	20 G's, 1/2 Sine, 11Ms
Vibration:	10 G's, 10 HZ - 2000 Hz
Temperature:	-55 to +85°C
Rel. Humidity:	0 — 95%

* Designs also available to offer 3 dB - 50 dB shape factor up to 1.15:1. Contact factory for details.
** Dimensions are determined with SMA connectors. Contact the factory for custom requirements.

To Order:

11	S	H	10	—	2000	/	T	6000	—	O	/	O
1	2	3	4		5		6	7		8		9

Code	Description
1	Number of Elements
2	Suspended Substrate
3	Series (Highpass)
4	Package (Contact Factory)
5	Lower Limit at -3 dB
6	Supplemental Codes (See Page 13)
7	Upper Passband Limit
8	Input Connector
9	Output Connector

Connectors:

Connector	Code
SMA Female	O
SMA Male	OP
N Female	N
N Male	NP

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Phone: 410-749-2424 • FAX: 443-260-2268
Email: sales@klmicrowave.com

www.klfilterwizard.com
2250 Northwood Drive
Salisbury, MD 21801

Features:

- Covers 2 GHz to 18 GHz Frequency Range
- Excellent Environmental Performance
- Ruggedized Package Design
- Custom Designs Available*



Specifications:

3 dB Cut Off (GHz)	Passband @ ≤ 1 dB (GHz)	VSWR	Avg. Power (Watts)	Shape Factor (3 dB-30 dB)	Impedance (Ohms)	**Dimensions Inches / mm			Shock	Vibration	Temp.	Rel. Humidity
						L	W	H				
2	DC - 1.8	2:1	15	1.3:1*	50	2.0/50.8	1.5/38.1	0.5/12.7	20 G's, 1/2 Sine, 11 Ms	10 G's, 10 HZ - 2000 Hz	-55 to +85°C	0 — 95%
3	DC - 2.7	2:1	15	1.3:1*	50	1.9/48.3	1.3/33.0	0.5/12.7				
4	DC - 3.6	2:1	15	1.3:1*	50	1.8/45.7	1.0/25.4	0.5/12.7				
5	DC - 4.5	2:1	15	1.3:1*	50	1.5/38.1	1.0/25.4	0.5/12.7				
6	DC - 5.4	2:1	15	1.3:1*	50	1.3/33.0	0.9/22.9	0.5/12.7				
7	DC - 6.3	2:1	15	1.3:1*	50	1.1/27.9	0.8/20.3	0.5/12.7				
8	DC - 7.2	2:1	15	1.3:1*	50	1.1/27.9	0.75/19	0.5/12.7				
9	DC - 8.1	2:1	15	1.3:1*	50	1.1/27.9	0.75/19	0.5/12.7				
10	DC - 9	2:1	15	1.3:1*	50	1.0/25.4	0.7/17.8	0.5/12.7				
11	DC - 9.9	2:1	15	1.3:1*	50	1.0/25.4	0.7/17.8	0.5/12.7				
12	DC - 10.8	2:1	15	1.3:1*	50	1.0/25.4	0.65/16.5	0.5/12.7				
13	DC - 11.7	2:1	15	1.3:1*	50	0.9/22.9	0.65/16.5	0.5/12.7				
14	DC - 12.6	2:1	15	1.3:1*	50	0.9/22.9	0.65/16.5	0.5/12.7				
15	DC - 13.5	2:1	15	1.3:1*	50	0.9/22.9	0.6/15.2	0.5/12.7				
16	DC - 14.4	2:1	15	1.3:1*	50	0.9/22.9	0.65/16.5	0.5/12.7				
17	DC - 15.3	2:1	15	1.3:1*	50	0.9/22.9	0.65/16.5	0.5/12.7				
18	DC - 16.2	2:1	15	1.3:1*	50	.85/21.6	0.6/15.2	0.5/12.7				

* Designs also available to offer 3 dB - 50 dB shape factor up to 1.15:1. Contact factory for details.
** Dimensions are determined with SMA connectors. Contact the factory for custom requirements.

To Order:

11	S	L	10	—	2000	/	T	2600	—	O	/	O
1	2	3	4		5		6	7		8		9

Connectors:

Connector	Code
SMA Female	O
SMA Male	OP
N Female	N
N Male	NP

Code	Description
1	Number of Elements
2	Suspended Substrate
3	Series (Lowpass)
4	Package (Contact Factory)
5	3 dB Cutoff Frequency
6	Supplemental Codes (See Page 13)
7	Upper Stopband Limit
8	Input Connector
9	Output Connector

Diplexers — SZ Series

Features:

- Covers 2 GHz to 18 GHz Frequency Range
- Excellent Environmental Performance
- Ruggedized Package Design
- Custom Designs Available*



Specifications:

5 dB Nom. Crossover Frequency (GHz)	Passband @ ≤ 1 dB (GHz)	VSWR	Avg. Power (Watts)	Shape Factor (3 dB-30 dB)	Impedance (Ohms)	**Dimensions Inches / mm		
						L	W	H
2	DC - 1.9 2.1 - 4	2:1	15	1.3:1*	50	2.6 / 66.0	1.4 / 35.5	0.5 / 12.7
4	DC - 3.8 4.2 - 8	2:1	15	1.3:1*	50	1.8 / 45.7	1.3 / 33.0	0.5 / 12.7
6	DC - 5.7 6.3 - 18	2:1	15	1.3:1*	50	1.6 / 40.6	1.6 / 40.6	0.5 / 12.7
8	DC - 7.6 8.4 - 18	2:1	15	1.3:1*	50	1.4 / 35.6	1.4 / 35.6	0.5 / 12.7
10	DC - 9.5 10.5 - 16	2:1	15	1.3:1*	50	1.3 / 33.0	1.3 / 33.0	0.5 / 12.7
12	DC - 11.6 12.6 - 18	2:1	15	1.3:1*	50	1.2 / 30.0	1.2 / 30.0	0.5 / 12.7

Shock:	20 G's, 1/2 Sine, 11Ms
Vibration:	10 G's, 10 HZ - 2000 Hz
Temperature:	-55 to +85°C
Rel. Humidity:	0 — 95%

* Designs also available to offer 3 dB - 50 dB shape factor up to 1.15:1. Contact factory for details.
** Dimensions are determined with SMA connectors. Contact the factory for custom requirements.

To Order:

11	S	Z	10	—	2000	/	T	4000	—	O	/	O
1	2	3	4		5		6	7		8		9

Code	Description
1	Number of Elements
2	Suspended Substrate
3	Series (Diplexer)
4	Package (Contact Factory)
5	Crossover at -5 dB
6	Supplemental Codes (See Page 13)
7	Upper Passband Limit
8	Input Connector
9	Output Connector

Connectors:

Connector	Code
SMA Female	O
SMA Male	OP
N Female	N
N Male	NP

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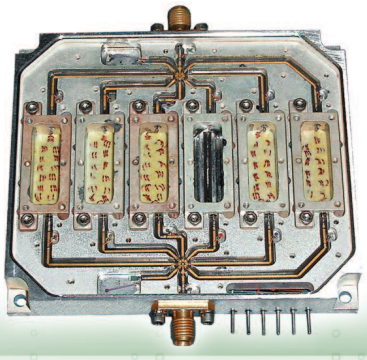
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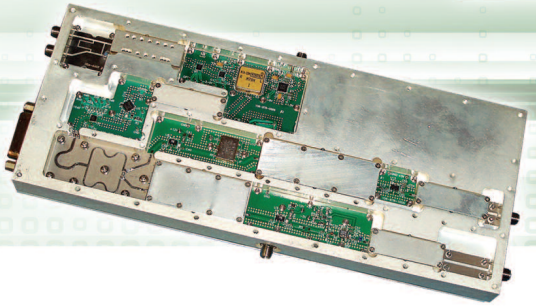
Multi-Function Assemblies

K&L Microwave offers a variety of Multi-Function Assemblies (MFA) products to satisfy a broad range of filtering applications. Many applications require frequency pre-selection at the front end of the communication or test and measurement system. Tunable Bandpass and Bandreject filters provide the best solution for pre-tuning the desired signals while rejecting the interfering signals. The method of tuning can be either mechanical via a tuning knob mounted on the front of the filter, or electro-mechanical via an optional remote digital interface such as GPIB, RS-232, RS-422 or BCD. Tunable filters can be offered to cover frequencies as low as 200 KHz, or as high as STAT GHz. K&L Microwave offers Tunable Filters from stock, which cover many popular frequencies for applications such as military communications and many popular wireless bands. Depending on the specific application, the tuning ranges can exceed an octave.

For many customer specific applications, K&L Microwave offers the ability to configure filters into an integrated product assembly. These MFA products range from electromechanically tuned diplexers and multicouplers to frequency agile filters and switched filter banks. Although many integrated products are engineered to order, many of the designs are derivatives of existing products, thus allowing the development cycle time to be kept to a minimum. MFA products provide the customer with the freedom to allow K&L Microwave to offer a turnkey solution to their more complex filtering requirements.

With this product base, K&L offers filter solutions for applications ranging from automated test labs to more complicated applications such as point-to-point communication and broadband signal analysis.



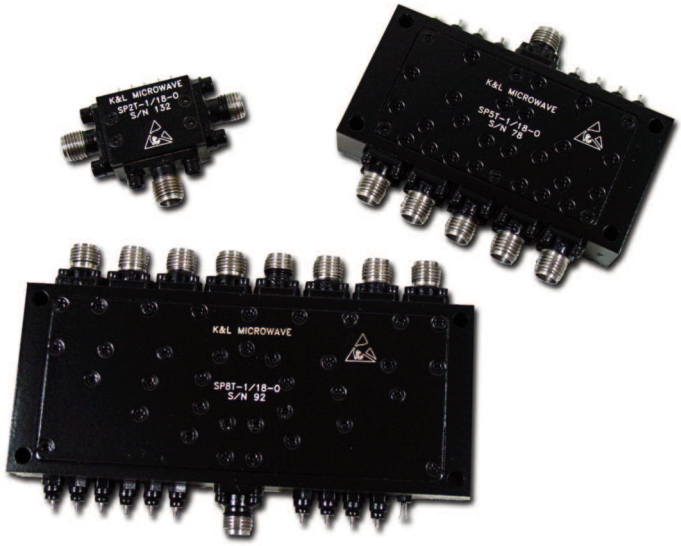




PIN Diode Switches

PIN Diode Switches

After producing quality PIN diode switches in-house for many years, K&L Microwave is pleased to offer packaged options for customer applications. The offerings below are intended to highlight standard products, however, with our extensive in-house capabilities, custom parts are also available. Please contact your local representative or K&L Microwave if you would like a quotation on any of the products listed below or if you need information for your custom application.



Specifications:

K&L Model	Frequency Range (MHz)	Insertion Loss at f_0	VSWR	Isolation	Switching Speed	Power Handling
SP	100 to 27000	1.0 to 5.0 dB	1.5:1 to 2.0:1	60 to 80 dB	100 to 500 nsec max	0.5 to 1 watt

Bias Voltage	DC Control	Connectors
(+5V +/- 0.5V) (-15V +/-3V)	TTL	SMA Females

Custom configurations (double throw, multi throw, and high power) versions also available. Contact the factory for custom requirements.

To Order:

SP 2T - 0.1 / 1 - O
1 2 3 4 5

Code	Description
1	Series
2	Number of Throws
3	Start Frequency
4	Stop Frequency
5	Connector Type

* Add - NR to part number for non-reflective unit; low video trans options

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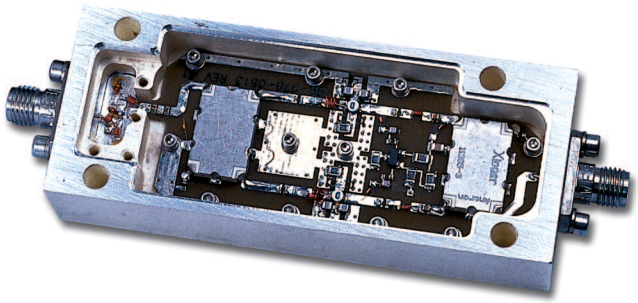
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2250 Northwood Drive
Salisbury, MD 21801

◆ Features:

- Integrated Assemblies Designed for Customer Specific Applications
- Systems Available Include Multichannel Switched Filter Banks, Tunable Filter Assemblies, Amplifier Assemblies and Tunable Multicoupler Assemblies
- Digital Control Options Include TTL, BDC, RS-232, RS-422 and GPIB.
- Designs Based on Standard Products Integrated into Complex Assemblies
- Offers Turn-key Solutions to Advanced Filtering Requirements

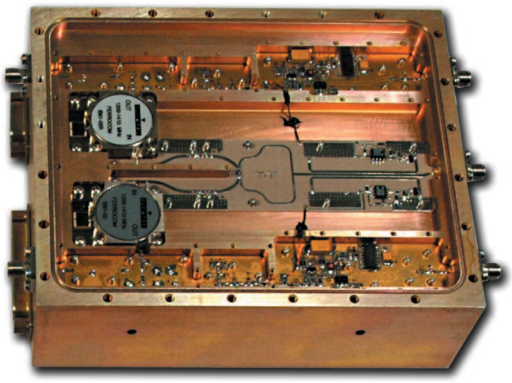
◆ GPS-Preamplifier:

The K&L GPS preamplifier provides a filtered low noise gain solution for GPS applications. A broadband filter allows selection of the desired GPS signals while rejecting unwanted out-of-band signals. The pre-amp also offers in-band RF power protection thru the use of limiter diodes up to 100 watts. The low noise gain stage maintains the receiver sensitivity. The pre-amp is powered by DC voltage applied to the center conductor of the output connector. The unit can also be powered through an external DC bias pin or connector.



◆ Up-Converter / Down-Converter

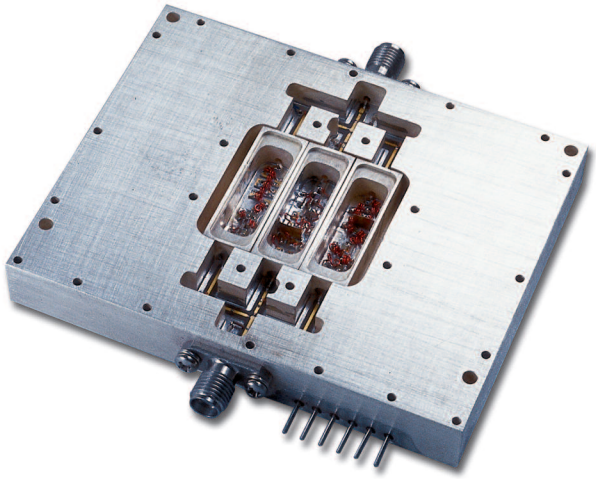
K&L Microwave's custom converter assembly designs draw on more than 30 years of filtering experience to provide spurious-free frequency conversion. Integrations employ state-of-the-art RF, analog and digital technologies to maximize performance while minimizing size. Assemblies are configured from proven modular designs consisting of amplifiers, switches, multipliers, couplers and limiters. To reduce lead times, K&L's manufacturing facilities utilize a high level of vertical integration, including machining, plating, assembly and environmental testing capabilities.



Integrated Products

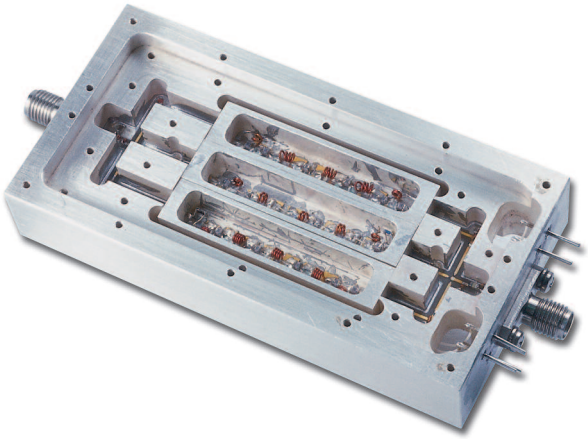
◆ 3 Channel Switched Filter Bank:

The 3SFB-1750/8250-0/0 is a TTL controlled 3 channel switched filter bank. This unit features chip and wire technology up to 8.25 GHz. It features 5 dB max insertion loss and 60 dB ultimate rejection. This unit also has a 400 ns max switching speed.



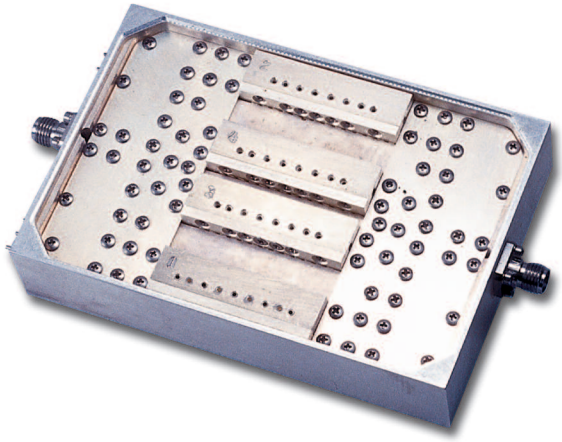
◆ 3-Channel Switched Filter Bank:

The 3SFB-1100/2100-0/0 is a 3 channel switched filter bank with channels centered at 1100, 1900 and 2100 MHz. The unit is TTL controlled and features low insertion loss and amplitude matching. This unit is modular constructed to allow various types of filtering in the same package configuration.



◆ 4 Channel Switched Filter Bank:

The 4SFB-10000/18000-0/0 is a TTL controlled 4 channel switched filter bank that covers 10 to 18 GHz in 4 equal bands. This unit maintains 70 dB rejection and is laser sealed and painted for the military environment.



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1% Tunable Bandpass Filters — BT Series

◆ Features:

- Available From Stock
- Manual Frequency Selection
- Direct-readout Center Frequency Dial
- 5 Section, Chebyshev Filter Response
- Digitally Controlled Versions Available



◆ Applications:

- ATE Labs
- Wireless Communications
- CATV Test Verification
- Surveillance

◆ Specifications:

K&L Model	Frequency Range (MHz)	Insertion Loss at f_0	Length Inch/mm	Width Inch/mm	Height Inch/mm
5BT-500/1000-1-N/N	500-1000	2.0 dB Max	9.80/249	5.38/137	2.75/50
5BT-1000/2000-1-N/N	1000-2000	2.5 dB Max	7.38/187	2.88/73	2.75/50
5BT-1500/3000-1-N/N	1500-3000	2.75 dB Max	7.38/187	2.88/73	2.75/50

Type	Nominal 3 dB BW	VSWR at f_0	Impedance	Shape Factor 30 dB to 3 dB / 50 dB to 3 dB	Power Handling at f_0	Dial Accuracy	RF Connector
5 Section	1%	1.5:1	50 Ohms	2.2:1 / 3.5:1	10 Watts CW	+/- 1%	Type N

Custom configurations and ruggedized versions also available. Contact the factory for custom requirements.

5% Tunable Bandpass Filters — BT Series

Features:

- Available From Stock
- Manual Frequency Selection
- Direct-readout Center Frequency Dial
- 5 Section, Chebyshev Filter Response
- Digitally Controlled Versions Available



Applications:

- ATE Labs
- Wireless Communications
- CATV Test Verification
- Surveillance

Specifications:

K&L Model	Frequency Range (MHz)	Insertion Loss at f_0	Length Inch/mm	Width Inch/mm	Height Inch/mm
5BT-24/48-5-N/N	24-48	1.3 dB Max	9.80/249	5.38/137	2.75/50
5BT-30/76-5-N/N	30-76	1.3 dB Max	9.80/249	5.38/137	2.75/50
5BT-48/95-5-N/N	48-95	1.3 dB Max	9.80/249	9.80/137	2.75/50
5BT-63/125-5-N/N	63-125	1.3 dB Max	9.80/249	5.38/137	2.75/50
5BT-95/190-5-N/N	95-190	1.3 dB Max	9.80/249	5.38/137	2.75/50
5BT-125/250-5-N/N	125-250	1.3 dB Max	9.80/249	5.38/137	2.75/50
5BT-190/375-5-N/N	190-375	1.3 dB Max	9.80/249	5.38/137	2.75/50
5BT-250/500-5-N/N	250-500	1.0 dB Max	9.80/249	5.38/137	2.75/50
5BT-375/750-5-N/N	375-750	1.0 dB Max	9.80/249	5.38/137	2.75/50
5BT-500/1000-5-N/N	500-1000	1.0 dB Max	9.80/249	5.38/137	2.75/50
5BT-750/1500-5-N/N	750-1500	1.0 dB Max	9.80/249	5.38/137	2.75/50
5BT-1000/2000-5-N/N	1000-2000	1.0 dB Max	7.38/187	2.88/73	2.75/50
5BT-1200/2600-5-N/N	1200-2600	1.0 dB Max	7.38/187	2.88/73	2.75/50
5BT-1500/3000-5-N/N	1500-3000	1.0 dB Max	7.38/187	2.88/73	2.75/50

Type	Nominal 3 dB BW	VSWR at f_0	Impedance	Shape Factor 30 dB to 3 dB / 50 dB to 3 dB	Power Handling at f_0	Dial Accuracy	RF Connector
5 Section	5%	1.5:1	50 Ohms	2.2:1 / 3.5:1	50 Watts CW	+/- 1%	Type N

Custom configurations and ruggedized versions also available. Contact the factory for custom requirements.

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Phone: 410-749-2424 • FAX: 443-260-2268
Email: sales@klmicrowave.com

www.klfilterwizard.com
2250 Northwood Drive
Salisbury, MD 21801

Tunable Bandreject (Notch) Filters — TNF Series

Features:

- Available From Stock
- Manual Frequency Selection
- Direct-readout Center Frequency Dial
- Greater than 45 dB Attenuation Typical
- Digitally Controlled Versions Available



Applications:

- ATE Labs
- Wireless Communications

Specifications:

K&L Model	Frequency Range (MHz)	Type	3 dB BW Range (MHz) (Relative)	40 dB Min. BW (KHz) (Relative)	Typ. Notch Depth (Relative)	Length Inch/mm	Width Inch/mm	Height Inch/mm
3TNF-30/76-N/N	30-76	3 Sec.	1-2.5	100	50 dB	6.56/167	5.38/137	2.75/70
3TNF-50/100-N/N	50-100	3 Sec.	3-6	300	50 dB	6.56/167	5.38/137	2.75/70
3TNF-100/200-N/N	100-200	3 Sec.	3-6	300	50 dB	6.56/167	5.38/137	2.75/70
3TNF-200/400-N/N	200-400	3 Sec.	3-7	300	50 dB	6.56/167	5.38/137	2.75/70
3TNF-250/500-N/N	250-500	3 Sec.	3-7	300	50 dB	6.56/167	5.38/137	2.75/70
3TNF-500/1000-N/N	500-1000	3 Sec.	6-16	400	45 dB	6.56/167	5.38/137	2.75/70
3TNF-800/1000-0.2-N/N	800-1000	3 Sec.	1.6-2.6	N/A	40 dB	6.56/167	5.38/137	2.75/70
3TNF-1000/2000-N/N	1000-2000	3 Sec.	9-24	400	45 dB	6.56/167	2.88/73	2.75/70
3TNF-1500/3000-N/N	1500-3000	3 Sec.	10-27	800	50 dB	5.36/136	2.81/71	2.53/64
5TNF-1700/2000-0.1-N/N	1700-2000	5 Sec.	3-3.6	N/A	30 dB	7.39/188	3.31/84	2.75/70

Passband VSWR	Insertion Loss	Impedance	Power Handling (within Passband)	Dial Accuracy	RF Connector
1.5:1	< 0.5 dB	50 Ohms	50 Watts CW	+/- 1%	Type N

Custom configurations and ruggedized versions also available. Contact the factory for custom requirements.

High Frequency Tunable Bandpass — CTB Series

Features:

- Manually Controlled
- High Performance Coaxial Cavity Design
- Multiple Tuning Ranges Available



Specifications:

K&L Model Bandpass	Frequency Range (MHz)	Insertion Loss at f_0 (typical)	Insertion Loss at f_0 (max)	3 dB Bandwidth (nominal)	VSWR at f_0 (typical)	Approx. Size X Y Z (inches)
5CTB-2000/4000-1-N/N	2000 - 4000	1.25 dB	1.75 dB	1%	1.5:1	8.02 x 7.26 x 3.01
5CTB-4000/6000-1-N/N	4000 - 6000	2.25 dB	2.75 dB	1%	1.5:1	6.75 x 5.36 x 3.01
5CTB-6000/8000-1-N/N	6000 - 8000	TBD	TBD	1%	1.5:1	6.75 x 5.36 x 3.01
5CTB-2000/4000-2-N/N	2000 - 4000	0.75 dB	1.25 dB	2%	1.5:1	8.02 x 7.26 x 3.01
5CTB-4000/6000-2-N/N	4000 - 6000	1.25 dB	1.75 dB	2%	1.5:1	6.75 x 5.36 x 3.01
5CTB-6000/8000-2-N/N	6000 - 8000	TBD	TBD	2%	1.5:1	6.75 x 5.36 x 3.01
5CTB-2000/4000-5-N/N	2000 - 4000	0.4 dB	1.0 dB	5%	1.5:1	8.02 x 7.26 x 3.01
5CTB-4000/6000-5-N/N	4000 - 6000	0.5 dB	1.0 dB	5%	1.5:1	6.75 x 5.36 x 3.01
5CTB-6000/8000-5-N/N	6000 - 8000	TBD	TBD	5%	1.5:1	6.75 x 5.36 x 3.01
Filter Type:	**5-Section Bandpass**					
Shape Factor (30 dB to 3 dB/ 50 dB to 3 dB):	**2.2:1/3.5:1**					
Impedance:	**50 ohms**					
RF Connectors:	**Type N standard, SMA optional**					

Applications:

- Test and Measurement Facilities
- Troubleshooting Co-location Environments
- Wireless Communications

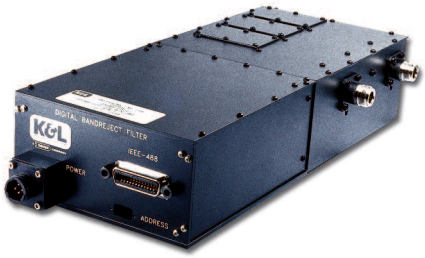
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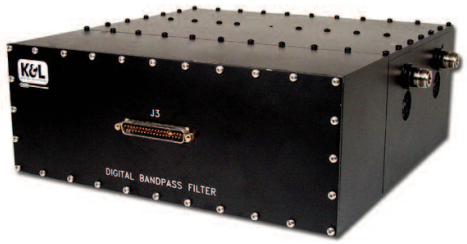
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Digitally Controlled Tunable Filters

K&L Microwave offers a variety of Tunable Filter Products to satisfy a broad range of filtering applications. Tunable Bandpass and Bandreject filters provide the best solution for pre-tuning the desired signals while rejecting the interfering signals. The method of tuning can be either mechanical via a tuning knob mounted on the front of the filter, or electro-mechanical via an optional remote digital interface such as GPIB, RS-232, RS-422, BCD, ARC171, ARC234, Ethernet, USB or "Thumbwheel" panel mount.

Tunable filters can be offered to cover frequencies as low as 800 KHz, or as high as 18 GHz. K&L Microwave offers Tunable Filters from stock, which cover many popular frequencies for applications such as military communications and wireless bands. Depending on the specific application, the tuning ranges can exceed an octave.





Control Logic:

Format	Code
RS232 (serial)	A
RS422 (serial)	B
BCD (parallel)	E
Binary (parallel)	F
IEEE-488 (parallel)	G
ARC171	H*
ARC234	J*
Thumbwheel	K
Ethernet	L
USB	M

Drive Voltage Key/Code:

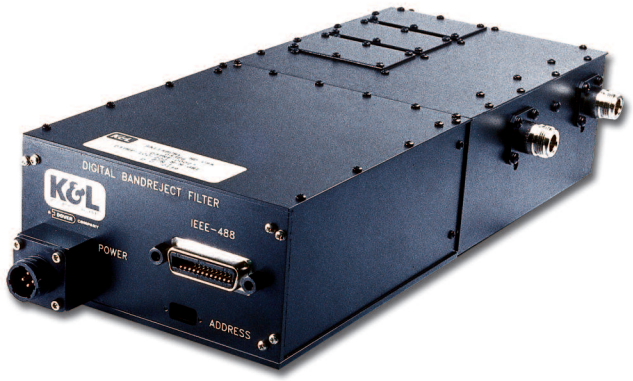
Voltage	Code
12-14 VDC	Q
24-28 VDC	R
110 VAC	S
220 VAC	T

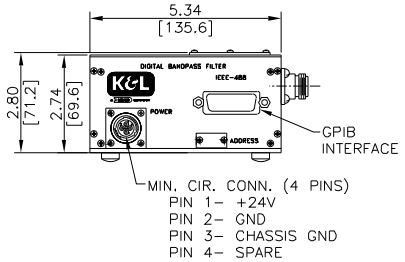
* Non-standard longer lead time option

Digitally Controlled Tunable Bandpass Filters

◆ Features:

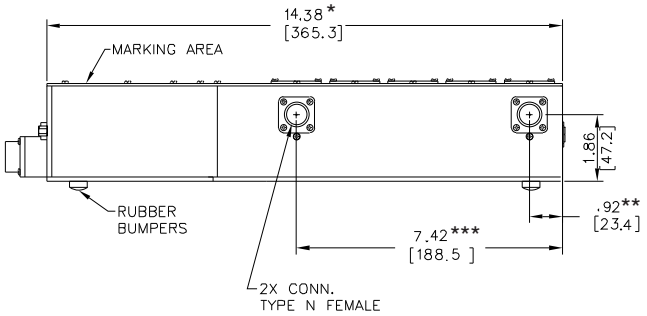
- Digital Control Allows Complete Automated Operation Via Remote Interfaces.
- GPIB (IEE-488) Standard Remote Interface, RS-232, RS-422, and BCD also Available.
- 24 VDC Standard Drive Voltage, 12 VDC, and 110 VAC also Available
- Contact Factory for Custom Tuning Ranges and Configurations.





◆ Applications:

- ATE Labs
- Wireless Communications
- Military Communications



D5BT-1200/2600-5-N/N-GRI =
* Length is 11.92" (303mm)
** Connector Diameter is .67" (17mm)
*** Connector Diameter is 5.17" (131mm)

◆ Specifications:

K&L Model Bandpass	Frequency Range (MHz)	Maximum Insertion Loss @ f_0	3 dB BW	VSWR	Shape Factor 30 dB to 3 dB / 50 dB to 3 dB	Power Handling @ f_0
D5BT-30/76-5-N/N-GRI	30-76	1.3 dB Max	5%	1.5:1	2.2:1 / 3.5:1	50 Watts CW
D5BT-63/125-5-N/N-GRI	63-125	1.3 dB Max	5%	1.5:1	2.2:1 / 3.5:1	50 Watts CW
D5BT-125/250-5-N/N-GRI	125-250	1.3 dB Max	5%	1.5:1	2.2:1 / 3.5:1	50 Watts CW
D5BT-250/500-5-N/N-GRI	250-500	1.0 dB Max	5%	1.5:1	2.2:1 / 3.5:1	50 Watts CW
D5BT-375/750-5-N/N-GRI	375-750	1.0 dB Max	5%	1.5:1	2.2:1 / 3.5:1	50 Watts CW
D5BT-500/1000-5-N/N-GRI	500-1000	1.0 dB Max	5%	1.5:1	2.2:1 / 3.5:1	50 Watts CW
D5BT-750/1500-5-N/N-GRI	750-1500	1.0 dB Max	5%	1.5:1	2.2:1 / 3.5:1	50 Watts CW
D5BT-1000/2000-5-N/N-GRI	1000-2000	1.0 dB Max	5%	1.5:1	2.2:1 / 3.5:1	50 Watts CW
D5BT-1200/2600-5-N/N-GRI	1200-2600	1.0 dB Max	5%	1.5:1	2.2:1 / 3.5:1	50 Watts CW

Filter Type:	5 Section Bandpass
Impedance:	50 Ohms
RF Connectors:	Type N Standard, SMA/TNC/BNC Optional
Digital Interface:	GPIB Standard, RS-232 / RS-422 / BCD Optional
Control Power:	24 VDC Standard, 12 VDC / 110 VAC Optional

Custom configurations and ruggedized versions also available. Contact the factory for custom requirements.

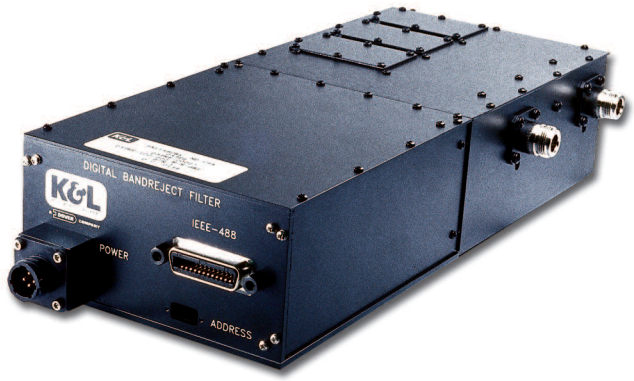
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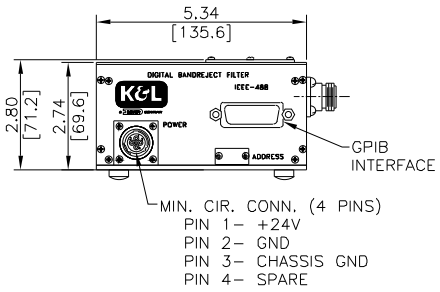
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Digitally Controlled Tunable Notch Filters

◆ Features:

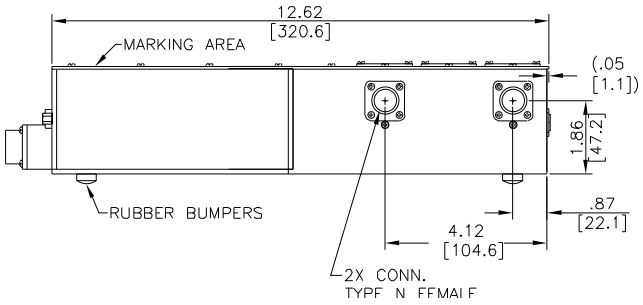
- Digital Control Allows Complete Automated Operation Via Remote Interfaces.
- GPIB (IEE-488) Standard Remote Interface, RS-232, RS-422, and BCD also Available.
- 24 VDC Standard Drive Voltage, 12 VDC, and 110 VAC also Available
- Contact Factory for Custom Tuning Ranges and Configurations.





◆ Applications:

- ATE Labs
- Wireless Communications
- Military Communications



◆ Specifications:

K&L Model Bandreject	Frequency Range (MHz)	Passband Insertion Loss	3 dB BW (MHz) (Relative)	40 dB Min. BW (KHz) (Relative)	Typ. Notch Depth (Relative)	VSWR	Power Handling (within Passband)
D3TNF-30/76-N/N-GRI	30-76	0.5 dB Max	1 - 2.5	100	50 dB	1.5:1	50 Watts CW
D3TNF-50/100-N/N-GRI	50-100	0.5 dB Max	3 - 6	300	50 dB	1.5:1	50 Watts CW
D3TNF-100/200-N/N-GRI	100-200	0.5 dB Max	3 - 6	300	50 dB	1.5:1	50 Watts CW
D3TNF-200/400-N/N-GRI	200-400	0.5 dB Max	3 - 7	300	50 dB	1.5:1	50 Watts CW
D3TNF-250/500-N/N-GRI	250-500	0.5 dB Max	3 - 7	300	50 dB	1.5:1	50 Watts CW
D3TNF-500/1000-N/N-GRI	500-1000	0.5 dB Max	6 - 16	400	45 dB	1.5:1	50 Watts CW
D3TNF-1000/2000-N/N-GRI	1000-2000	0.5 dB Max	9 - 24	400	45 dB	1.5:1	50 Watts CW

Filter Type:	3 Section Notch
Impedance:	50 Ohms
RF Connectors:	Type N Standard, SMA/TNC/BNC Optional
Digital Interface:	GPIB Standard, RS-232 / RS-422 / BCD Optional
Control Power:	24 VDC Standard, 12 VDC / 110 VAC Optional

Custom configurations and ruggedized versions also available. Contact the factory for custom requirements.

Digitally Controlled High Frequency Tunable Filters

Features:

- Digitally Controlled
- High Performance Coaxial Cavity Design
- Multiple Tuning Ranges Available
- Drive Voltages Include 110 VAC (standard), 12 VDC, 24 VDC, 220 VAC
- Remote Interfaces Include GPIB (standard), RS-232, RS-422, and USB



Specifications:

K&L Model Bandpass	Frequency Range (MHz)	Insertion Loss at f_0 (typical)	Insertion Loss at f_0 (max)	3 dB Bandwidth (nominal)	VSWR at f_0 (typical)	Approx. Size X Y Z (inches)
D5CTB-2000/4000-1-N/N-GSI	2000 - 4000	1.25 dB	1.75 dB	1%	1.5:1	7.3 x 12.2 x 3.1
D5CTB-4000/6000-1-N/N-GSI	4000 - 6000	2.25 dB	2.75 dB	1%	1.5:1	5.5 x 10.8 x 3.1
D5CTB-6000/8000-1-N/N-GSI	6000 - 8000	TBD	TBD	1%	1.5:1	5.5 x 10.8 x 3.1
D5CTB-2000/4000-2-N/N-GSI	2000 - 4000	0.75 dB	1.25 dB	2%	1.5:1	7.3 x 12.2 x 3.1
D5CTB-4000/6000-2-N/N-GSI	4000 - 6000	1.25 dB	1.75 dB	2%	1.5:1	5.5 x 10.8 x 3.1
D5CTB-6000/8000-2-N/N-GSI	6000 - 8000	TBD	TBD	2%	1.5:1	5.5 x 10.8 x 3.1
D5CTB-2000/4000-5-N/N-GSI	2000 - 4000	0.4 dB	1.0 dB	5%	1.5:1	7.3 x 12.2 x 3.1
D5CTB-4000/6000-5-N/N-GSI	4000 - 6000	0.5 dB	1.0 dB	5%	1.5:1	5.5 x 10.8 x 3.1
D5CTB-6000/8000-5-N/N-GSI	6000 - 8000	TBD	TBD	5%	1.5:1	5.5 x 10.8 x 3.1
Filter Type:	**5-Section Bandpass**					
Shape Factor (30 dB to 3 dB/ 50 dB to 3 dB):	**2.2:1/3.5:1**					
Impedance:	**50 ohms**					
RF Connectors:	**Type N standard, SMA optional**					
Digital Interface:	**GPIB standard, RS-232, RS-422, USB optional**					
Power:	**110 VAC standard, 12 VDC, 24 VDC, 220 VAC optional**					

Applications:

- Automated Test and Measurement Facilities
- Troubleshooting Co-location Environments
- Wireless Communications

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Wireless Solutions - Cellular/PCS/UMTS Tunable Bandreject Filters

◆ Features:

- Super Narrow 3 dB BW
- Digitally Controlled
- Available Remote Interfaces Include GPIB (IEEE-488, RS-232, RS-422, and BCD)
- Drive Voltages Include 12 VDC, 24 VDC, and 110 VAC
- Manually Controlled Versions also Available



◆ Applications:

- Designed specifically for automated testing required in: Cellular, PCS and UMTS applications

◆ Specifications:

K&L Model	Frequency Range (MHz)	Type	3 dB BW Range (MHz) (Relative)	Typ. Notch Depth (Relative)	Length Inch/mm	Width Inch/mm	Height Inch/mm
D3TNF-800/1000-0.2-N/N-GRI	800-1000	3 Section	1.6-2.6	40 dB	10.71/272	5.34/136	3.94/100
D5TNF-1700/2000-0.2-N/N-GRI	1700-2000	5 Section	3-3.6	30 dB	11.64/296	5.31/135	3.94/100
D5TNF-2080/2200-0.5-N/N-GRI	2080-2200	5 Section	9.5-11	50 dB	12.03/305.6	3.22/81.9	3.31/84.2

Passband VSWR	Insertion Loss	Impedance	Operating Power	Remote Interface	RF Connector
1.5:1	< 0.5 dB	50 Ohms	24 VDC Standard, 12 VDC/110 VAC Optional	GPIB Standard, RS-232/RS-422/BDC Optional	Type N Standard, SMA/TNC/BNC Optional

Custom configurations and ruggedized versions also available. Contact the factory for custom requirements.

VHF High Q Tunable Bandpass — HBTM Series

◆ Description:

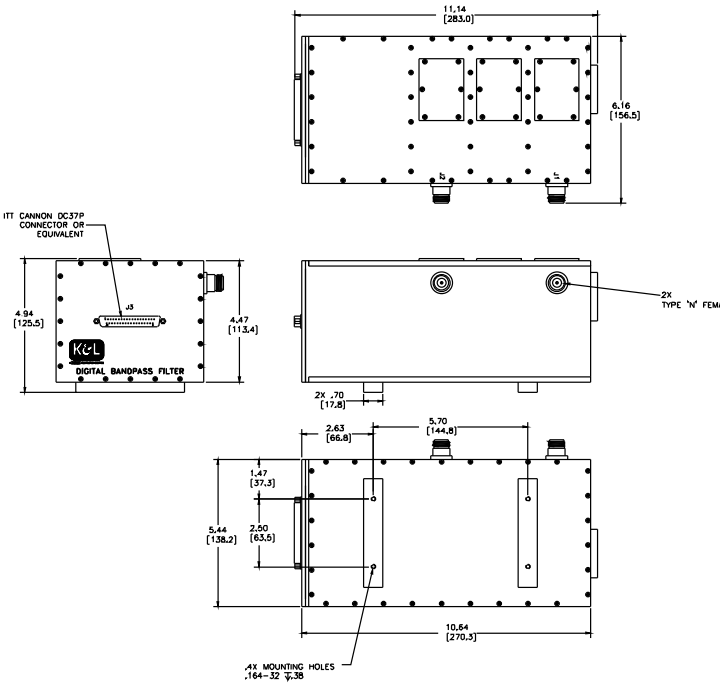
K&L Microwave autotuned bandpass filters are high "Q" devices covering the VHF frequency band 100 to 164 MHz. When configured with a VHF Transceiver, these devices provide filtering solutions for field applications where co-location interference must be eliminated. Each filter is tuned by a remote BCD interface output from the transceiver. When a new frequency is entered on the radio, the filter tunes to the same frequency automatically. An internal microprocessor is used for all control functions of the filter, reducing the number of electronic and electromechanical components in the unit while maintaining high accuracy.

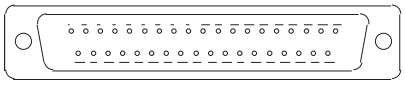


K&L Model: D3HBTM-100/164-1-N/N-ERI

◆ Specifications:

Tuning Range:	100 MHz-164 MHz
3 dB Bandwidth:	>800 KHz
Filter shape factor	
30 dB BW / 3 dB BW:	4.5:1 (3.5:1 Nominal)
VSWR:	1.5:1 maximum
Insertion loss:	2.7 dB maximum
	2.4 dB typical
RF Impedance:	50 ohms
RF Power Handling:	40 watts average
	160 watts peak
RF Connectors:	'N' Type
Data Connector:	37 Pin 'D'
Control Interface:	'BCD' 16 line parallel std.
	GPIB, RS-232, RS-422 opt.
Operating Temperature:	-20 to 45°C
Storage Temperature:	-40 to 70°C
Tuning Time:	7 seconds typ.
(Entire Range)	10 seconds max.
Tuning Accuracy:	25 kHz typical
	50 kHz maximum
Supply Power:	24 VDC to 33 VDC std.
	12 VDC, 110 VAC opt.
Humidity:	95% Storage
	85% Operation
EMC intent:	Mil Std 461





J3 PIN ASSIGNMENTS

PIN NO	FUNCTION
1	LSB } CODED REPRESENTATION OF 10 KHZ/1 KHZ DIGITS
2	MSB } 0=0 KHZ, 1=25 KHZ, 2=50 KHZ, 3=75 KHZ
3	LSB
4	
5	} BCD REPRESENTATION OF 100 KHZ DIGIT
6	MSB } (0-9)
7	LSB
8	
9	} BCD REPRESENTATION OF 1 MHZ DIGIT
10	MSB } (0-9)
20	LSB
21	
22	} BCD REPRESENTATION OF 10 MHZ DIGIT
23	MSB } (0-9)
24	LSB } BCD REPRESENTATION OF 100 MHZ DIGITS
25	MSB } (1-3)
26	TUNE INPUT
32	SPARE
17	
18	} GROUND
19	
35	
36	} UNREGULATED 28V
37	

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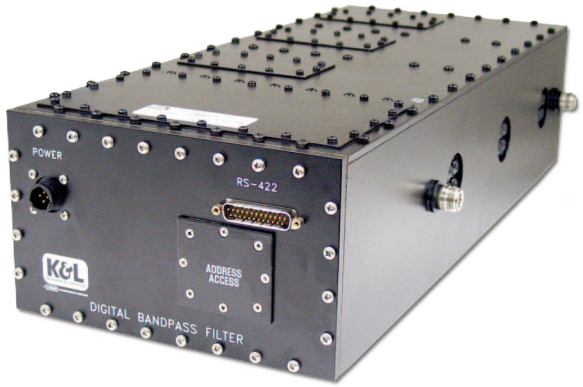
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Salisbury, MD 21801

UHF High Q Tunable Bandpass — HBTM Series

◆ Features:

- High Q, Low Loss
- Super Narrow 3 dB BW
- Digitally Controlled
- Available Remote Interfaces include RS-422 (shown), RS-232, GPIB (IEEE-488), and BCD. Customer Interfaces also available
- Drive Voltages Include 12 VDC, 24 VDC, and 110 VAC
- Ruggedized Package Designed for Mobile Environments



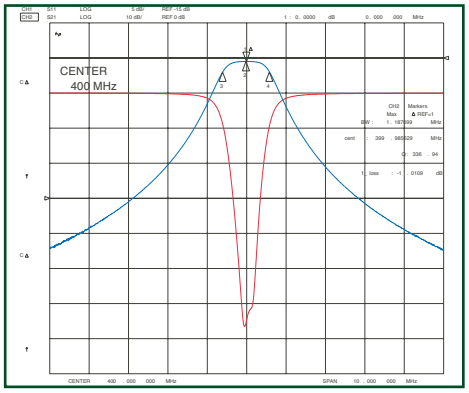
◆ Specifications:

Tuning Range:	225 MHz to 400 MHz
Insertion Loss:	2.0 dB maximum
VSWR:	1.5:1 maximum
Impedance:	50 ohms
3 dB Bandwidth:	0.3%
Filter shape factor 30 dB BW / 3 dB BW:	4.5:1 (3.5:1 Nominal)
Control Logic:	RS-422 (Others Available)
RF Power Handling:	40 watts average 160 watts peak
RF Connectors:	'N' Type, Female
Operating Temperature:	-20 to 45 °C
Storage Temperature:	-40 to 70 °C

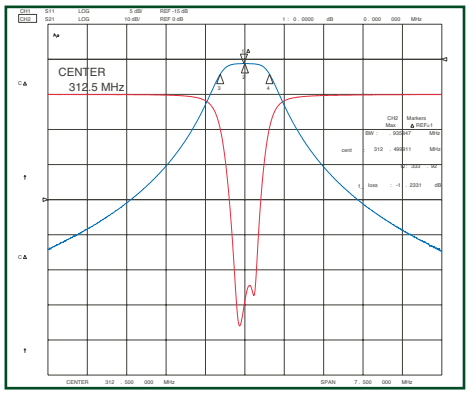
Tuning Time: (Entire Range):	7 seconds typical 10 seconds maximum
Tuning Accuracy:	75 kHz typical 150 kHz maximum
Drive Voltage:	28 VDC, (Others Available)
Humidity:	95% Storage 85% Operation
EMC / EMI Intent:	Mil Std 461
Size:	20.0"L x 8.3"W x 5.38"H (508 x 211 x 137mm)

◆ Applications:

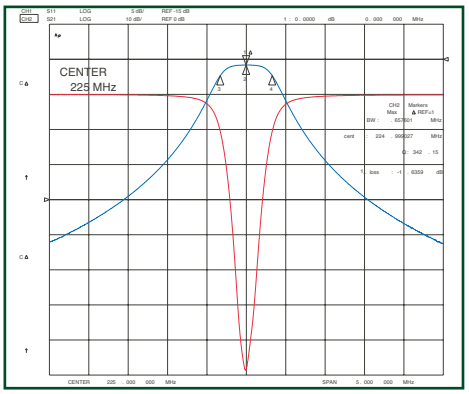
- Air Traffic Control
- Military Communication
- Surveillance



Passband/Return Loss @ 400 MHz



Passband/Return Loss @ 312.5 MHz



Passband/Return Loss @ 255 MHz

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Multi-Octave Tunable Solutions

◆ Features:

- Tunable Ranges Cover from 1 MHz to 4 GHz
- Bandwidths 1% to 5% of Tuned Center Frequency
- Digital Control Offered in Various Inputs, including USB, Ethernet, IEEE-488, and RS-232
- Custom Interfaces Available
- Suitable for Analog to Digital Converter Test Systems
- Suitable for Test and Measurement Applications
- Suitable for Military and/or Commercial Communications Systems
- 19" Rack Mountable



SPCL-00380



SPCL-00310



SPCL-00310

◆ Specifications:

(The information listed below is for part number SPCL-00310. Please contact the factory for more options.)

Representative Specifications:

Tunable 15 MHz to 4 GHz
Bandwidth 2 % of Center Frequency
Insertion Loss 2.5 to 4.5 dB (depending on frequency range)
VSWR: 1.5:1 min.
Filter Shape Factor: 15 to 30 MHz:
  30:3 dB, 3.0:1
  50:3 dB, 5.0:1
Filter Shape Factor All Other Bands:
  30:3 dB, 2.2:1
  50:3 dB, 3.5:1
Harmonic Rejection 60 dB min.

Optional external paths for connection of customers' test equipment. Specifications of the external paths are as follows:

External Path 1 and 2:
  Insertion Loss: 15 MHz to 40 GHz, 3.5 dB max.
  VSWR:
    15 MHz to 12 GHz 1.5:1 max.
    12 to 26.5 GHz 1.8:1 max.
    26.5 to 40 GHz 2.1:1 max.
Terminated External Path:
  Terminated in 50 ohm Load
  VSWR:
    15 MHz to 12 GHz 1.5:1 max.
    12 to 26.5 GHz 1.8:1 max.
    26.5 to 40 GHz 2.1:1 max.

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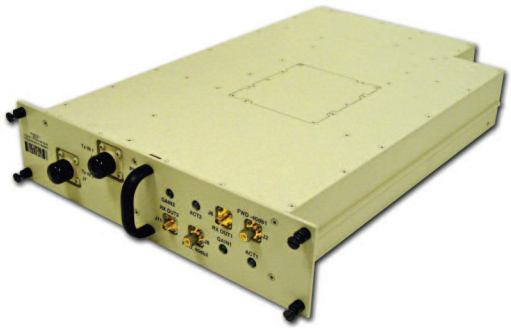
Wireless System Assemblies (WSA)

Wireless System Assemblies are Multi-Function, higher-level integration assemblies designed to integrate significant portions of BTS (Base Transceiver System) filtering and associated function into one assembly. In many cases, WSA integrates low-noise amplification, multi-coupling, transmit combining and antenna status monitoring (analog or digital) into the assembly as well. Often, these assemblies include power supplies, with conditioning necessary for remote environments.

An example of this high-level integration is the WSA-00289 (Wireless Duplexer Assembly).
This product features:

- A Single Assembly Providing High-Power Transmit Filtering
- Extended Stopband to 12.5 GHz
- High Accuracy Power Monitoring
- Dual Gain LNA
- Total Noise Control as Low as 2.0 dB, While Maintaining an Output Intercept Point over 40 dBm
- Isolated DC/DC Converters with Hot-Swap Protection
- Internal Microcontrollers
- CAN-bus interface

Such integrated solutions allow K&L to enhance customer satisfaction by providing the specific integrated features desired, improving performance, reducing size, simplifying procurement and installation, increasing reliability and reducing cost when compared to discrete component solutions. These solutions are available from K&L on a custom basis. Please contact your local K&L representative or account executive for more information about these products.





Wireless System Duplexer (WSD)

Duplexers and Diplexers are very important to the BTS (Base Transceiver System) designer because these products allow both receive and transmit functions from the BTS to be connected to a single antenna. This feature is important when considering the added cost, especially when evaluating the aesthetic and potential zoning problems of adding more antennae to each sector of a tower.

Duplexers and Diplexers serve essentially the same function: to connect two 50-ohm portions of a BTS or Wireless System (two transmitters, receiver and transmitter or two receivers) at separate frequencies to a common 50-ohm antenna. Generally, Duplexers combine receive and transmit systems, while Diplexers combine two transmitters or two receivers. When duplexed, isolation between the two portions of a system is determined by the rejection each filter path in the Duplexer or Diplexer provides. Therefore, isolation/rejection is specified usually at a minimum of 20 dB higher than separate receive or transmit filters would be, resulting because the special isolation from antenna to antenna is not present in a duplexed system. The engineer must take into consideration worst-case transmit noise, or LNA gain/IP3/de-sense, when specifying Duplexer or Diplexer electrical specifications.

Power handling of the transmit path is also an important specification since multiple transmitters can be combined (either through hybrid, filter or multi-carrier power amplifier) and presented to the transmit path of the Duplexer. Multiple carriers add, as a function of the square, the voltage of each carrier potentially creating very high levels of peak power. In the case of the Diplexer with two transmit input paths, power handling is even more critical since RF power from both paths is represented to the common junction, creating even higher levels of off-peak power. With frequency spaced at precise intervals, multiple carriers can also create Intermodulation Distortion (IMD) products as seen by either BTS receiver(s) as well as co-located or line-of-sight systems. Specify both the necessary minimum power handling and IMD performance to the Duplexer or Diplexer manufacturer.





Wireless System Filters (Receive Filters- WSF)

Receive Filters serve primarily as a front-end pre-selector to reject or limit out-of-band energy prior to low-noise amplification and down conversion in the BTS. The Receive Filter also serves to reject local oscillator re-radiation to the antenna from the BTS, hence eliminating BTS-caused interference to other services.

In Diversity Systems the Receive Filter is in the primary and secondary receive paths. Minimizing the receive filter insertion loss is critical since insertion loss contributes directly to the system noise figure. The system noise figure establishes the overall receive sensitivity and is essentially the noise contribution of the Wireless system (above theoretical in a given bandwidth).

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Rejection is also important since it determines the level of transmit or adjacent transmitter energy that is presented to the low-noise amplifier and down conversion system. With the use of special materials, such as TE mode (puck) ceramics, our engineers have designed very low loss and high selectivity receive filters that have been delivered in high volume to meet the needs of crowded spectrum or co-location requirements globally.





Wireless System Filters (Transmit Filters- WSF)

Transmit Filters are used primarily to limit out-of-band noise generated by the transmit portion of the BTS. Unless rejected, wideband noise, generated by the amplifier and/or transmit system, frequently causes interference or de-sensitization in the receive system. Additionally, transmit noise can interfere with other services, sometimes in co-located systems or other systems in the direct path (line-of-sight) of the transmitting system.

The insertion loss of only the Transmit Filter (not including the connectors, cables or associated in-path losses) directly influences the total RF power available at the antenna. For this reason, Transmit Filter insertion loss is highly important to the radiated RF power available at the antenna. Because the insertion loss of the Transmit Filter directly influences RF power at the antenna, it also directly influences the efficiency of the transmitting system. For very high power systems, higher Transmit Filter loss translates into significantly higher energy costs. When multiplied by the number of cell sites and sectors per site, these added costs are most appreciable.

Rejection is another key operating parameter of the Transmit Filter. As mentioned earlier, adequate rejection is needed to reduce wideband transmit noise to acceptable levels. Often times a tradeoff exists among the loss, rejection and size of the Transmit Filter. Frequently a specification will require both high rejection and low loss but not provide adequate physical space to realize the filter. In these cases, design tradeoffs are required to arrive at an acceptable solution. With the transmit path of the duplexer, peak power handling and IMD products caused by multiple transmit carriers should be considered.





Wireless System Notch Filters (WSN)

While most of the filters offered in this catalog are band-pass types, Notch Filters provide the function of passing a very wide range of frequencies while rejecting or "notching" a very limited range of frequencies or channels. Very often Notch Filters are installed into systems as "fixes" or "patches" to eliminate unwanted interference that is encountered only after the entire BTS and radiating coax and antenna systems have been installed.

Test applications often require the use of Notch Filters. A typical requirement for fixed Notch Filters would be to reject two very narrow band signals while monitoring broadband for out-of-band spurious or harmonic radiations. When placing an order for Fixed Notch Filters, please specify the center frequency needed.

Specifications to consider for Notch Filters are insertion loss and power handling in the passband, rejection in the notch region and the transition "steepness" between the passband and notch rejection frequency range.



WSN-00280 Weather Sealed Notch Filter

Please refer to page 134 to view the data sheet on this product.



WSN-00198 High-Power Bandreject Filter

Please refer to page 132 to view the data sheet on this product.

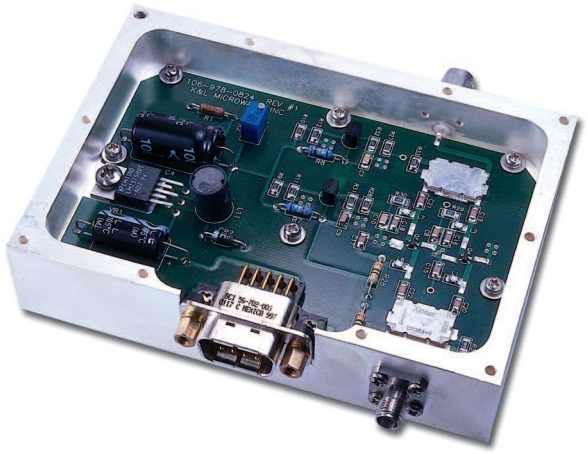
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Low Noise Amplifier

Features:

- E-pHEMT Technology
- Low Noise Figure - 0.7 dB Typical
- High Gain - 18 dB Typical
- High Output IP3 - +38 dBm Typical
- Single Supply Voltage
- Low Power Consumption

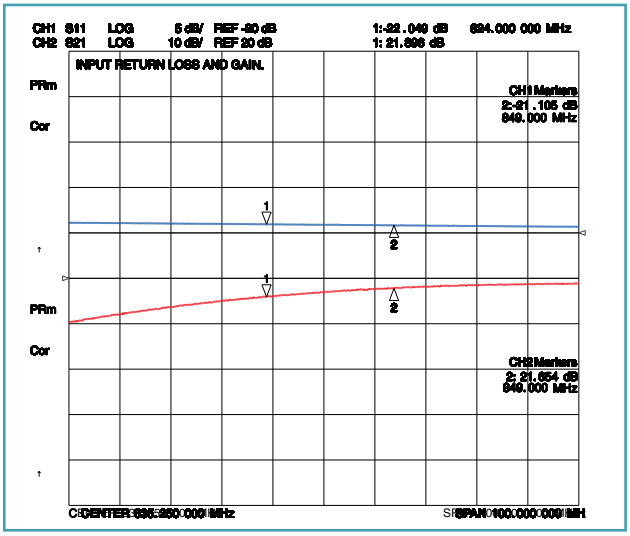


Specifications:

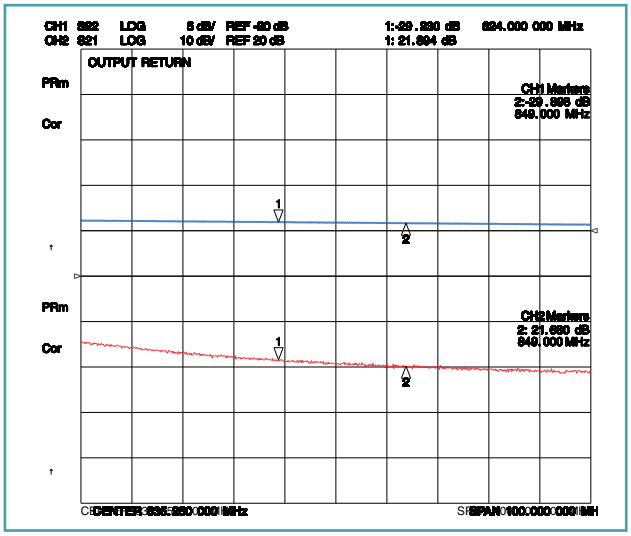
Frequency Range:	300-2500 MHz
Configuration:	Hybrid Pair, Soft Fail
Specification Bandwidth:	3% nominal
Gain:	
900 MHz	20 dB minimum
2000 MHz	15 dB minimum
Gain Flatness:	
0 to +50°C	+/- 0.10 dB maximum
Full Temperature Range	+/- 0.20 dB maximum
Noise Figure Typical:	
900 MHz	0.6 dB
2000 MHz	0.7 dB
Noise Figure Maximum:	
900 MHz	0.9 dB
2000 MHz	1.0 dB
Output IP3:	+35 dBm minimum
Input Voltage:	
Standard	+9 to +24 VDC
Optional:	To +48 VDC or -48 VDC
Input Current:	135 mA maximum
Reverse Voltage Protection:	Reverse Polarity Diode
Over Voltage Protection:	Regulated to +35 VDC
Fault Detection:	Optional, Consult Factory
Operating Temperature Range:	-20 to +70°C
Dimensions:	4.4"L x 3.0"W x 1.2"H
(excluding connectors)	(111.76 x 76.2 x 30.48mm)
Connectors:	
Input	SMA-M
Output	SMA-F

Applications:

- Macro, Micro or Pico Cellular Base Stations
- Tower Top Amplification
- Integration with Receive Filters or Duplexers



Input Return Loss and Gain



Output Return Loss and Gain

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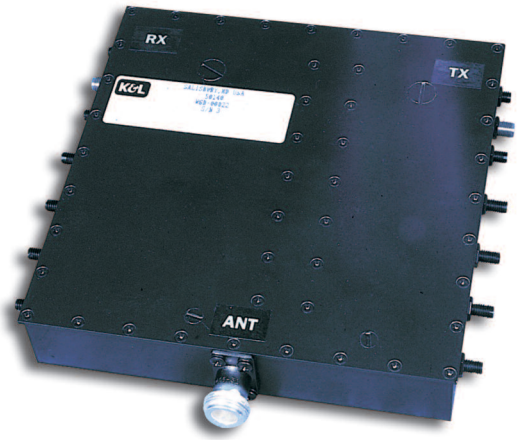
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WSD-00025 AMPS Fullband Duplexer

Features:

- 50 dB Minimum Isolation
- Low Insertion Loss
- Ideal for Microcell Applications
- Small, Low Profile Housing

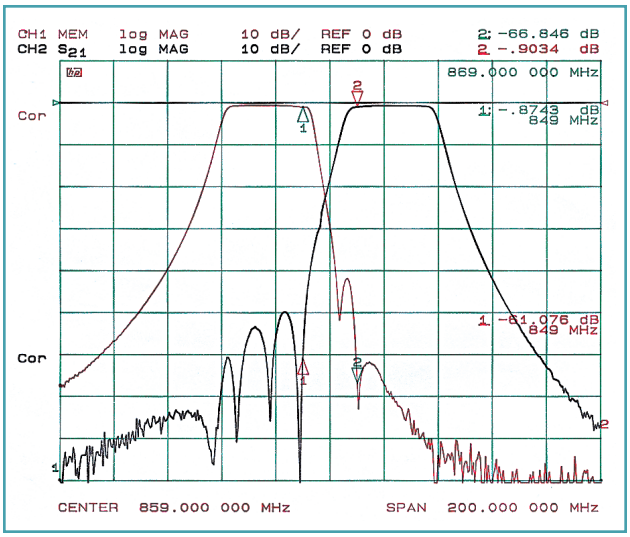
WSD-00022 Shown



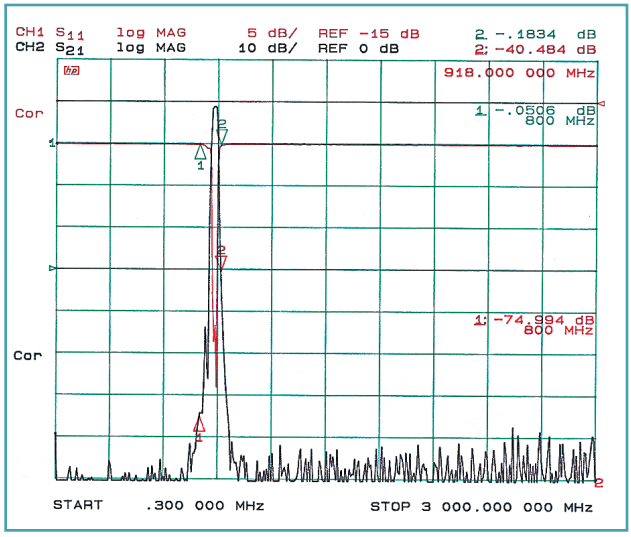
Specifications:

Passbands:	
Receive	824-849 MHz
Transmit	869-894 MHz
Passband Insertion Loss:	1.0 dB maximum
Antenna to Receive Rejection:	
DC-779 MHz	50 dB minimum
869-2000 MHz	50 dB minimum
Transmit to Antenna Rejection:	
DC-849 MHz	50 dB minimum
939-2682 MHz	50 dB minimum
Channel to Channel Isolation:	50 dB minimum
Maximum Transmit Power Handling:	
CW	20 watts
Peak Instantaneous	200 watts

Passband Return Loss:	14 dB minimum
Operating Temperature:	0 to +50°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions :	7.14"W x 5.98"D x 1.16"H
(excluding connectors)	(181.3 x 151.9 x 29.5mm)
Connectors:	
Antenna/Tx Ports	N-F
Rx Port	SMA-F
WSD-00022:	
Antenna	N-F
Tx/Rx Ports	SMA-F
WSD-00028:	N-F



Passband Response



Out-of-Band Response

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WSD-00136 AMPS Fullband Duplexer

Features:

- High Isolation - 85 dB minimum
- Low Insertion Loss - 0.7 dB typical
- High Return Loss - 20 dB typical



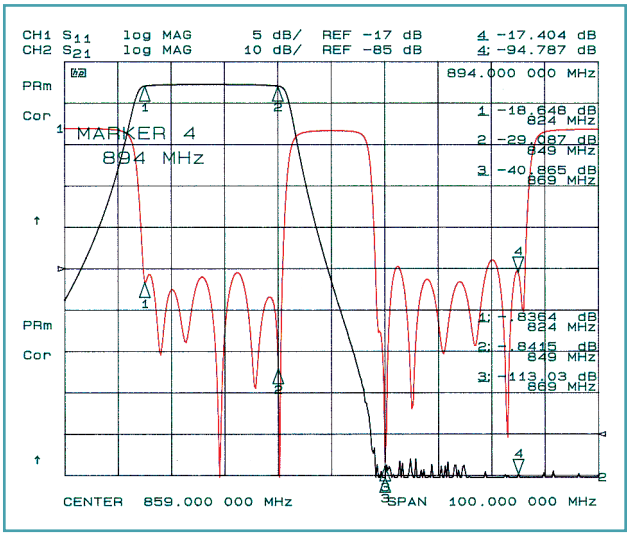
Specifications:

Passbands:	
Receive	824-849 MHz
Transmit	869-894 MHz
Passband Insertion Loss:	1.0 dB maximum
Passband Ripple:	0.4 dB p-p maximum
Antenna to Receive Rejection:	
DC-784 MHz	60 dB minimum
869-894 MHz	85 dB minimum
894-2574 MHz	50 dB minimum
Transmit to Antenna Rejection:	
DC-824 MHz	60 dB minimum
824-849 MHz	85 dB minimum
934-2682 MHz	50 dB minimum
Channel to Channel Isolation:	85 dB minimum

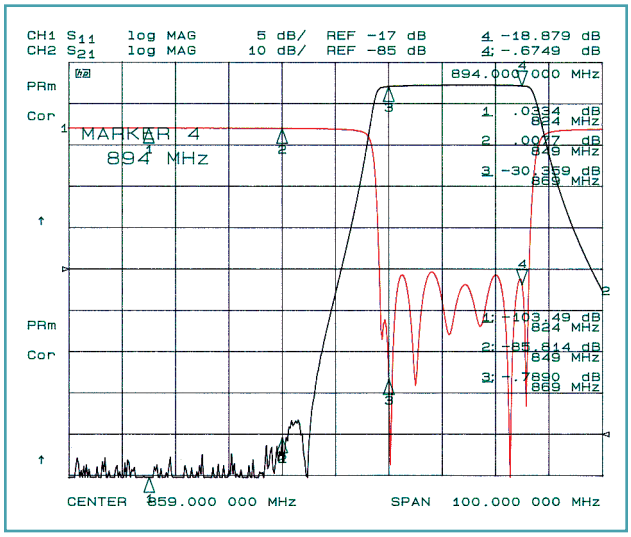
Maximum Transmit Power Handling:	
CW	45 watts
Peak Instantaneous	450 watts
Passband Return Loss:	17 dB minimum
Operating Temperature:	0 to +50°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions:	6.75"W x 6.32"D x 2.75"H
(excluding connectors)	(171.5 x 160.6 x 70mm)
Connectors:	N-F

Applications:

- Micro and Pico Cellular BTS
- Test Stands and Equipment



Receive Channel



Transmit Channel

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WSD-00027 AMPS Fullband Duplexer

Features:

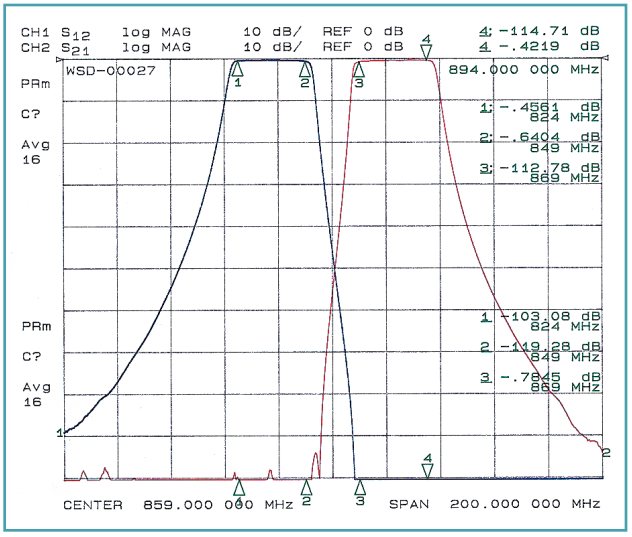
- 95 dB Minimum Isolation
- Low Insertion Loss - 0.6 dB typical
- High Return Loss - 20 dB typical
- Excellent Harmonic Rejection



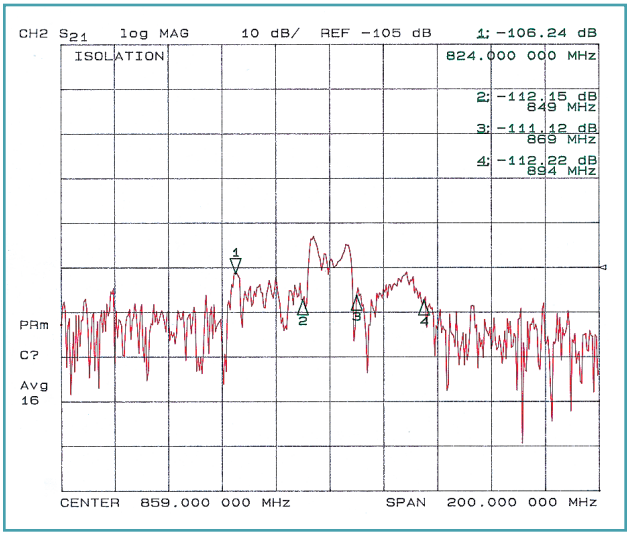
Specifications:

Passbands:	
Receive	824-849 MHz
Transmit	869-894 MHz
Passband Insertion Loss:	1.0 dB maximum
Antenna to Receive Rejection:	
DC-775 MHz	60 dB minimum
869-2000 MHz	95 dB minimum
2000-2682 MHz	75 dB minimum
Transmit to Antenna Rejection:	
DC-849 MHz	95 dB minimum
960-2682 MHz	75 dB minimum
Channel to Channel Isolation:	95 dB minimum
Maximum Transmit Power Handling:	
CW	200 watts
Peak Instantaneous	4,000 watts

Passband Return Loss:	18 dBm minimum
Antenna Port Coupling:	-50 +/-3 dB, non-directional
Operating Temperature:	0 to +50°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	Up to 90%, non-condensing
Dimensions :	16.25"W x 3.81"D x 3.0"H
(excluding connectors)	(412.8 x 96.8 x 76.2mm)
Connectors:	
Ant/Rx/Tx	N-F
Coupled Port	BNC-F



Passband Response



Passband to Passband Isolation

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WSD-00026 EGSM Fullband Duplexer

Features:

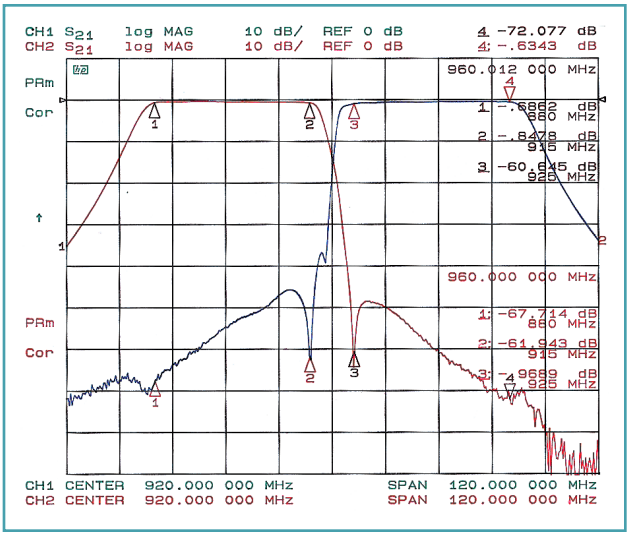
- 40 dB Minimum Isolation
- Low Insertion Loss; 0.7 dB typical
- Ideal for Microcell Application
- Ideal for Microcell Requirements



Specifications:

Passbands:	
Receive	880-915 MHz
Transmit	925-960 MHz
Passband Insertion Loss:	1.2 dB maximum
Antenna to Receive Rejection:	
DC-845 MHz	40 dB minimum
925-2000 MHz	40 dB minimum
Transmit to Antenna Rejection:	
DC-915 MHz	40 dB minimum
995-2000 MHz	40 dB minimum
Channel to Channel Isolation:	40 dB minimum

Maximum Transmit Power Handling:	
CW	20 watts
Peak Instantaneous	200 watts
Passband Return Loss:	14 dB minimum
Operating Temperature:	0 to +50°C
Non-operating Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions :	5.5"W x 5.10"D x 2.75"H
(excluding connectors)	(139.7 x 129.5 x 69.9mm)
Connectors:	N-F



Passband Response

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WSD-00126 GSM Duplexer

Features:

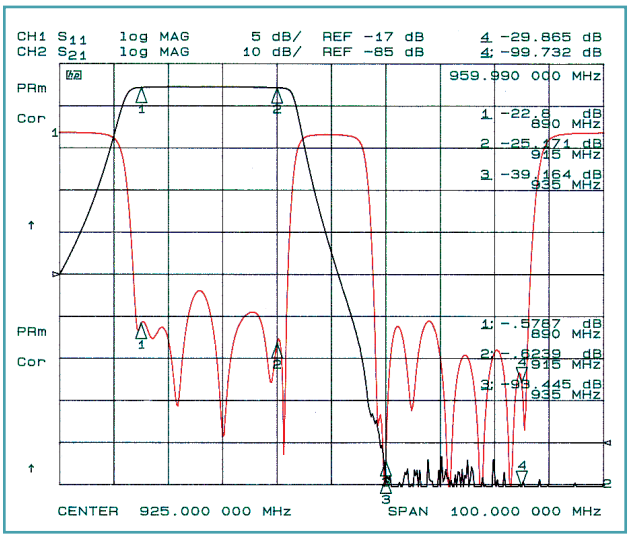
- High Isolation - 85 dB minimum
- Low Insertion Loss; 0.7 dB typical
- High Return Loss - 17 dB typical



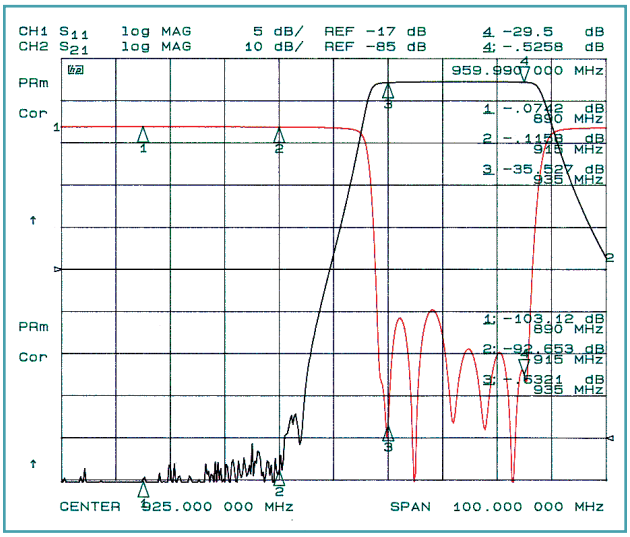
Specifications:

Passbands:	
Receive	890-915 MHz
Transmit	935-960 MHz
Passband Insertion Loss:	1.0 dB maximum
Passband Ripple:	0.4 dB p-p maximum
Antenna to Receive Rejection:	
DC-850 MHz	60 dB minimum
935-960 MHz	85 dB minimum
960-2670 MHz	50 dB minimum
Transmit to Antenna Rejection:	
DC-890 MHz	60 dB minimum
890-915 MHz	85 dB minimum
1000-2880 MHz	50 dB minimum
Channel to Channel Isolation:	85 dB minimum

Maximum Transmit Power Handling:	
CW	45 watts
Peak Instantaneous	450 watts
Passband Return Loss:	17 dB minimum
Operating Temperature:	0 to +50°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions:	6.75"W x 6.32"D x 2.75"H
(excluding connectors)	(171.5mm x 160.6mm x 70mm)
Connectors:	N-F



Receive Channel



Transmit Channel

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WSD-00184 EGSM Duplexer

Features:

- High Isolation — 75 dB minimum
- Low Insertion Loss — 1.25 dB maximum
- High Power Handling — 50 watts CW



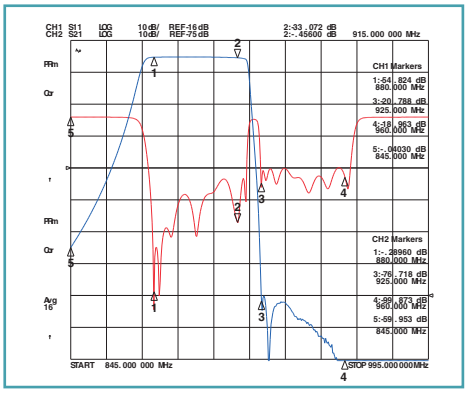
Specifications:

Passbands:	
Receive	880-915 MHz
Transmit	925-960 MHz
Passband Insertion Loss:	1.25 dB maximum
Antenna to Receive Rejection:	
DC-845 MHz	50 dB minimum
925-2000 MHz	75 dB minimum
2000-2880 MHz	30 dB minimum
Transmit to Antenna Rejection:	
DC-915 MHz	75 dB minimum
1050-2000 MHz	75 dB minimum
Passband to Passband Isolation:	75 dB minimum

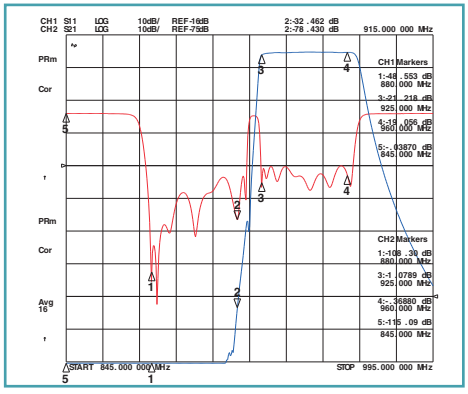
Maximum Transmit Power Handling:	
CW	50 watts
Peak Instantaneous	100 watts
Passband Return Loss:	15 dB minimum
Operating Temperature:	0 to +55°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, relative, non-condensing
Dimensions: (excluding connectors)	9.43"L x 7.93"W x 3.0"H (239.5 x 201.4 x 76.2mm)
Connectors:	N-F

Applications:

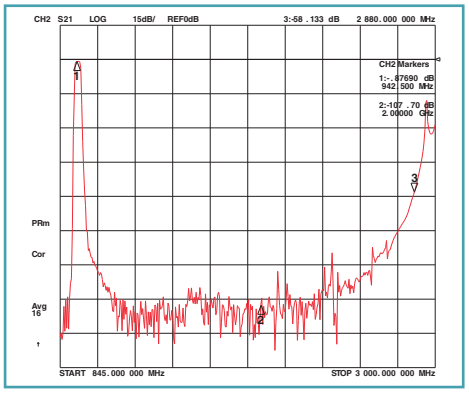
- Macro or Micro EGSM Base Stations
- EGSM Repeaters and Systems
- Base Station or Handset EGSM Test Systems



Receive Channel



Transmit Channel



Tx Stopband Response

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WSD-00018 DCS Fullband Duplexer

Features:

- Low Insertion Loss; <0.6 dB typical
- 50 dB Minimum Isolation
- Compact Design
- Ideal for Microcell Requirements

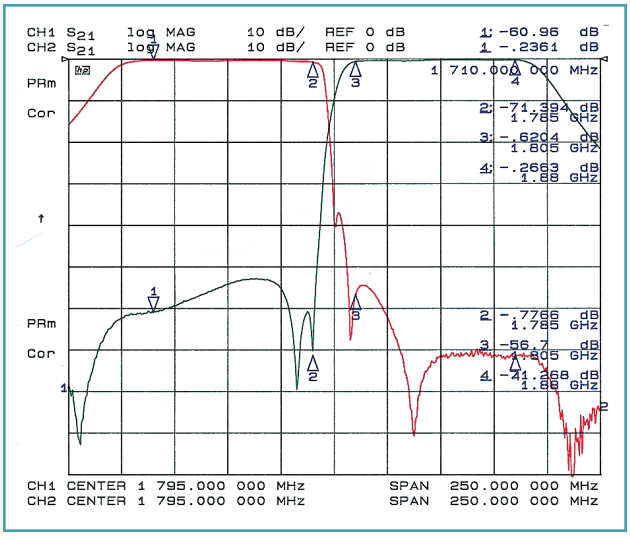
* **AVAILABLE FROM STOCK**



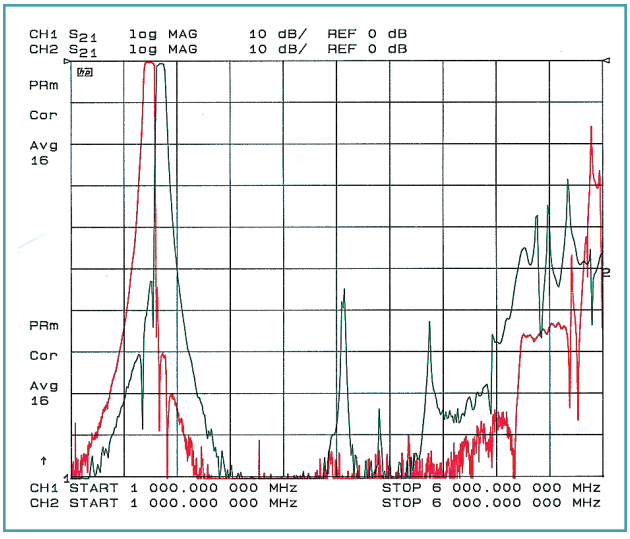
Specifications:

Passbands:	
Receive	1710-1785 MHz
Transmit	1805-1880 MHz
Passband Insertion Loss:	1.0 dB maximum
Antenna to Receive Rejection:	
DC-1575 MHz	50 dB minimum
1805-4000 MHz	50 dB minimum
Transmit to Antenna Rejection:	
DC-1785 MHz	50 dB minimum
2030-4000 MHz	50 dB minimum
Channel to Channel Isolation:	50 dB minimum

Maximum Transmit Power Handling:	
CW	20 watts
Peak Instantaneous	200 watts
Passband Return Loss:	14 dB minimum
Operating Temperature:	0 to +50°C
Non-operating Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions:	5.00"W x 4.64"D x 2.0"H
(excluding connectors)	(127 x 117.9 x 50.8mm)
Connectors:	N-F



Passband Response



Out-of-Band Response

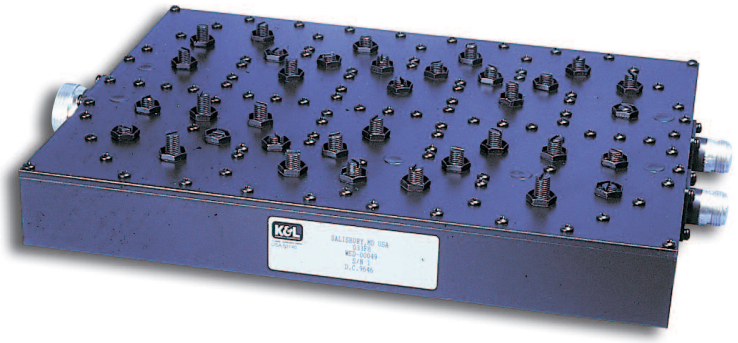
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WSD-00049 DCS Fullband Duplexer

Features:

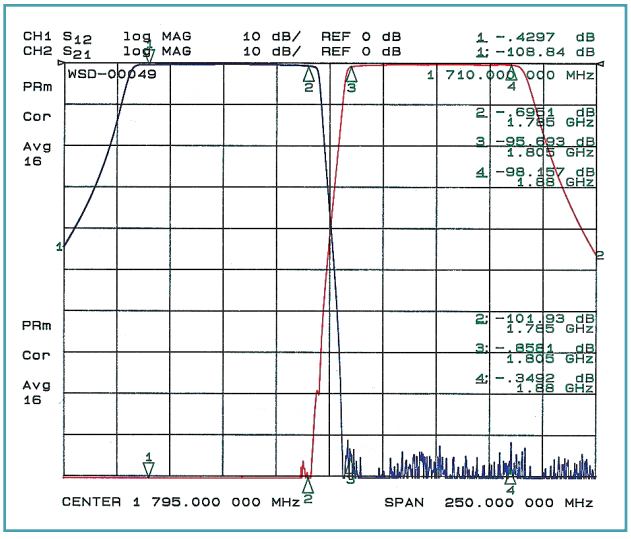
- 90 dB Minimum Isolation
- Low Insertion Loss - 0.6 dB typical
- High Return Loss - 20 dB typical



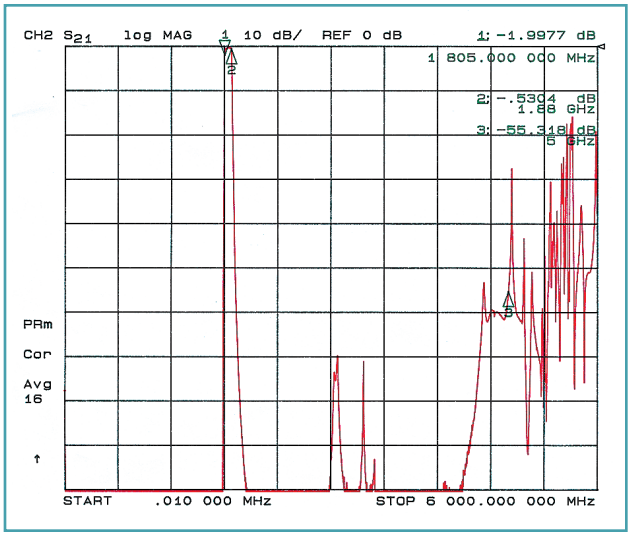
Specifications:

Passbands:	
Receive	1710-1785 MHz
Transmit	1805-1880 MHz
Passband Insertion Loss:	1.2 dB maximum
Antenna to Receive Rejection:	
DC-1630 MHz	60 dB minimum
1805-1880 MHz	90 dB minimum
1880-4500 MHz	60 dB minimum
Transmit to Antenna Rejection:	
DC-1785 MHz	90 dB minimum
1960-4500 MHz	60 dB minimum
Channel to Channel Isolation:	90 dB minimum
Maximum Transmit Power Handling:	
CW	100 watts
Peak Instantaneous	1000 watts
Passband Return Loss:	18 dB minimum

Operating Temperature:	0 to +50°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions:	7.73"W x 10.85"D x 2.0"H
(excluding connectors)	(275.6 x 196.3 x 50.8mm)
Connectors:	
Antenna	DIN 7/16-F
Rx/Tx Ports	N-F
WSD-00100	
Antenna	DIN 7/16-M
Rx/Tx Ports	N-F
WSD-00137	SMA-F



Passband Response



Out-of-Band Response

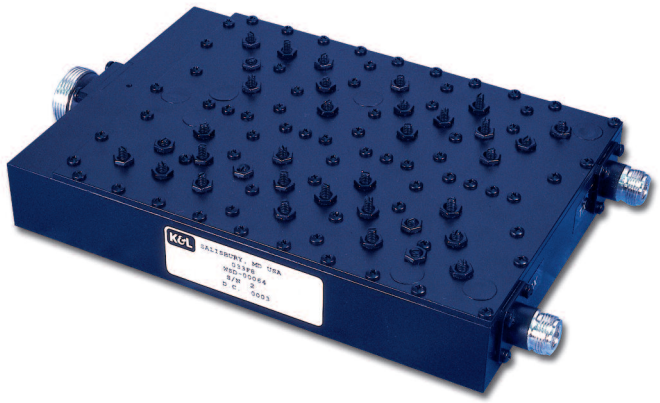
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WSD-00064 DCS Fullband Duplexer

Features:

- High Isolation — 90 dB typical
- Low Insertion Loss — 1.0 dB typical
- Rejection to 12.75 GHz — 35 dB typical
- Small Size — 212.3mm x 146mm x 45mm



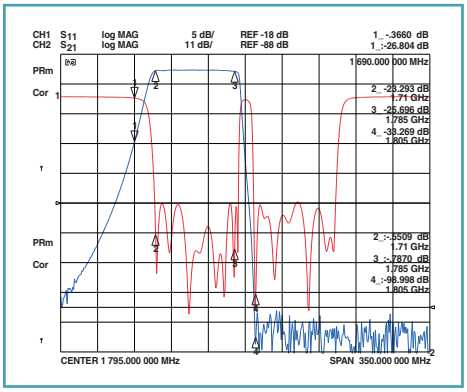
Specifications:

Passbands:	
Receive	1710-1785 MHz
Transmit	1805-1880 MHz
Passband Insertion Loss:	1.3 dB maximum
Antenna to Receive Rejection:	
DC-1620 MHz	60 dB minimum
1620-1690 MHz	25 dB minimum
1805-1880 MHz	85 dB minimum
1880-3800 MHz	45 dB minimum
3800-12750 MHz	30 dB minimum
Transmit to Antenna Rejection:	
DC-1780 MHz	85 dB minimum
1970-3800 MHz	60 dB minimum
3800-12750 MHz	30 dB minimum
Passband to Passband Isolation:	85 dB minimum

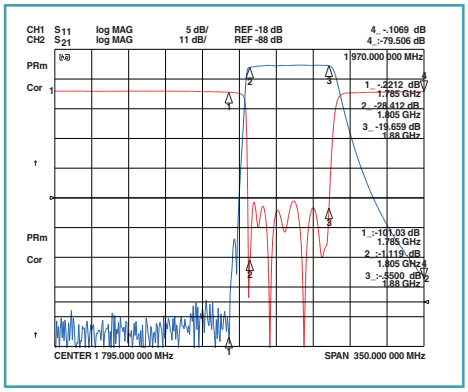
Maximum Transmit Power Handling:	
CW	40 watts
Peak Instantaneous	160 watts
Passband Return Loss:	15 dB minimum
Operating Temperature:	-20 to +70°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, relative, non-condensing
Dimensions:	8.36"L x 5.75"W x1.77"H
(excluding connectors)	(212.3 x 146 x 45 mm)
Connectors:	
Antenna Port	DIN 7/16-F
Receive/Transmit Ports	N-F

Applications:

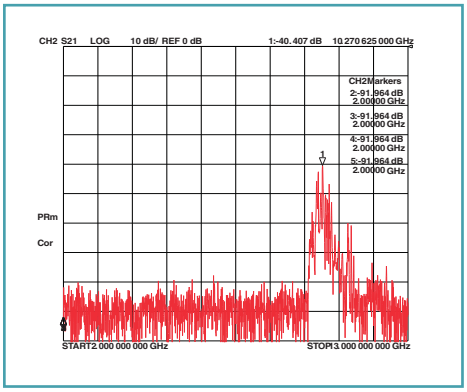
- Macro or Micro DCS Base Stations
- DCS Repeaters and Systems
- Base Station or handset DCS Test Systems



Receive Channel



Transmit Channel



Out-of-Band Response

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WSD-00010 PCS Fullband Duplexer

Features:

- 40 dB Minimum Isolation
- Very Low Insertion Loss - 0.5 dB Maximum
- Low Profile, Compact Housing
- Ideal for Microcell Requirements

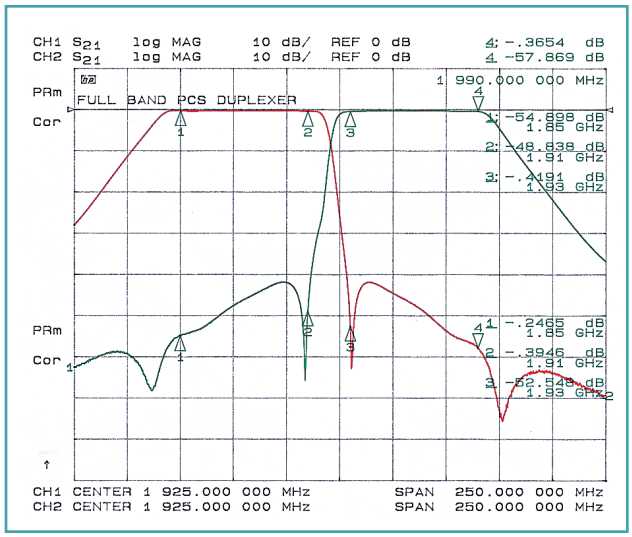
*** AVAILABLE FROM STOCK**



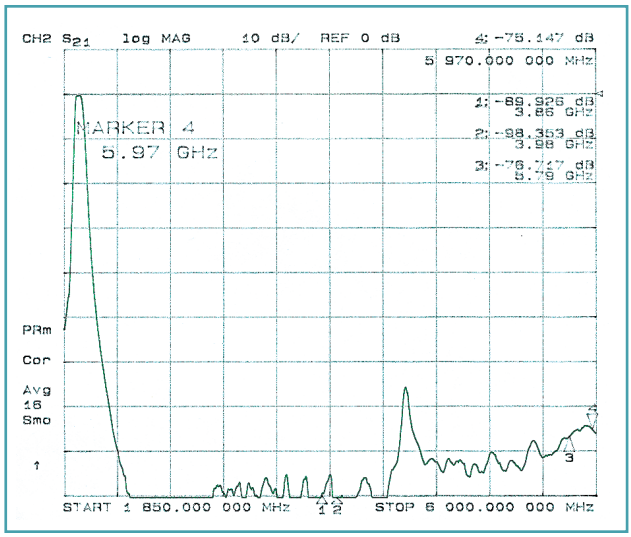
Specifications:

Passbands:	
Receive	1850-1910 MHz
Transmit	1930-1990 MHz
Passband Insertion Loss:	0.5 dB maximum
Antenna to Receive Rejection:	
DC-1770 MHz	30 dB minimum
1930-1990 MHz	40 dB minimum
1990-5790 MHz	30 dB minimum
Transmit to Antenna Rejection:	
DC-1910 MHz	40 dB minimum
3860-5970 MHz	30 dB minimum
Channel to Channel Isolation:	40 dB minimum
Maximum Transmit Power Handling:	
CW	200 watts
Peak Instantaneous	2000 watts

Passband Return Loss:	15 dB minimum
Operating Temperature:	-25 to +70°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	Up to 90%, non-condensing
Dimensions :	5.12"W x 4.33"D x 1.5"H
(excluding connectors)	(130 x 110 x 38.1mm)
Connectors:	N-F
WSD-00040	SMA-F
WSD-00044	
Antenna	N-M
Tx/Rx Ports	N-F



Passband Response



Transmit Harmonic Performance

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WSD-00045 PCS Fullband Duplexer

Features:

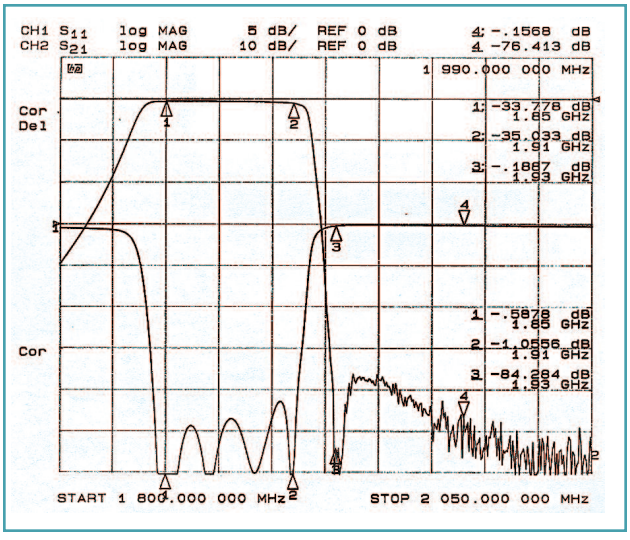
- 62 dB Minimum Isolation
- Low Insertion Loss - 0.8 dB typical
- High Return Loss - 18 dB typical
- Small, High Performance Package



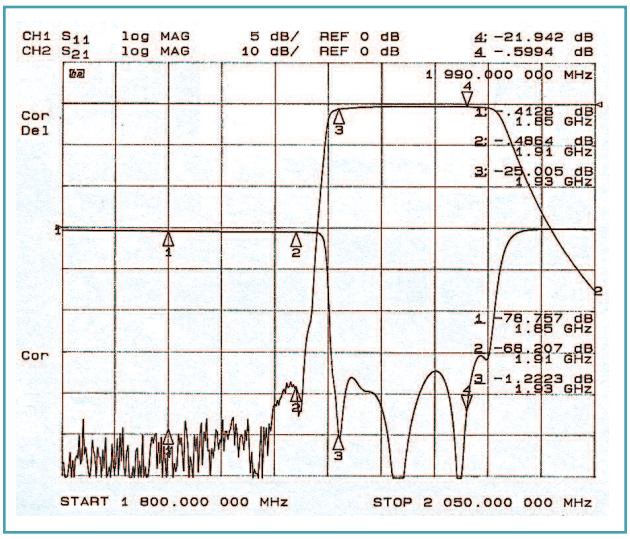
Specifications:

Passbands:	
Receive	1850-1910 MHz
Transmit	1930-1990 MHz
Passband Insertion Loss:	1.5 dB maximum
Passband Flatness:	1.0 dB P-P maximum
Antenna to Receive Rejection:	
DC-1747.5 MHz	52 dB minimum
1790-1825 MHz	10 dB minimum
1930-2332.5 MHz	62 dB minimum
2332.5-2387.5 MHz	70 dB minimum
2387.5-6000 MHz	52 dB minimum
Transmit to Antenna Rejection:	
DC-1910 MHz	62 dB minimum
2092.5-6000 MHz	52 dB minimum

Channel to Channel Isolation:	62 dB minimum
Maximum Transmit Power Handling:	25 watts CW
Passband Return Loss:	15 dB minimum
Operating Temperature:	-20 to +70°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	Up to 90%, non-condensing
Dimensions : (excluding connectors)	7.00"W x 3.25"D x 1.5"H (177.8 x 82.6 x 38.1mm)
Connectors:	SMA-F



Receive Channel



Transmit Channel

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WSD-00001 PCS Fullband Duplexer

Features:

- 75 dB Minimum Isolation
- Low Insertion Loss - 0.7 dB typical
- Full Band, Highly Selective Performance for both Transmit and Receive Channels

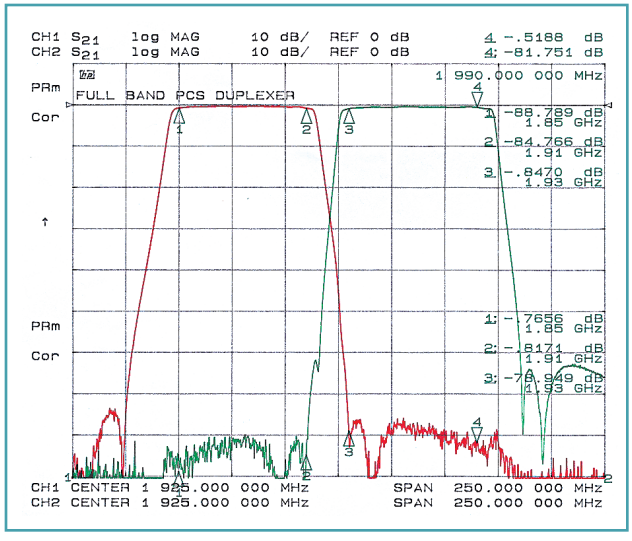
*** AVAILABLE FROM STOCK**



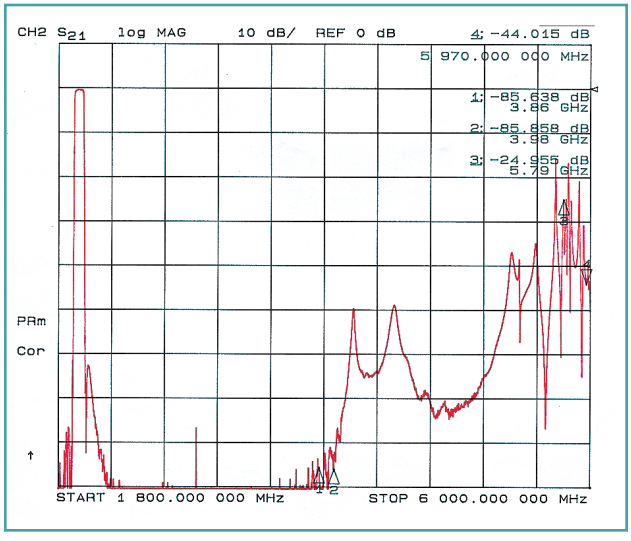
Specifications:

Passbands:	
Receive	1850-1910 MHz
Transmit	1930-1990 MHz
Passband Insertion Loss:	1.0 dB maximum
Antenna to Receive Rejection:	
DC-1830 MHz	60 dB minimum
1930-1990 MHz	75 dB minimum
1990-3980 MHz	55 dB minimum
Transmit to Antenna Rejection:	
DC-1910 MHz	75 dB minimum
2010-3980 MHz	55 dB minimum
Channel to Channel Isolation:	75 dB minimum

Maximum Transmit Power Handling:	
CW	50 watts
Peak Instantaneous	800 watts
Passband Return Loss:	15 dB minimum
Operating Temperature:	-25 to +70°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	Up to 90%, non-condensing
Dimensions :	7.25"W x 7.25"D x 2.0"H
(excluding connectors)	(184.2 x 184.2 x 50.8mm)
Connectors:	N-F



Passband Response



Transmit Harmonic Performance

WSD-00050 PCS Fullband Duplexer

Features:

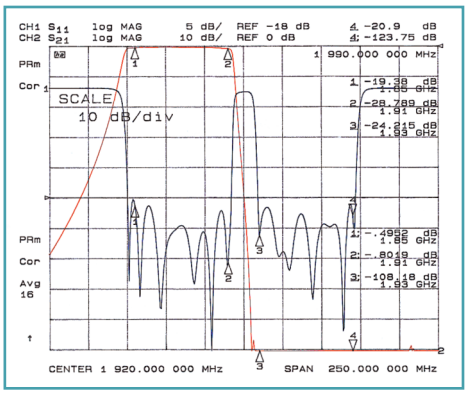
- High Isolation - 95 dB Minimum
- Low Insertion Loss - 0.6 dB typical
- High Return Loss - 20 dB typical



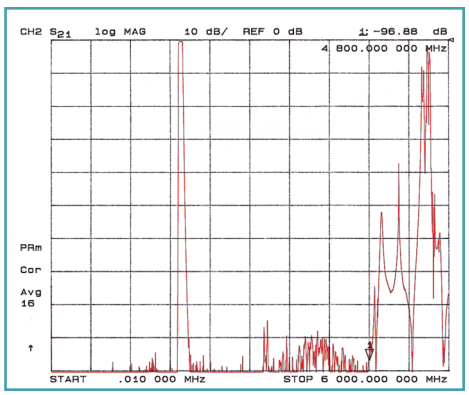
Specifications:

Passbands:	
Receive	1850-1910 MHz
Transmit	1930-1990 MHz
Passband Insertion Loss:	1.2 dB maximum
Antenna to Receive Rejection:	
DC-1790 MHz	60 dB minimum
1930-1990 MHz	95 dB minimum
1990-3980 MHz	60 dB minimum
Transmit to Antenna Rejection:	
DC-1910 MHz	95 dB minimum
2050-3980 MHz	60 dB minimum
Channel to Channel Isolation:	95 dB minimum
Maximum Transmit Power Handling:	
CW	50 watts
Peak Instantaneous	800 watts

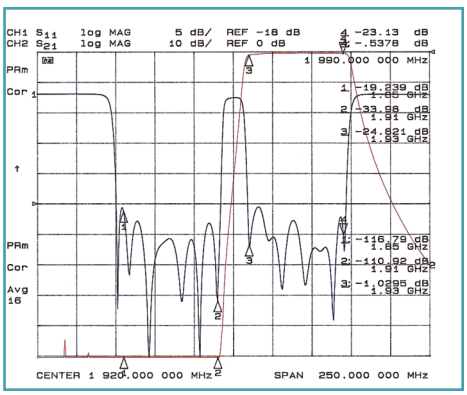
Passband Return Loss:	18 dB minimum
Operating Temperature:	0 to +50°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions:	8.45"W x 10.75"D x 1.75"H
(excluding connectors)	(214.6 x 273.1 x 44.5mm)
Connectors:	N-F



Receive Channel



Out-of-Band Response



Transmit Channel

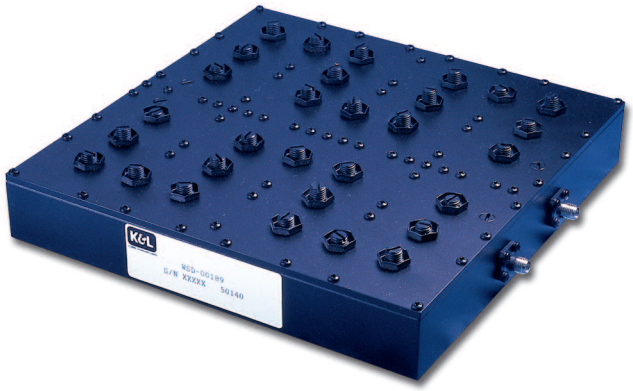
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WSD-00189 UMTS Band Duplexer

Features:

- 75 dB Minimum Isolation
- Low Insertion Loss — 0.8 dB typical
- High Transmit Power Handling



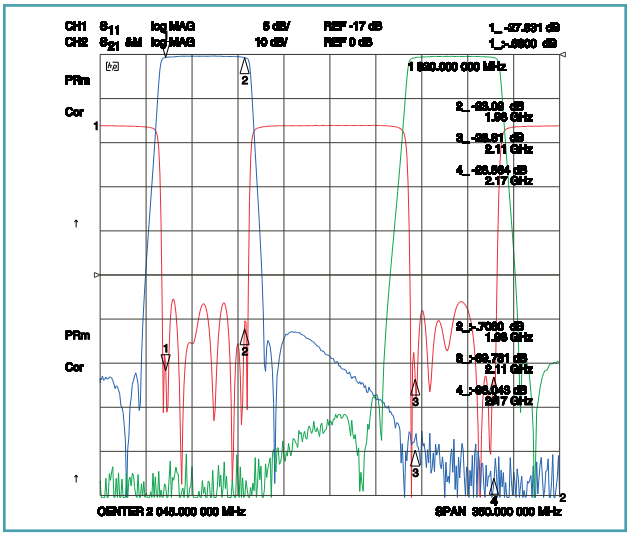
Specifications:

Passbands:	
Receive	1920-1980 MHz
Transmit	2110-2170 MHz
Passband Insertion Loss:	1.25 dB maximum
Passband Return Loss:	15 dB minimum
Antenna to Receive Rejection:	
DC-1900 MHz	60 dB minimum
2110-2170 MHz	75 dB minimum
2170-3980 MHz	55 dB minimum
Transmit to Antenna Rejection:	
DC-1980 MHz	75 dB minimum
2190-3980 MHz	55 dB minimum

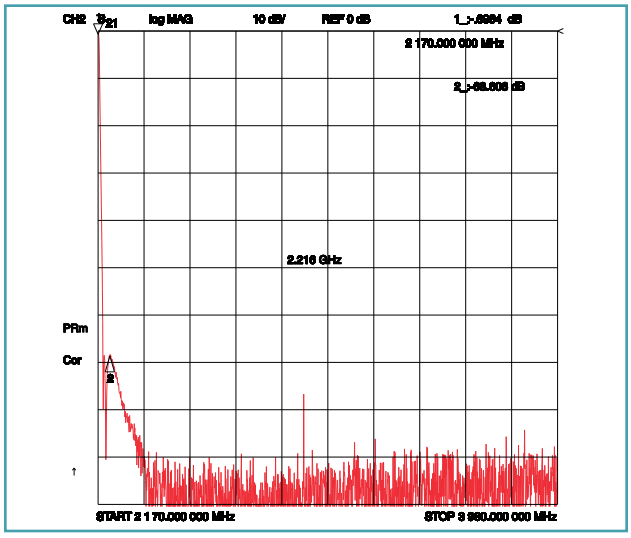
Channel to Channel Isolation:	75 dB minimum
Maximum Transmit Power Handling:	
CW	50 watts
Peak Instantaneous	800 watts
Operating Temperature:	-25 to +70°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, relative, non-condensing
Dimensions:	7.25"W x 7.25"D x 2.0"H
(excluding connectors)	(184.2 x 184.2 x 50.8mm)
Connectors:	SMA-F
WSD-00199:	N-F

Applications:

- Picocell, Microcell and Macrocell Base Station Installations.
- Handset or Equipment Test Systems.



Passband Response



Out-of-Band Response

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WSD-00191 UMTS Band Duplexer

Features:

- 75 dB Minimum Isolation
- Low Insertion Loss – 0.8 dB typical
- High Transmit Power Handling



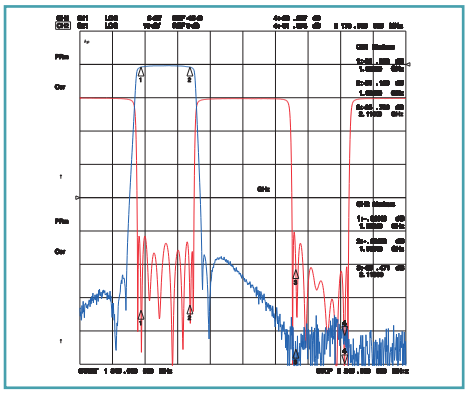
Specifications:

Passbands:	
Receive	1920–1980 MHz
Transmit	2110-2170 MHz
Passband Insertion Loss:	1.0 dB maximum
Passband Return Loss:	15 dB minimum
Antenna to Receive Rejection:	
DC-1900 MHz	60 dB minimum
2110-4000 MHz	50 dB minimum
4000-6500 MHz	25 dB minimum
Transmit to Antenna Rejection:	
DC-2090 MHz	60 dB minimum
2190-4000 MHz	50 dB minimum
4000-6500 MHz	55 dB minimum

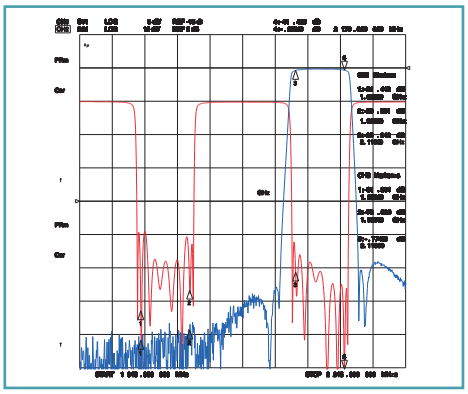
Channel to Channel Isolation:	75 dB minimum
Maximum Transmit Power Handling:	
CW	50 watts
Peak Instantaneous	1000 watts
Operating Temperature:	-20 to +70°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, relative, non-condensing
Dimensions:	5.62"L x 5.5"W x 1.5"H
(excluding connectors)	(142.7 x 139.7 x 38.1mm)
Connectors:	N-F

Applications:

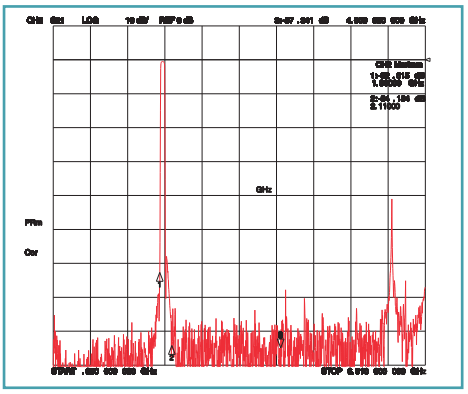
- Picocell, Microcell and Macrocell base station installations.
- Handset or equipment test systems.



Receive Channel



Transmit Channel



Out-of-Band Response

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WSA-00045 Dual Band Duplexer

Description:

The WSA-00045 is a dual band duplexer which allows for simplified dual band handset testing, or can be used in dual band base station applications. The assembly contains two duplexers. The first provides AMPS band coverage of 824 to 849 MHz and 869 to 894 MHz. The second provides PCS band coverage of 1850 to 1910 MHz and 1930 to 1990 MHz (receive and transmit bands respectively). Each similar function port (for example, Rx-Rx, Tx-Tx, and Antenna to Antenna) are multiplexed together to provide the customer with single receive, transmit and antenna ports for integration to test systems.

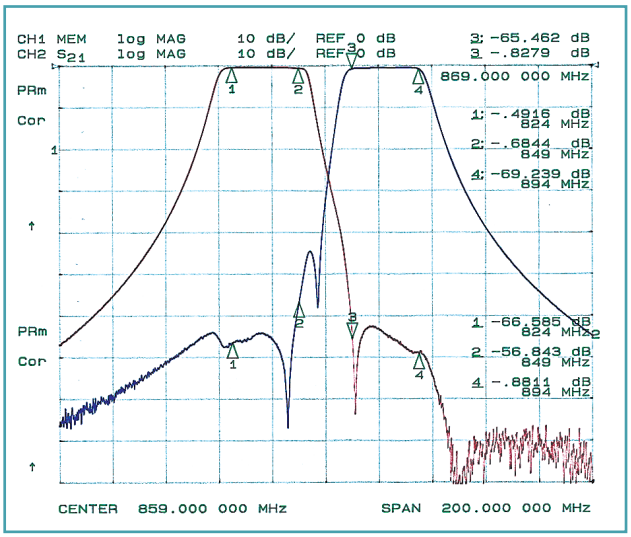


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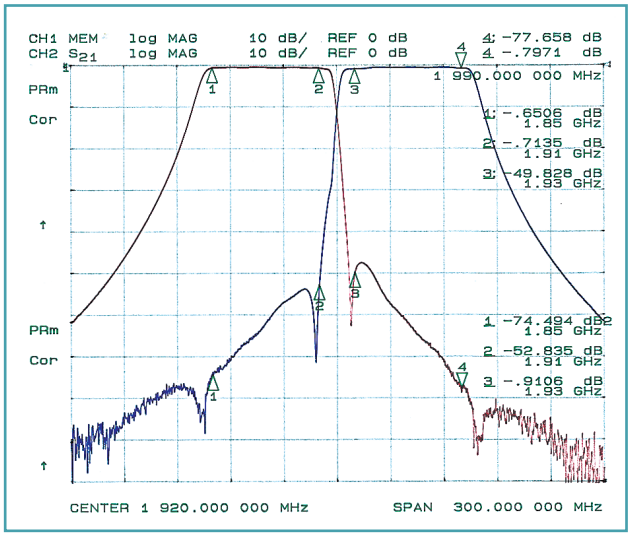
Specifications:

Receive Passbands:	
AMPS	824-849 MHz
PCS	1850-1910 MHz
Transmit Passbands:	
AMPS	869-894 MHz
PCS	1930-1990 MHz
Passband Insertion Loss:	1.0 dB maximum
Passband Ripple:	0.8 dB p-p maximum
Antenna to Receive Rejection:	
DC-780 MHz	40 dB minimum
869-1790 MHz	40 dB minimum
1930-3000 MHz	40 dB minimum
Transmit to Antenna Rejection:	
DC-849 MHz	40 dB minimum
935-1910 MHz	40 dB minimum
2050-3000 MHz	40 dB minimum

Isolation:	
Rx Passband(s) to Tx Passband(s)	40 dB minimum
Tx Passband(s) to Rx Passband(s)	40 dB minimum
Passband Return Loss:	12 dB minimum
Maximum Power Handling:	
CW	100 watts
Peak Instantaneous	500 watts
Operating Temperature:	0 to +50°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions:	10.10"L x 4.60"W x 2.40"H
(excluding connectors)	(256.5 x 116.8 x 61.0mm)
Connectors:	N-F (x3)



AMPS Filters

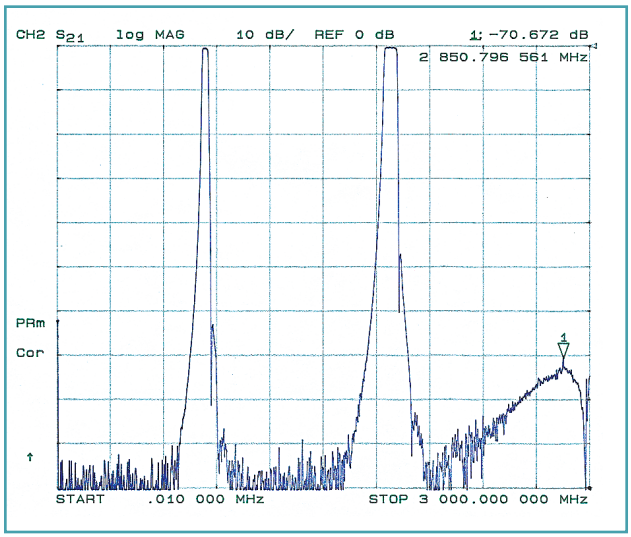


PCS Filters

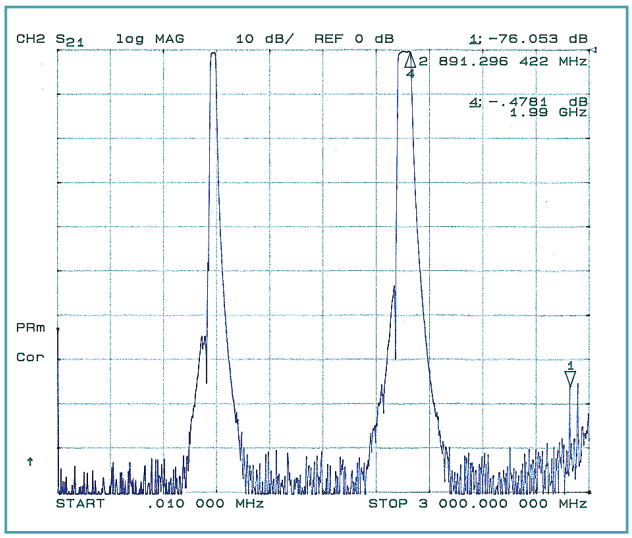
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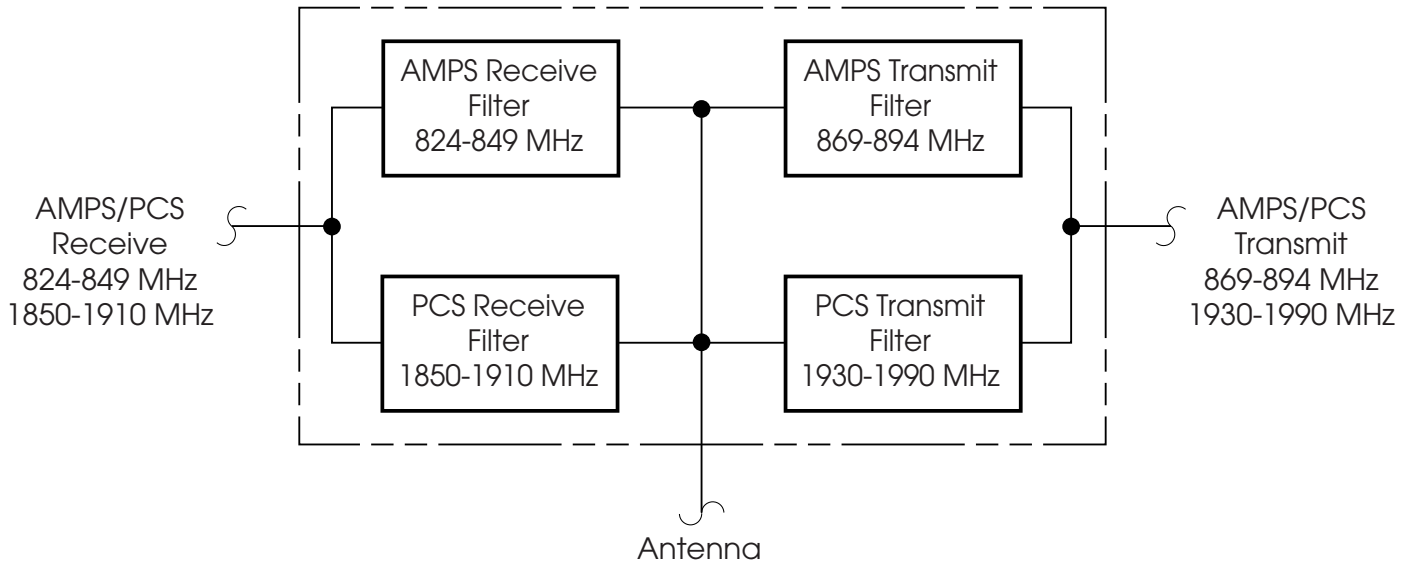
WSA-00045 Dual Band Duplexer



Receive Port



Transmit Port



WSA-00045 Dual Band Duplexer

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High-Power, Broadband Matched Band-Pass/Band-Stop Diplexers

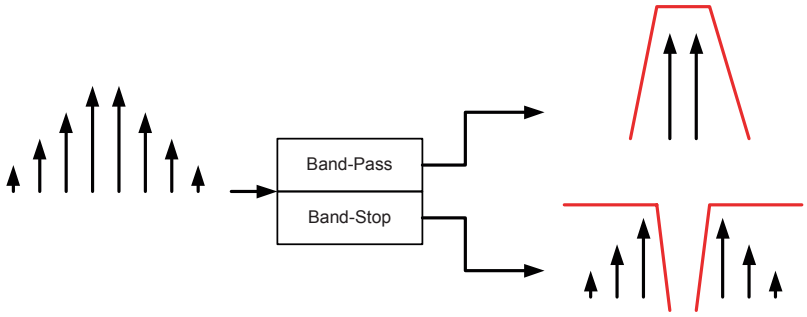
BP/BS Applications:



- **Up/Down Converters** - As a Buffer Between the Mixer and the Amplifier
- **RF/Microwave Multi-Plexer Modules** - Cascade of BP/BS Stages
- **Combining/Splitting Three Cellular Base Stations to a Common Antenna**
  Example: DCS, PCS, UMTS
- **Broadband Measurement of RF Emission from Cellular Base Station**
  by Splitting the Carriers from the Intermodulation Products
  (See Diagram Below)

Features:

- High-Power Handling
- Low-Loss
- Sharp Rejection Skirts
- Broadband Matched



3GPP Bands:

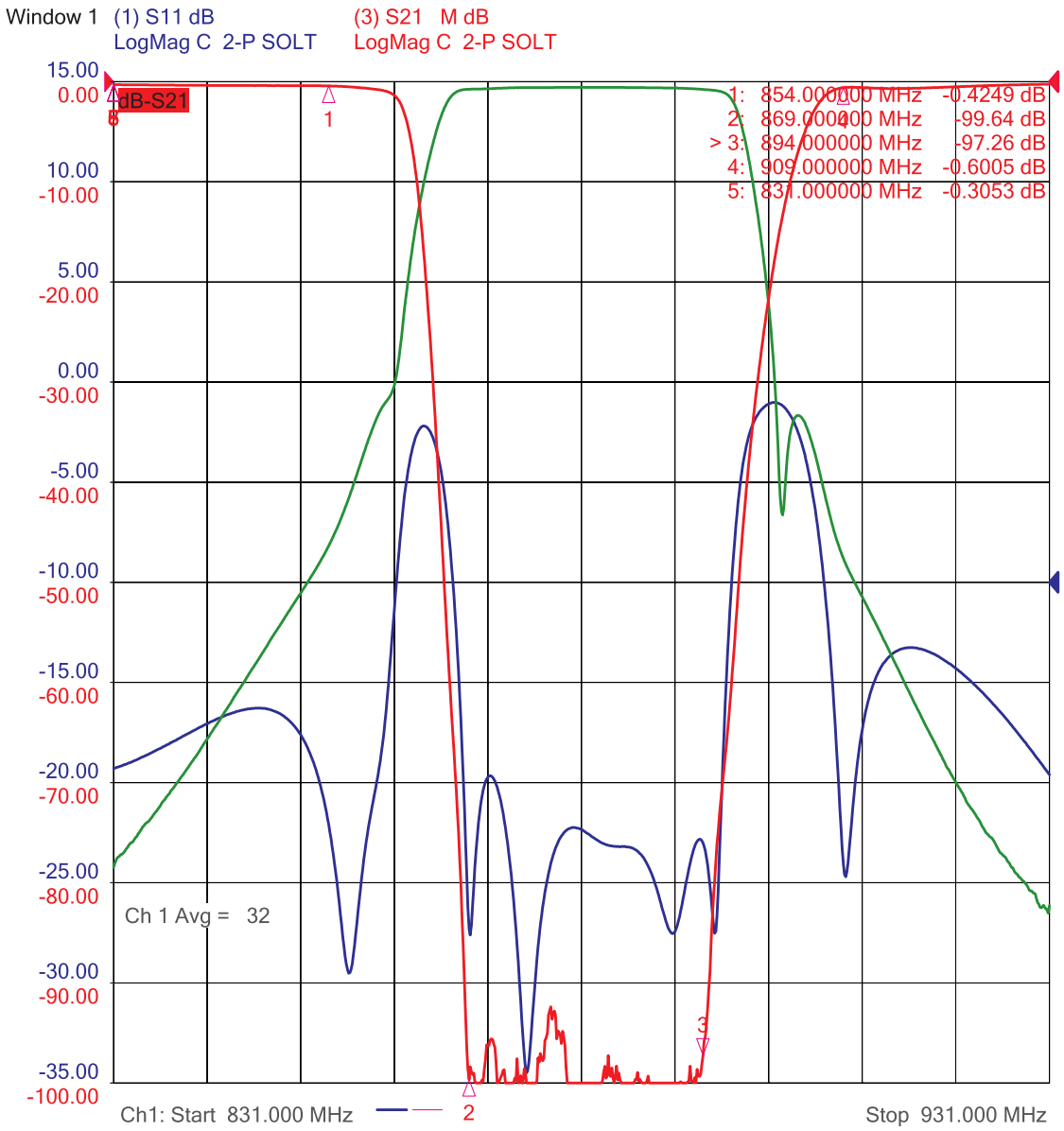
	F1 (MHz)	F2 (MHz)	F3 (MHz)	K&L Part
Band 1	2110	2170	3500	WSD-00459
Band 2	1930	1990	3500	WSD-00485
Band 3	1805	1880	3500	WSD-00458
Band 4	2110	2155	3500	WSD-00487
Band 5	869	894	1650	WSD-00488
Band 6	875	885	1650	WSD-00489
Band 7	2620	2690	3500	WSD-00490
Band 8	925	960	1650	WSD-00491
Band 9	824	849	1650	WSD-00526
Band 10	880	915	1650	WSD-00527
Band 11	1710	1785	3500	WSD-00528
Band 12	1850	1910	3500	WSD-00529
Band 13	1920	1980	3500	WSD-00563
Band 14	2500	2570	3500	WSD-00564

(Rejection / Loss: from F1 to F2)
Antenna to Band-stop: 90dB Rejection
Antenna to Band-pass: <3 dB

VSWR:
From DC to F1-15 (MHz) and from F2+15 (MHz) to F3; 2:1
From F1 to F2; 1.4:1

High-Power, Broadband Matched Band-Pass/Band-Stop Diplexers

Band 5: WSD-00488 Frequency Response:



S11- Reflection at Antenna Port
S21- Transmission from Antenna port to Band-Stop port (Data)
S21- Transmission from Antenna port to Band-Pass port (Memory)

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WSF-00009 AMPS Fullband Receive Filter

Features:

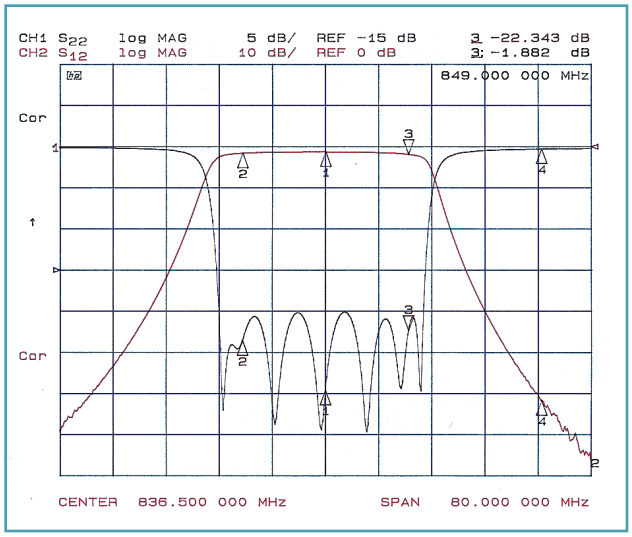
- Low Insertion Loss; STAT
- Compact, Low Profile Design
- Wide Operating Temperature Range



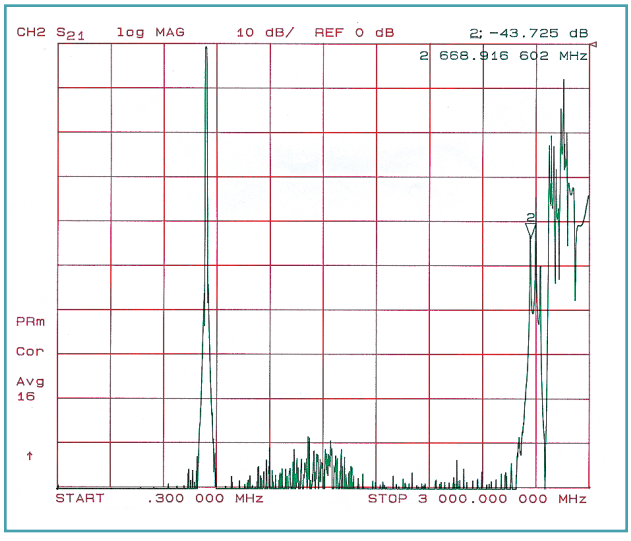
Specifications:

Passband:	824-849 MHz
Passband Insertion Loss:	2.0 dB maximum
Rejection:	
DC-795 MHz	60 dB minimum
869-2000 MHz	60 dB minimum
Passband Return Loss:	14 dB minimum

Operating Temperature:	-25 to +70°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions:	4.81"W x 2.5"D x 1.0"H
(excluding connectors)	(122.2 x 63.5 x 25.4mm)
Connectors:	N-F



Passband Response



Out-of-Band Response

WSF-00077 GSM Receive Filter

Features:

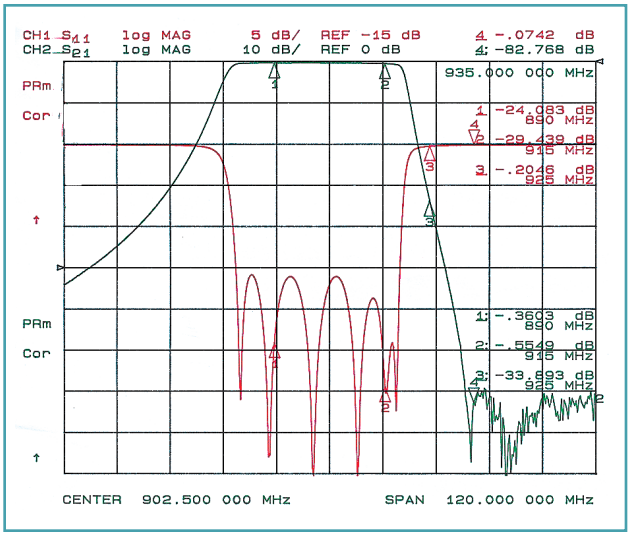
- Very High Rejection - 80 dB typical
- Low Insertion Loss - 0.6 dB typical @ 915 MHz
- High Return Loss - 18 dB typical
- Excellent Harmonic Rejection



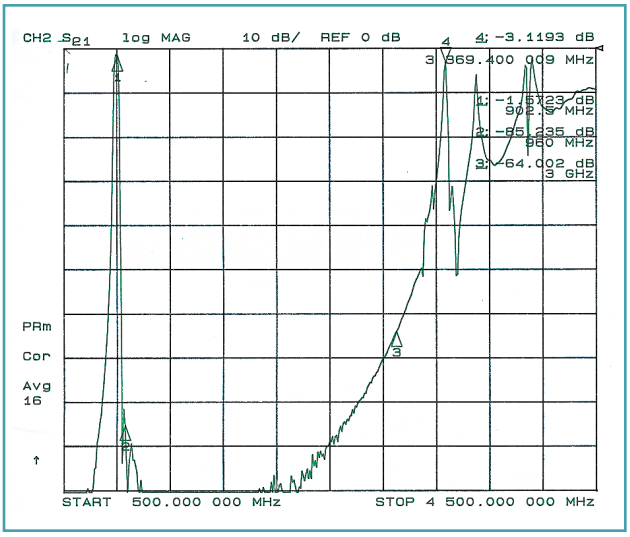
Specifications:

Passband:	890-915 MHz
Passband Insertion Loss:	1.0 dB maximum
Rejection:	
DC-842.5 MHz	45 dB minimum
925-935 MHz	20 dB minimum
935-960 MHz	70 dB minimum
960-3000 MHz	60 dB minimum
Passband Return Loss:	15 dB minimum

Operating Temperature:	-40 to +60°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions: (excluding connectors)	5.19"L x 2.71"W x 2.55"H (131.8 x 68.8 x 64.8mm)
Connectors:	N-F



Passband Response



Out-of-Band Response

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Phone: 410-749-2424 • FAX: 443-260-2268
Email: sales@klmicrowave.com

www.klfilterwizard.com
2250 Northwood Drive
Salisbury, MD 21801

WSF-00177 DCS Receive Bandpass Filter

Features:

- Excellent Selectivity,
  >60 dB @ 1900 MHz, and >50 dB
  @ 2000 MHz (Bandedges + 20 MHz)
- Low Insertion Loss
- Small Size

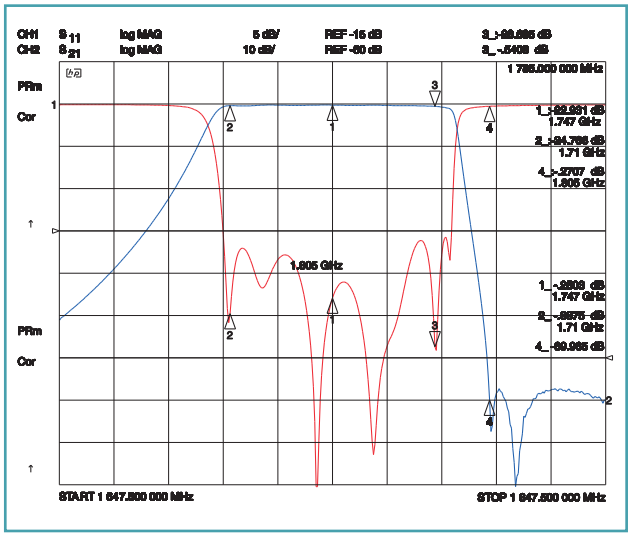


Specifications:

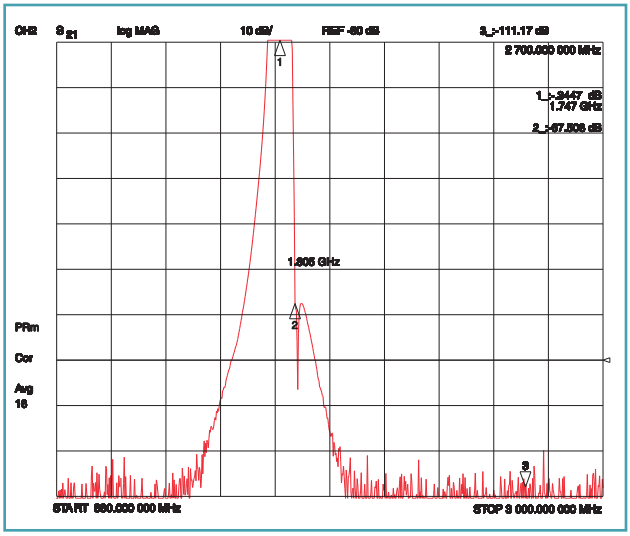
Passbands:	1710-1785 MHz	Operating Temperature:	0 to +50°C
Passband Insertion Loss:	1.5 dB maximum	Storage Temperature:	-40 to +85°C
Passband Return Loss:	15 dB minimum	Operating Humidity:	0 to 90%, relative, non-condensing,
Rejection:		Dimensions:	5.45"L x 2.67"W x 1.67"H
DC-1615 MHz	50 dB minimum	(excluding connectors)	(355.6 x 152.4 x 55.9mm)
1805-2700 MHz	50 dB minimum	Connectors:	SMA-F

Applications:

- Picocell, Microcell and Macrocell base station installations
- Handset or equipment test systems



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WSF-00007 PCS Fullband Receive Filter

Features:

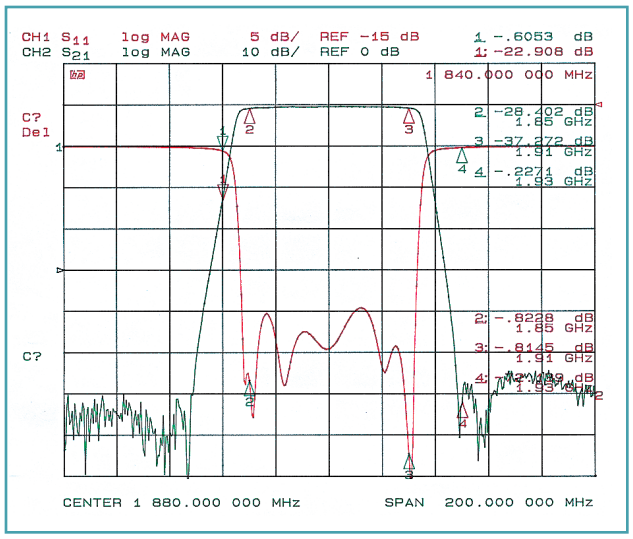
- Compact, Low Profile Design
- Low Insertion Loss; <0.7 dB typical
- Full Band, Highly Selective Performance
- Wide Operating Temperature Range



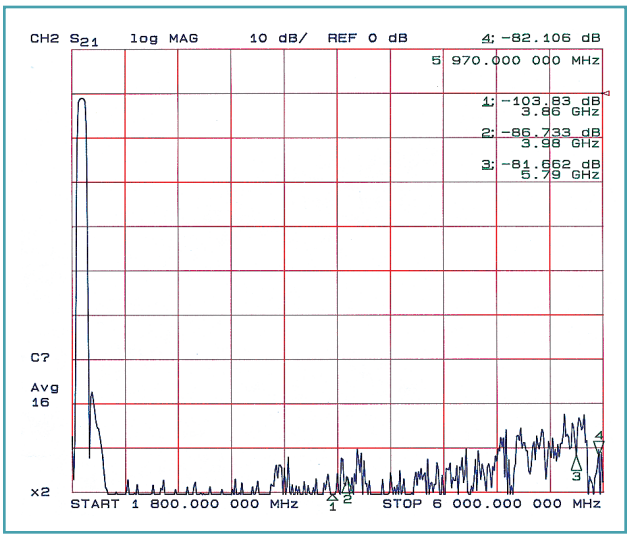
Specifications:

Passband:	1850-1910 MHz
Passband Insertion Loss:	1.0 dB maximum
Rejection:	
DC-1825 MHz	60 dB minimum
1930-4000 MHz	60 dB minimum
4000-6000 MHz	40 dB minimum
Passband Return Loss:	15 dB minimum

Operating Temperature:	-25 to +70°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions:	4.79"W x 2.32"D x 1.5"H
(excluding connectors)	(121.7 x 58.9 x 38.1mm)
Connectors:	N-F



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WSF-00172 3G Receive Bandpass Filter

Features:

- Excellent selectivity, >60 dB @ 1900 MHz, and >50 dB @ 2000 MHz. (Bandedges + 20 MHz)
- Low Insertion Loss — 0.8 dB typical
- Small Size



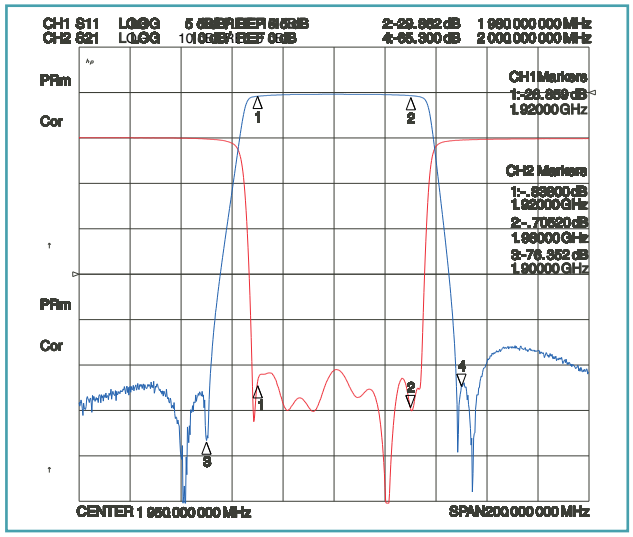
Specifications:

Passband:	1920-1980 MHz
Passband Insertion Loss	1.0 dB maximum
Passband Flatness:	0.5 dB maximum
Passband Return Loss:	15 dB minimum
Rejection:	
DC-1900 MHz	60 dB minimum
2000-4000 MHz	50 dB minimum
4000-6000 MHz	40 dB minimum

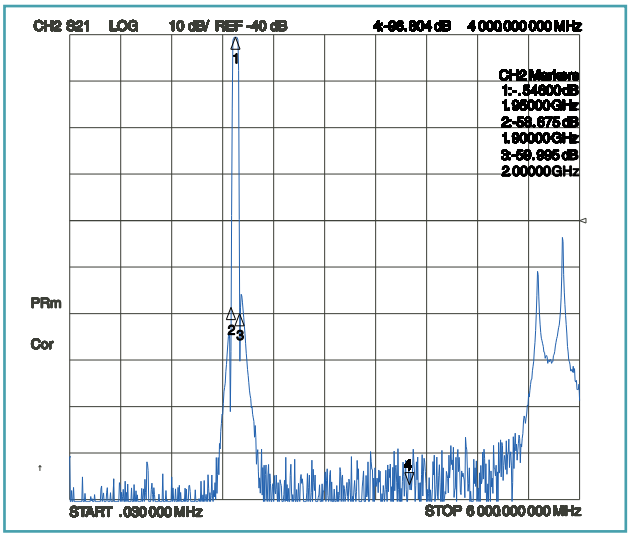
Operating Temperature:	-25 to +70°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, relative, non-condensing
Dimensions:	4.79"L x 2.32"W x 1.31"H
(excluding connectors)	(121.7 x 58.9 x 33.3mm)
Connectors:	N-F

Applications:

- Picocell, Microcell and Macrocell base station installations.
- Handset or equipment test systems.



Passband Response



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WSF-00043 PCS Fullband Transmit Filter

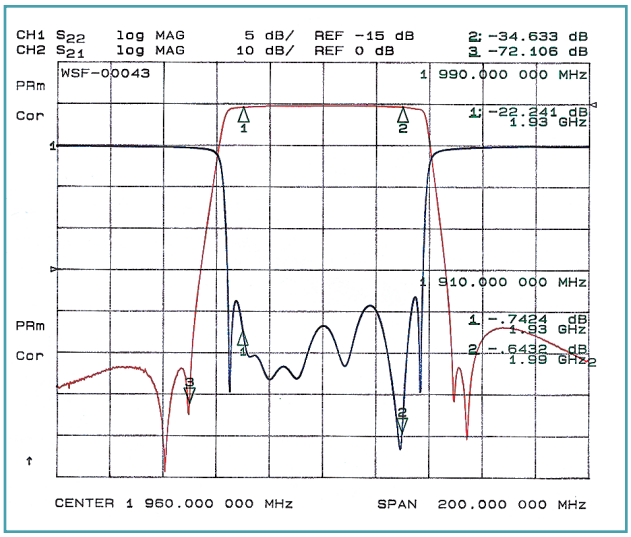
Features:

- Compact, Low Profile Design
- Low Insertion Loss, <0.7 dB typical
- Fullband, Highly Selective Performance
- Wide Operating Temperature Range

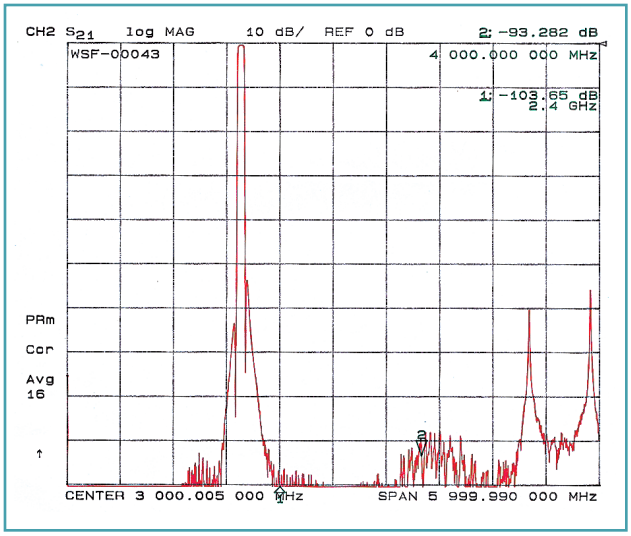


Specifications:

Passbands:	1930-1990 MHz
Passband Insertion Loss:	1.0 dB maximum
Rejection:	
DC-1910 MHz	60 dB minimum
2010-4000 MHz	50 dB minimum
4000-6000 MHz	40 dB minimum
Passband Return Loss:	15 dB minimum
Maximum Power Handling:	
CW	50 watts
Peak Instantaneous	100 watts
Intermodulation Products:	-110 dBm maximum with two +40 dBm carriers
Operating Temperature:	-25 to +70°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	Up to 90%, non-condensing
Dimensions : (excluding connectors)	4.79"W x 2.32"D x 1.31"H (121.7 x 58.9 x 33.3mm)
Connectors:	N-F



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WSF-00154 3G Transmit Bandpass Filter

Features:

- Excellent Selectivity,
  >60 dB @ 2090 MHz, and >50 dB

  @ 2190 (Bandedges ± 20 MHz)
- High Power Handling
- Low Insertion Loss
- Rejection to 3rd Harmonic

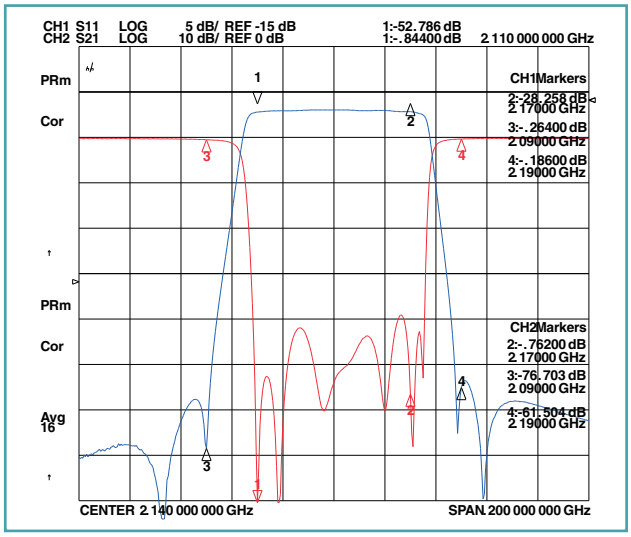


Specifications:

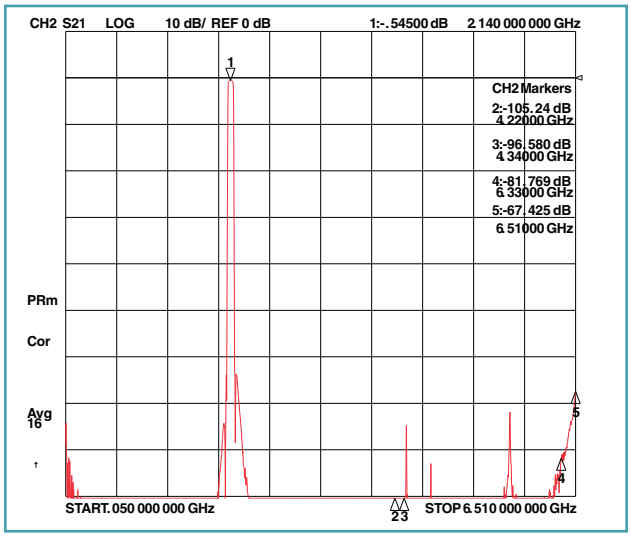
Passband:	2110-2170 MHz	Operating Temperature:	-25 to +70°C
Passband Insertion Loss:	1.0 dB maximum	Storage Temperature:	-40 to +85°C
Passband Return Loss:	15 dB minimum	Operating Humidity:	0 to 90%, relative, non-condensing
Rejection:			
DC-2090 MHz	60 dB minimum	Dimensions:	5.62"L x 2.94"W x 1.25"H
2190-4000 MHz	50 dB minimum	(excluding connectors)	(142.7 x 74.7 x 31.8mm)
4000-6510 MHz	25 dB minimum	Connectors:	N-F
Power Handling:			
CW	50 watts		
Peak Instantaneous	1000 watts		

Applications:

- Picocell, Microcell and Macrocell Base Station Installations.
- Handset or Equipment Test Systems.



Passband Response



Out-of-Band Response

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AMPS/DCS/PCS Mechanically Tunable CDMA Combiners

AMPS Band Combiner Model Selection Matrix

Tx Channels	K&L Model Number	Description	Dimensions (excluding connectors)
2	WSC2-00002	2-way AMPS Band CDMA Tx Combiner	11.5"L x 7.6"W x 4.7"H (292.1mm x 193mm x 119.4mm)
3	WSC3-00004	3-way AMPS Band CDMA Tx Combiner	11.5"L x 11.2"W x 4.7"H (292.1mm x 284.5mm x 119.4mm)
4	WSC4-00008	4-way AMPS Band CDMA Tx Combiner	11.5"L x 14.9"W x 4.7"H (292.1mm x 378.5mm x 119.4mm)

DCS Band Combiner Model Selection Matrix

Tx Channels	K&L Model Number	Description	Dimensions (excluding connectors)
2	WSC2-00006	2-way DCS Band CDMA Tx Combiner	9.5"L x 6.0"W x 2.7"H (241.3mm x 152.4mm x 68.6mm)
3	WSC3-00003	3-way DCS Band CDMA Tx Combiner	9.5"L x 8.3"W x 2.7"H (241.3mm x 210.8mm x 68.6mm)
4	WSC4-00009	4-way DCS Band CDMA Tx Combiner	9.5"L x 11.85"W x 2.7"H (241.3mm x 301mm x 68.6mm)

PCS Band Combiner Model Selection Matrix

Tx Channels	K&L Model Number	Description	Dimensions (excluding connectors)
2 **Available from Stock**	WSC2-00011	2-way PCS Band CDMA Tx Combiner	9.5"L x 6.0"W x 2.7"H (241.3mm x 152.4mm x 68.6mm)
3	WSC3-00002	3-way PCS Band CDMA Tx Combiner	9.5"L x 8.3"W x 2.7"H (241.3mm x 210.8mm x 68.6mm)
4	WSC4-00002	4-way PCS Band CDMA Tx Combiner	9.5"L x 11.85"W x 2.7"H (241.3mm x 301mm x 68.6mm)

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Cellular Band Fixed Notch Filter

Features:

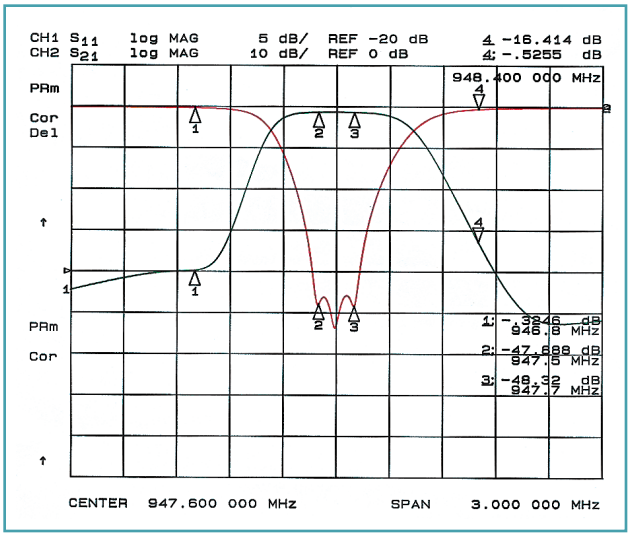
- Dielectrically Loaded Waveguide Designs
- Very Selective - 40 dB minimum @ +/-100 KHz from f_0
- Excellent for AMPS and EGSM Test and Spurious Response Measurements
- Temperature Stabilized - Holds Specifications at Thermal Extremes



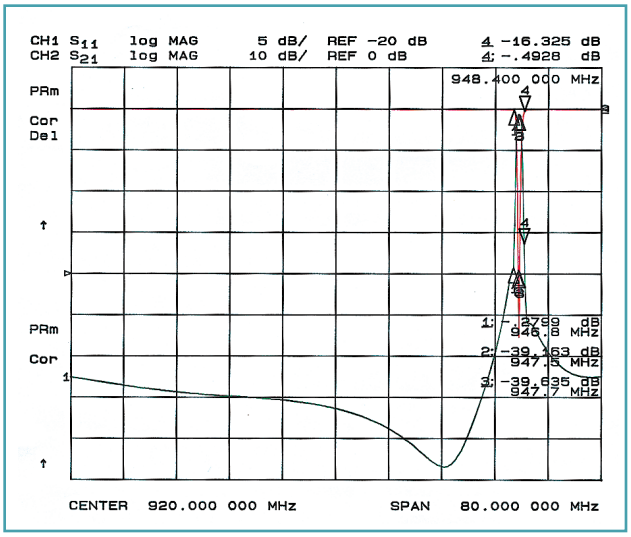
Specifications:

Passband:	806-960 MHz
Passband Insertion Loss:	1.0 dB maximum
Notch Center Frequency (f_0):	Specified by customer within 806-960 MHz passband-factory set
Notch Depth:	
1 dB Points:	f_0 @ +/- 1.5 MHz maximum
3 dB Points:	f_0 @ +/- 800 KHz maximum
40 dB Points:	f_0 @ +/- 100 KHz minimum
Passband Return Loss:	14 dB minimum

Power Handling:	100 watts CW
Operating Temperature:	0 to +50°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions:	10.2"L x 4.28"W x 3.61"H
(excluding connectors)	(259.1 x 108.7 x 91.7mm)
Connectors:	N-F
Model Number:	Contact Factory



Passband Response



Out-of-Band Response

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DCS/PCS Band Fixed Notch Filter

Features:

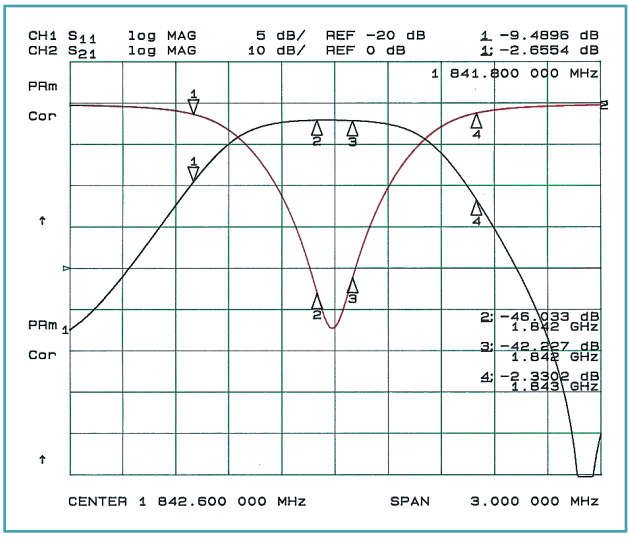
- Dielectrically Loaded Waveguide Designs
- Very Selective - 40 dB minimum @ +/-100 KHz from f_0
- Excellent for DCS and PCS System Test and Spurious Response Measurements
- Temperature Stabilized - Holds Specifications at Thermal Extremes



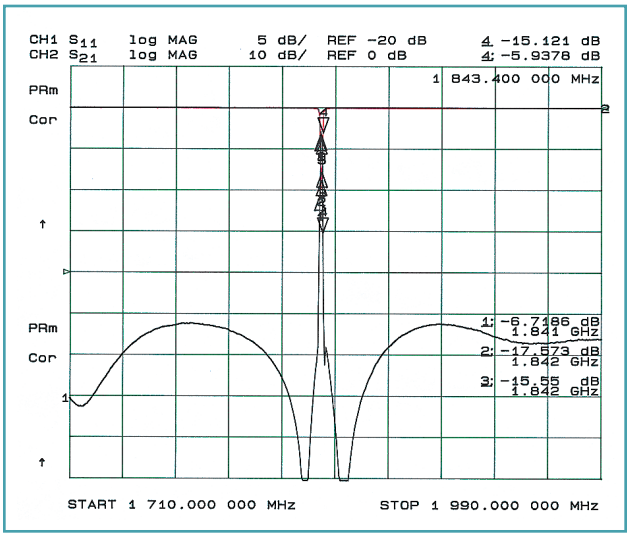
Specifications:

Passbands:	
DCS-1800:	1710-1880 MHz
PCS-1900:	1850-1990 MHz
Passband Insertion Loss:	1.0 dB maximum
Notch Center Frequency (f_0):	Factory set-specified
by customer within passbands per above	
Notch Depth:	
1 dB Points	f_0 @ +/- 1.5 MHz maximum
3 dB Points	f_0 @ +/- 800 KHz maximum
40 dB Points	f_0 @ +/- 100 KHz minimum
Passband Return Loss:	14 dB minimum

Power Handling:	100 watts CW
Operating Temperature:	0 to +50°C
Storage Temperature:	-40 to +85°C
Operating Humidity:	0 to 90%, non-condensing
Dimensions:	5.67"L x 4.87"D x 2.15"H
(excluding connectors)	(144 x 123.7 x 54.6mm)
Connectors:	N-F
Model Number:	Contact Factory



Passband Response



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WSN-00097 PCS Bandreject Filter

Features:

- Testing and Calibration Filter
- 70 dB Rejection of PCS Frequencies
- Very Low Insertion Loss in Passband Region
- Designed for High-Power Test Applications

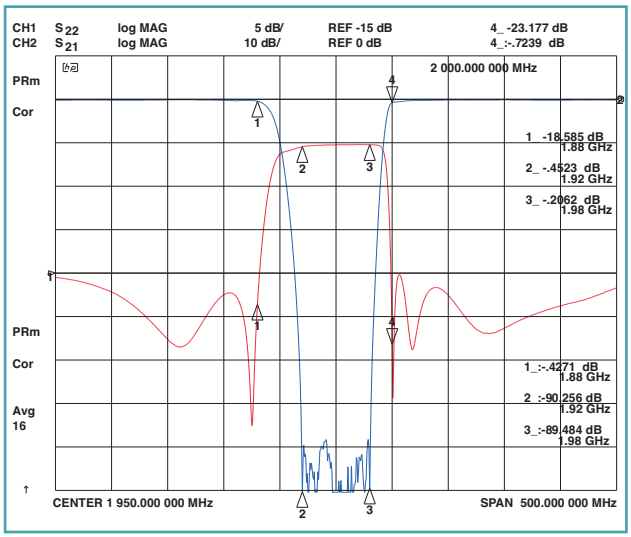


Specifications:

Rejection:	≥70 dB at 1920-1980 MHz
Passband Low:	DC-1880 MHz
Passband High:	2000-2200 MHz
Passband Insertion Loss:	≤1.0 dB
Passband Flatness:	0.5 dB Peak to Peak
Passband Return Loss:	≥14 dB
Input Power:	100 Watts in the Passbands
Connectors:	SMA-Female
Dimensions:	14" L x 1.3" W x 2" H (355.6 x 33.0 x 50.8 mm)

Applications:

- Testing Calibration of Base Station of Equipment
- Field Performance Measurements



Filter Response

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WSN-00198 High-Power Bandreject Filter

Features:

- Positioned at the Output of a VHF-UHF Amplifier
- Maintains Low-Loss Passbands
- Special Features to Extend the Upper Passband
- Mixed Technologies Yield Compact and Rugged Design

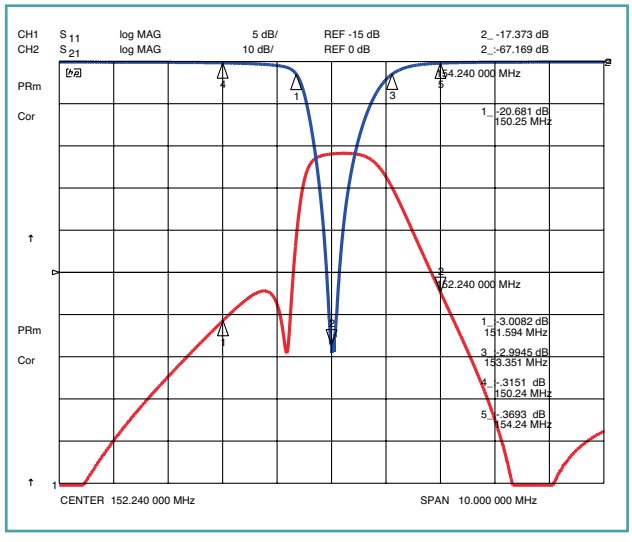


Specifications:

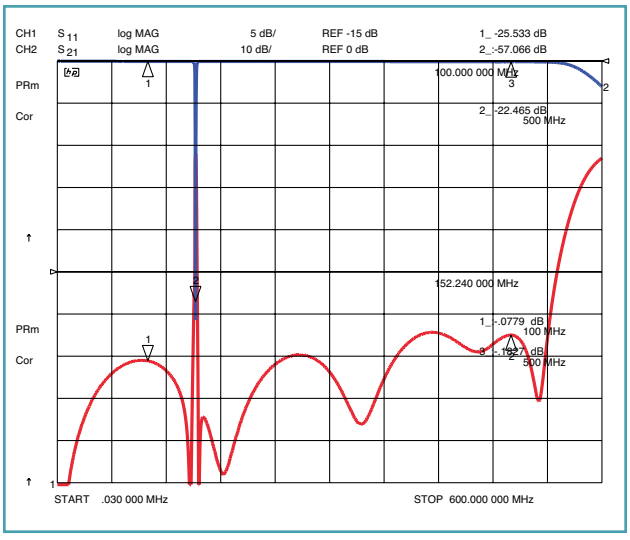
Frequency Passband:	100 - 500 MHz (excluding the notch)	RF Power Handling:	600 Watts CW in the passband 5 Watts CW in the notch
Notch Frequency:	152.24 MHz		
3 dB Bandwidth:	1.6 MHz typical	Connectors:	Type N Female
Passband Insertion Loss:	<0.75 dB typical		
Passband VSWR:	<1.25:1 typical		

Applications:

- Narrowband VHF Hi-Q Band Reject Filter for Interference Mitigation



Narrowband Response



Wideband Response

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WSN-00278 High-Power UHF Notch Filter

Applications & Features:

- Protects the Receiver from a nearby Transmit Antenna
- Eliminates Unwanted Spectral Product at the Transmitter End

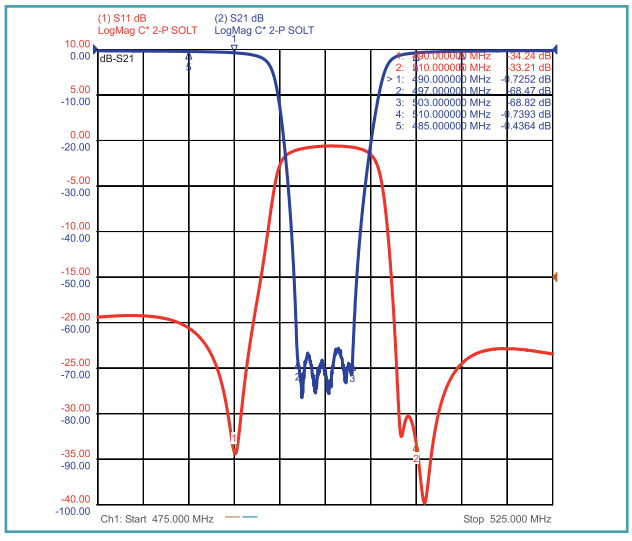


Specifications:

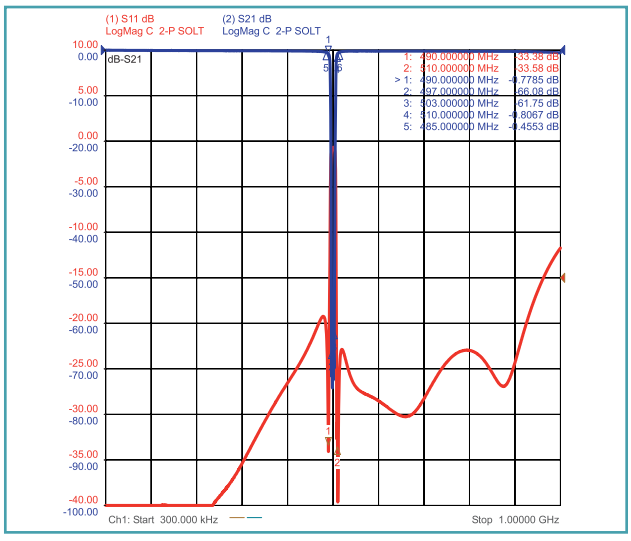
Centre Frequency:	500 MHz	Dimensions:	13.2" x 5.5" x 2.4" typ
Insertion Loss:	100-490 & 510-800 MHz 1.0 dB max. (0.75 dB Typical)	Connectors:	SMA Female
Passband VSWR:	1.5:1 min.		
Rejection:	497-503 MHz; 65 dB min.		
Power Handling:	500 W CW		

Frequency Response:

- Interference mitigation of a high power signal protects the receiver from de-sensitization.



Zoom-In Response



Zoom-Out Response

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WSN-00280 Weather Sealed Notch Filter

Features:

- Weather Resistant
- NPSPAC Notch Filter
- Elliptic Response Design; Sharp Rolloff
- High Passband Power Handling



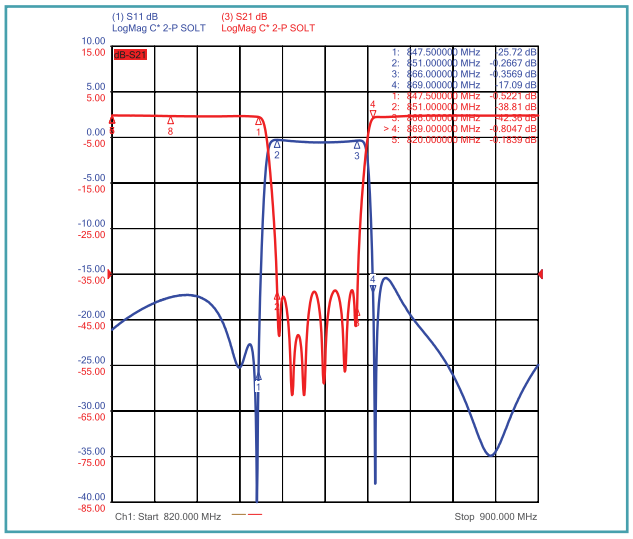
Specifications:

High Rejection:	>40 dB @ 851 MHz
Low Loss:	1.0 dB Typical @ 846.5 MHz
Passbands:	DC - 846.5 MHz
	869 - 891.5 MHz
Passband Insertion Loss:	
DC - 846.5 MHz:	0.65 dB maximum
869 - 891.5 MHz:	0.65 dB maximum
Passband Return Loss:	15 dB maximum

Rejection:	
851 - 866 MHz:	37 dB minimum
869 - 891.5 MHz	
Power Handling:	
CW:	500 Watts
Peak Instantaneous:	10,000 Watts
Operating Temperature:	-10 °C to +65 °C
Dimensions:	12.74" D x 7.36" W x 4.28" H (excluding connectors)
Connectors:	N - F

Applications:

- Eliminate interference due to close proximity of systems



Zoom-In Response

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