# ANATECH ELECTRONICS INC

RF & Microwave Filters & Products

# SHORT FORM CATALOG


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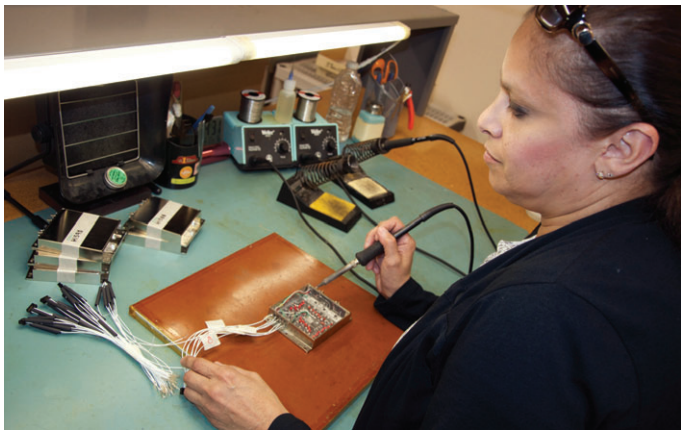
# ABOUT US

Anatech Electronics, Inc. (AEI), is a privately-held, ISO9001 Certified company founded in January of 1990 that focuses on the design and manufacturing of RF and microwave filters and related products. Our broad array of products is used in commercial, aerospace and defense, and industrial applications throughout the world. We specialize in rapidly responding to customer needs, creating cost-effective solutions to meet them.



## APPLICATIONS WE SERVE

**Our products are used in a broad array of applications, such as:**

- Wireless communication systems
- Defense electronic systems (electronic warfare, electronic countermeasures, radar, and communications)
- Public safety
- Medical systems
- GPS navigation systems
- Satellite communications terminals
- IEEE 802.11a/b/g/n WiFi systems
- Point-to-point microwave links

… And many others.

## PRODUCTS FOR DEFENSE APPLICATIONS

The aerospace and defense industry is one of AIE's primary markets, and it has developed the capabilities, facilities, and quality control procedures required by defense customers. Anatech Electronics (AEI) is an ISO9001-2008 certified company, and also follows the guidelines of MIL-STD-45208A and MIL-F-18327. AIE is a registered supplier with Aerospace Corp., L-3 Communications, BAE Systems, Boeing, General Dynamics, Harris Corp., Lockheed Martin, NAVSUP, Northrop Grumman, Peterson Air Force Base, Raytheon, Rockwell Collins, SPAWAR, and other defense contractors.

## CAPABILITIES AND FACILITIES

AEI's capabilities include a technical staff with many decades of experience in RF and microwave design, which is supported by highly-qualified sales engineers, administrators, quality control, marketing, IT, and accounting staff. The company maintains a full manufacturing facility, geared for low and high volume manufacturing and testing.

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### BANDPASS FILTERS



**ANATECH ELECTRONICS INC**

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**Bring us your challenge, we'll provide the answer!**


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# AEI BANDPASS FILTERS

***Anatech Electronics (AEI) bandpass filters*** *are available from 10 kHz to 40 GHz with 2 to 15 sections with bandwidths ranging from 0.5% to 100%. The most commonly used topology types are Chebyshev, Butterworth, Elliptic and other special topologies are also used depending on the requirements. Our designs are optimized to reduce package size as much as possible, while keeping the insertion loss to a minimum, and meet the electrical requirements with a reasonable margin. Our proprietary design techniques allow us to design very complex filters for a broad range of bandwidths from very narrow to very wide, with excellent performance, such as very sharp passband to stopband transition, high power handling, and very low insertion loss. The filters can be optimized for other performance parameters such as group delay variation, amplitude matching, and phase matching.*

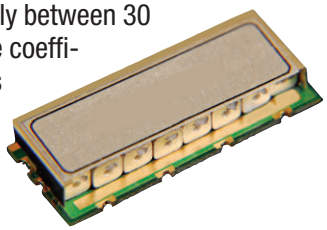
## CAVITY BANDPASS


Anatech Electronics cavity bandpass filters are available in a wide range of frequencies, power levels, bandwidths, and rejection. The resonators and cavities are silver plated for low RF resistivity, in order to achieve low insertion loss and high selectivity. Filter size depends on performance requirements, frequency of operation, RF power handling, insertion loss, and number of sections. AEI uses the best topology required to achieve the requirements. The cavity bandpass filters range in length from 1 in. to more than 18 in., depending on number of sections, insertion loss, power handling, and center frequency. Packaging and mounting options include surface mount, connectorized, printed circuit board mount, and drop-in. AEI offers a broad range of customization possibilities, from electrical characteristics to size, mounting, and weatherization.

| Frequency Range (MHz) | 3dB Bandwith (%) | Nunber of Sections | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 20-40000 | 0.3 to more than 100 | 2 to 15 | 1.5:1 | 50 | 500 | Connectorized PC Mount, Drop In | -55 to +85 | 30G, 11ms | 20G, 5-200Hz |

## CERAMIC BANDPASS

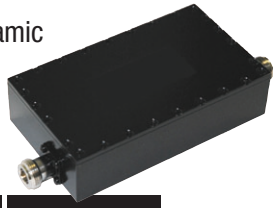
AEI's ceramic bandpass filters deliver extremely high performance and reliability and serve a broad array of applications from 400 to 6500 MHz. Their size depends on the dielectric constant of the ceramic resonator (typically between 30 and 90), and the lower the dielectric constant the larger the resonator and the better the temperature coefficient (and vice versa). Ceramic bandpass filters can be made from discrete ceramic resonators or as a single piece of ceramic material called a "monoblock" structure. Monoblock ceramic filters are best suited for high-volume applications in which their higher manufacturing cost can be amortized over a large number of devices. Other than reduced size, monoblock ceramic filters have performance nearly identical to that of their discrete counterpart.



| Frequency Range (MHz) | 3dB Bandwith (%) | Nunber of Sections | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 400-6500 | 2 to 35 | 2 to 8 | 1.5:1 | 50 | 5 to 8 | Surface Mount | -55 to +85 | 20G, 11ms | 10G, 5-200Hz |

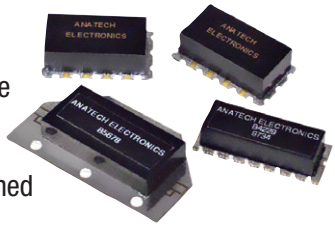
## CONNECTORIZED CERAMIC BANDPASS

Connectorized ceramic bandpass filters have the same performance and characteristics as their SMT ceramic bandpass filter counterparts except that they are conveniently enclosed inside a connectorized metal enclosure. This makes them usable in both indoor and outdoor applications when housed in a weatherproof enclosure, and they can withstand extreme environmental conditions. Connectorized ceramic filters can be fitted with SMA, Type-N, SMC, SMB, F, or TNC connectors in any combination.



| Frequency Range (MHz) | 3dB Bandwith (%) | Nunber of Sections | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 400 to 6500 | 2 to 35 | 2 to 8 | 1.5:1 | 50 | 5 to 8 | Connectorized | -55 to +85 | 20G, 11ms | 10G, 5-200Hz |

## SURFACE MOUNT PC BANDPASS



AEI surface-mount (SMT) PC bandpass filters are small, rugged designs that are an excellent choice when cost and size are primary considerations. Their frequency range is 10 to 500 MHz, they can have between 3 and 6 sections, and can handle up to 20 W. Size depends on operating frequency and number of sections and is typically between 1 and 2.5 inches. They are typically designed in a Chebyshev 0.05 dB type topology.

| Frequency Range (MHz) | 3dB Bandwith (%) | Nunber of Sections | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 10 to 500 | 2 to 20 | 2 to 7 | 1.5:1 | 50 | 20 | Surface Mount | -55 to +85 | 10G, 11ms | 10G, 5-200Hz |

## CRYSTAL BANDPASS

Crystal bandpass filters use the piezoelectric effect of quartz crystals and convert mechanical motion into electric signals. The low thermal expansion of quartz crystals allows crystal filters to produce stable performance over a wide temperature range. AEI crystal filters exhibit extremely high Q factor, giving them the ability to achieve extremely narrow bandwidth in the range of a few kHz. Such a high Q factor, in the range of 5000 and higher than 10000 results in relatively low loss considering their extremely narrow bandwidth. The crystal bandpass filters are available in frequencies up to 250 MHz, in connectorized, surface mount, PC board mount, and drop-in type packages, with a length ranging from approximately 1 to 5 in.

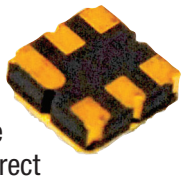
| Frequency Range (MHz) | 3dB Bandwith (%) | Nunber of Sections | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 4.74 to 250 | <=0.03 | 2 to 8 | 1.5:1 | 50 | 8 | Connectorized, SMT, PC Mount, Drop In | -55 to +85 | 20G, 11ms | 10G, 5-200Hz |

## LC BANDPASS

Lumped-element (LC) bandpass filters range in frequency from 10 kHz to 2500 MHz, and are based on LC tank circuits consisting of parallel or series inductors and capacitors. They are relatively small and are optimized to achieve peak performance within a given set of specifications and mechanical requirements. AEI LC filters are designed to achieve very high Q, low insertion loss, and high selectivity. Standard responses include Chebyshev, Butterworth, elliptic, and Bessel and special filter shapes are available as well. They range in length from 0.5 inch to more than 10 inches, depending on the frequency, power requirements, and performance. Packaging options include surface mount, connectorized, printed circuit board mount, and drop-in. Custom mechanical configurations, and special requirements, such as group delay variation, amplitude matching, phase matching, and tracking can be specified.

| Frequency Range (MHz) | 3dB Bandwith (%) | Nunber of Sections | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 0.1-2500 | 3 to more than 100 | 2 to 16 | 1.5:1 | 50 or 75 | 300 | Connectorized, SMT, PC Mount, Drop In | -55 to +85 | 20G, 11ms | 10G, 5-200Hz |

## SAW BANDPASS



Surface acoustic wave (SAW) bandpass filters employ the piezoelectric effect to convert an electromagnetic signal into an acoustic signal and vice versa. SAW bandpass filters provide sharp cut-off, very linear phase characteristics, high stability, and are highly reliable. Electrical signals are converted to a mechanical wave in a device constructed of a piezoelectric crystal or ceramic, and the wave is delayed as it propagates across the device before being converted back to an electrical signal. The delayed outputs are recombined to produce a direct analog implementation of a finite impulse-response filter. AEI offers a very broad range of SAW bandpass filters that can be specified for operating frequencies from 4.75 MHz up to 6 GHz. They are extremely compact surface-mount devices and typically measure 2 x 2 x 2 mm, and can be as long as 50 mm in length.

| Frequency Range (MHz) | 3dB Bandwith (%) | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|
| 4.75-6000 | 2 to 10 | 1.5:1 | 50 | 0.5 | Surface Mount | -45 to +85 | 20G, 11ms | 10G, 5-200Hz |

# AEI DUPLEXERS

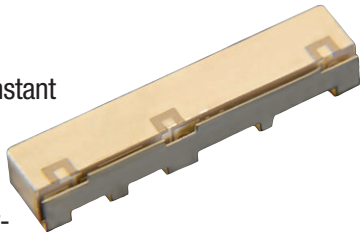
***Anatech Electronics (AEI) duplexers*** *are custom products that combine receive and transmit channels to allow a single antenna to be used, as well as splitting the received RX, and TX signals. They are available with operating frequencies of 1 MHz to 17 GHz and in 2 to 15 sections with isolation up to 100 dB, and RF power handling ability of 500 W or more. Technologies used are cavity, ceramic, LC, and SAW. Duplexers designed specifically for commercial and military wireless applications, such as GSM, PCS, WCDMA, LTE, and Wi-Fi, as well as multi-band applications are available in custom and standard models. AEI will match the specification, and form-fit factor of duplexers from other manufacturers as well. AEI duplexers can be manufactured with SMA, Type-N, BNC, TNC, SMC, SMB, 7/16 connectors. Duplexers are also available in surface mount, PC mount, and drop-in style enclosures. Special packaging and connectors can also be specified.*

## CAVITY DUPLEXERS


AEI cavity duplexers are available with 2 to 18 resonators and bandwidths ranging from 3% to 100%. The resonator and cavity are silver plated for low insertion loss and high selectivity. The cavity duplexers range in frequencies from 20 MHz to 20 GHz, and can handle RF power inputs up to 500 W. Duplexers are available that can withstand hostile environments encountered in outdoor installations. Standard designs use a 0.05-dB Chebyshev response and other response types such as Butterworth and elliptic are also used depending on the performance. They range in length from 1.5 to more than 10 in. depending on the insertion loss, power handling, and center frequency requirements. The duplexers are available in surface mount, connectorized, PC mount, drop-in, as well as special configurations specified by the requirements.

| Frequency Range (MHz) | 3dB Bandwith (%) | Nunber of Sections | Isolation (dB) | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 20 to 40 | 0.7 to 50 | 2 to 13 | 30 to 120 | 1.5:1 | 50 | 500 | Connectorized, Drop-in | -55 to +85 | 20G, 5-200Hz |

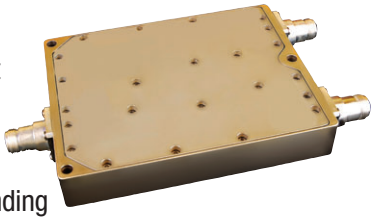
## CERAMIC DUPLEXERS



AEI ceramic duplexers are fabricated with the highest quality ceramic material with a dielectric constant between 30 to more than 90. The dielectric constant is chosen based on size and performance requirements. The lower dielectric constant ceramic material will result in higher Q factors, high temperature stability, and large size, while the high dielectric constant material will result in lower performance, lower temperature stability, but very small size. Their high Q factor leads to higher performance in a minimal size with lower insertion loss and better selectivity. AEI ceramic duplexers are available in surface mount packages, as well as connectorized packages available on request. The size of a ceramic duplexer depends on the frequency range, insertion loss, and selectivity of the filter and can range in length from 10 to 80 mm.

| Frequency Range (MHz) | 3dB Bandwith (%) | Nunber of Sections | Isolation (dB) | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 400 to 6500 | 2 to 35 | 2 to 8 | 25 to 80 | 1.5:1 | 50 | 5 to 8 | Surface Mount | -45 to +85 | 10G, 5-200Hz |

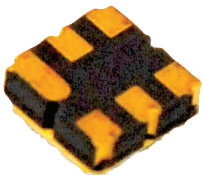
## LC DUPLEXERS



AEI LC duplexers are manufactured using inductors and capacitors with a high Q factor that results in low insertion loss and high selectivity. LC duplexers can be designed to operate from 100 kHz up to 2500 MHz and can handle up to 40 W. Standard designs use the 0.05-dB Chebyshev Butterworth, elliptic, and Bessel response topology, and other special shapes using in house developed design tools. AEI LC duplexers range in length from 1 to more than 18 in. depending on frequency of operation, power handling, insertion loss, and other parameters. The LC duplexers are available in connectorized, surface mount, PC mount, drop-in, and any other special configurations required by the customer.

| Frequency Range (MHz) | 3dB Bandwith (%) | Nunber of Sections | Isolation (dB) | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 0.1 to 2500 | 2 to 100 | 2 to 10 | 30 to 120 | 1.5:1 | 50 or 75 | 300 | Connectorized, PC Mount, Drop-in, SMT | -55 to +85 | 20G, 5-200Hz |

## SAW DUPLEXERS



Surface Acoustic Wave (SAW) duplexers provide high stability and sharp rejection characteristics in a compact surface-mount package ranging in size from 3 x 3 x 2 mm to 30 x 15 x 2.5 mm. Insertion loss ranges from 1.8 dB to 6 dB with isolation ranging from 20 dB to more than 50 dB. The maximum RF power of a SAW duplexer is about 1 W.

| Frequency Range (MHz) | 3dB Bandwith (%) | Nunber of Sections | Isolation (dB) | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 50 to 3500 | 1 to 10 | Application Dependant | 25 to 60 | 1.5:1 | 50 | 0.5 | Surface Mount | -45 to +75 | 10G, 5-200Hz |

## CONNECTORIZED CERAMIC DUPLEXERS


Connectorized ceramic duplexers have the same electrical characteristics as their SMT ceramic duplexer counterparts but are housed in a connectorized metal enclosure. They can also be a lower-cost alternative to cavity duplexers in low-power applications. Connectorized duplexers have the same functionality as their SMT counterparts and are used to duplex a receive/transmit communication system, combine signals to use only one antenna in transceivers, and in many other wireless applications. Connectorized ceramic duplexers have operating frequencies between 400 MHz and 6 GHz. Their enclosure size depends on the size of the ceramic duplexer within them and is typically between 0.75 and 3.5 in. Available connectors can be SMA, Type-N, TNC, or F in any combination. Special connectors are available per customer requirement.

| Frequency Range (MHz) | 3dB Bandwith (%) | Nunber of Sections | Isolation (dB) | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 400 to 6500 | 2 to 35 | 2 to 8 | 25 to 80 | 1.5:1 | 50 | 5 to 8 | Connectors | -45 to +85 | 10G, 5-200Hz |

# AEI BANDPASS-LNA & DUPLEXER-LNA FILTERS

***Anatech Electronics (AEI) bandpass-LNA filters and duplexer-LNA filters*** *combine a bandpass filter or duplexer with a low-noise amplifier, bringing two essential components together in a compact, ruggedized package that is well suited for military applications from C thru Ku band (2 to 20 GHz). Some of our duplexer-LNA filters are tailored for satellite communications applications and feature increased dynamic range and receive sensitivity. LNA amplification range is up to 40 dB and noise figure is between 2 to 4 dB. Size depends on the operating frequency, selectivity, isolation (duplexer only), amplification, and power levels. Customized designs are welcome.*

## BANDPASS-LNA

Anatech Electronics (AEI) bandpass-LNA filters and duplexer-LNA filters combine a bandpass filter or duplexer with a low-noise amplifier, bringing two essential components together in a compact, ruggedized package that is well suited for military applications from C thru Ku band (2 to 20 GHz). Some of our duplexer-LNA filters are tailored for satellite communications applications and feature increased dynamic range and receive sensitivity. LNA amplification range is up to 40 dB and noise figure is between 2 to 4 dB. Size depends on the operating frequency, selectivity, isolation (duplexer only), amplification, and power levels. Customized designs are welcome.

| Frequency Range (GHz) | 3dB Bandwith (%) | Nunber of Sections | Gain (dB) | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Noise Figure (typ.) |
|---|---|---|---|---|---|---|---|---|---|
| 2 to 20 | 0.7 to 50 | 2 to 13 | 10 to 50 | 1.5:1 | 50 | 100 | Connectorized, Drop-in | -45 to +85 | 2 to 10 |

## DUPLEXERS-LNA

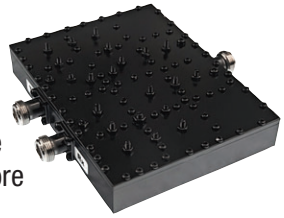
AEI duplexer/LNAs combine a duplexer filter with the same high performance characteristics as our standard and custom duplexers with an integrated low-noise amplifier. They are well suited for both commercial and military applications. The LNA/duplexers operate in the C, X, and Ku bands (2 to 20 GHz) with isolation ranging from 30 to 90 dB. The LNA increases the dynamic range and sensitivity of the receive portion of the duplexer or when combining signals will increase the sensitivity of the receiver. The LNA/duplexers can be supplied in either connectorized or drop-in styles, with SMA or Type-N connectors in any combination. Overall package size depends on duplexer size as well as power handling ability. For space-constricted applications, AEI can optimize their performance within the confines of a given footprint.

| Frequency Range (GHz) | 3dB Bandwith (%) | Nunber of Sections | Isolation (dB) | VSWR (typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Noise Figure (typ.) |
|---|---|---|---|---|---|---|---|---|---|
| 2 to 20 | 0.7 to 50 | 2 to 13 | 30 to 90 | 1.5:1 | 50 | 100 | Connectors, Drop-in | -40 to +85 | 2 to 3 |

# AEI MULTI-BAND MULTIPLEXERS/COMBINERS

***Anatech Electronics (AEI) multiband multiplexers*** *provide a cost-effective solution for carriers operating in multiple frequency bands to multiplex both transmit and receive paths into a single antenna (or vice versa), or split signals from a single antenna into multiple base stations, allowing the system to accommodate a greater number of users. The units can combine or split two ways (duplexer) or three ways (triplexer) with up to six wireless bands in any combination, regardless of the wireless standard. Multiband multiplexers can be designed with cavity or ceramic filter technologies, each with advantages for specific applications. They can be used in commercial as well as military and public safety wireless systems from VHF through microwave frequencies.*

## MULTI-BAND CAVITY MULTIPLEXERS/COMBINERS



AEI multiband cavity multiplexers/combiners allow multiple frequency bands to be combined into one antenna or processing unit or split from a receiving antenna to multiple paths. Two bands can be combined (duplexer) or three bands (triplexer) covering up to six bands. The units have isolation from 30 to 100 dB and they can be designed with passive intermodulation distortion (PIM) as low as 165 dB. Operating frequencies range from about 30 MHz to 20 GHz. Connectors can be Type-N, SMA, 7/16-DIN, or UPC-7. Please contact us for more information or to submit your requirements.

| Frequency Range (MHz) | 3dB Bandwith (%) | Number of Sections | Number of Ports | VSWR (typ.) | Isolation (dB) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Vibration |
|---|---|---|---|---|---|---|---|---|---|---|
| 30 to 20000 | 0.2 to 50 | 2 to 13 | 3 to 8 | 1.5:1 | 30 to 120 | 50 | 500 | Connectorized, Drop-in | -55 to +85 | 20G, 5-200Hz |

## MULTI-BAND CERAMIC MULTIPLEXERS/COMBINERS


Our multiband ceramic multiplexers allow multiple frequency bands to be combined into one antenna or processing unit or split from a receiving antenna to multiple paths. Combining or splitting two bands results in a duplexer, three bands in a triplexer, and four bands in a quadruplexer. Isolation ranges from 20 to 50 dB depending on the proximity of the bands to each other. The multiband ceramic multiplexers are designed as either surface mount or connectorized with SMA, or Type-N connectors depending on the application. Weatherproof designs for outdoor application are also available. Operating frequencies range from 400 MHz and extend to 6000 MHz. Please contact us more information or to submit your requirements.

| Frequency Range (MHz) | 3dB Bandwith (%) | Number of Sections | Number of Ports | VSWR (typ.) | Isolation (dB) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Vibration |
|---|---|---|---|---|---|---|---|---|---|---|
| 400 to 6500 | 2 to 30 | 2 to 8 | 3 to 5 | 1.5:1 | 20 to 50 | 50 | 5 to 7 | Connectorized, or Surface Mount | -55 to +85 | 20G, 5-200Hz |

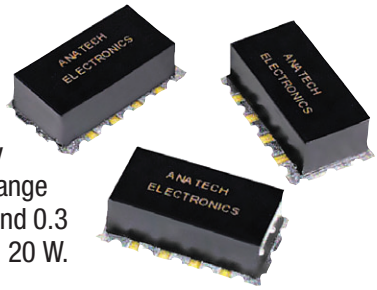
# AEI LC LOWPASS FILTERS

## LC (LUMPED CONSTANT) LOWPASS FILTERS

AEI lumped element (LC) lowpass filters have a high Q factor resulting in low insertion loss and high selectivity. Standard designs have a 0.05-dB Chebyshev response, Butterworth, or elliptic response are available in non-standard filter shapes. AEI LC lowpass filters range in length from 1 in. to more than 15 in. depending on the operating frequency, power handling, insertion loss, and other requirements with power handing capability up to 500 W. Special requirements such as group delay variation, phase linearity, impedance matching, and other special characteristics can also be specified. Packages can be surface mount, connectorized, PC mount, drop-in, or a mixed combination.

| Cutoff Freq. range | Number of Sections | VSWR (Typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|
| 100 KHz to 10 GHz | 4 to 20 | 1.5:1 | 50 or 75 | 500 | Connectorized, PC Mount, Drop-in | -55 to +85 | 30G, 11ms | 10G, 5-200Hz |

## SURFACE MOUNT PC LOWPASS FILTERS




AEI PC SMT lowpass filters series are miniature, low-cost lumped element types that are an excellent choice when circuit board space is limited. They are highly reproducible and designed for high-volume production. The filters are manufactured with high-Q stable components that have a low temperature coefficient. Standard designs have a 0.05-dB Chebyshev response and Butterworth and elliptic responses are available. AEI PC Series lowpass filters range in frequency from 5 to 1000 MHz, and sizes are from 0.5 to 1.75 in. long, 0.3 to 0.5 in. wide, and 0.3 to 0.5 in. high, and come with either a metal or a plastic cover, with a power handling of up 20 W. The SMT PC lowpass filters are available in tape and reel, depending on the quantities.

| Cutoff Freq. range | Number of Sections | VSWR (Typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|
| 5 to 1,000MHz | 3 to 16 | 1.5:1 | 50 or 75 | 10 | Surface Mount | -45 to +85 | 20G, 11ms | 5G, 5-200Hz |

## LC (LUMPED CONSTANT) HIGHPASS FILTERS


AEI LC highpass filters exhibit a high Q factor resulting in low insertion loss and good selectivity. Standard designs have a 0.05-dB Chebyshev, Butterworth, elliptic, Bessel, or special response shapes. AEI LC highpass filters range in length from 1 in. to more than 15 in. and their width and height vary depending on the application. Maximum RF power handling ability is 500 W. The LC highpass filters are available in connectorized, SMT, PC mount, and drop-in style packages. Other configurations can be specified.

| Cutoff Freq. range | Number of Sections | VSWR (Typ.) | Impedance (Ohms) | Maximum power (W) | Package styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|
| 10 KHz to 10 GHz | 3 to 16 | 1.5:1 | 50 or 75 | 500 | Connectorized, PC Mount, Drop-in | -55 to +85 | 20G, 11ms | 10G, 5-200Hz |

## SURFACE MOUNT PC LC HIGHPASS FILTERS

AEI lumped element (LC) lowpass filters have a high Q factor resulting in low insertion loss and high selectivity. Standard designs have a 0.05-dB Chebyshev response, Butterworth, or elliptic response are available in non-standard filter shapes. AEI LC lowpass filters range in length from 1 in. to more than 15 in. depending on the operating frequency, power handling, insertion loss, and other requirements with power handing capability up to 500 W. Special requirements such as group delay variation, phase linearity, impedance matching, and other special characteristics can also be specified. Packages can be surface mount, connectorized, PC mount, drop-in, or a mixed combination.

| Cutoff Freq. range | Number of Sections | VSWR (Typ.) | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|
| 2 to 2000 | 4 to 20 | 1.5:1 | 50 | 1 to 20 | Surface Mount | -45 to +45 | 10G, 11ms | 5-200Hz |

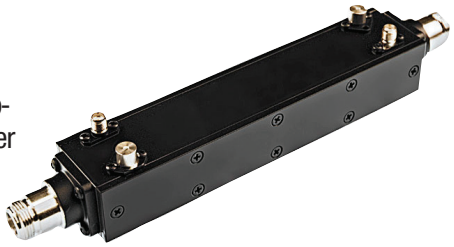
## LUMPED ELEMENTS (LC) BANDSTOP FILTERS


AEI PC SMT lowpass filters series are miniature, low-cost lumped element types that are an excellent choice when circuit board space is limited. They are highly reproducible and designed for high-volume production. The filters are manufactured with high-Q stable components that have a low temperature coefficient. Standard designs have a 0.05-dB Chebyshev response and Butterworth and elliptic responses are available. AEI PC Series lowpass filters range in frequency from 5 to 1000 MHz, and sizes are from 0.5 to 1.75 in. long, 0.3 to 0.5 in. wide, and 0.3 to 0.5 in. high, and come with either a metal or a plastic cover, with a power handling of up 20 W. The SMT PC lowpass filters are available in tape and reel, depending on the quantities.

| Notch Freq. range | Number of Sections | VSWR (Typ.) | Notch BW to Pass-band Ratio | Impedance (Ohms) | Maximum power (W) | Package Styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|---|
| 1 to 1000MHz | 2 to 8 | 1.5:1 | 2:1 to 10:1 | 50 | 100 | Connectors, PC Mount, Drop-in | -55 to +85 | 20G, 11ms | 10 G, 5-200Hz |

# AEI DIRECTIONAL COUPLERS

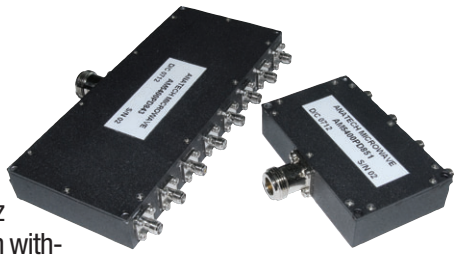
## DIRECTIONAL COUPLERS



AEI manufactures single-ended, dual-directional, and hybrid directional couplers with operating frequencies from 1 MHz to 18 GHz. They are available in low-power or high-power models, have low insertion loss, directivity up to 30 dB, and coupling values from 6 dB to 50 dB. The directional couplers are rugged, highly stable over temperature, and can withstand hostile environmental conditions. They range in length from 0.5 to 8 in. depending on their performance characteristics. Connectorized, surface mount, and printed circuit board mount configurations are available and they can be specified in low power, high power, low loss, octave, dual octave, and broadband versions. Maximum RF power handling ability is 500 W average and 3 kW peak. AEI hybrid couplers split an input signal with a 90-deg. phase shift between their output ports or combine two signals while maintaining high isolation between ports.

| Freq. Range (MHz) | Coupling Value (dB) | VSWR (Typ.) | Coupling Ports | Maximum power (W) | Impedance (Ohms) | Package Style | Operating Temp (deg.C) | Vibration |
|---|---|---|---|---|---|---|---|---|
| 1MHz to 40GHz | 5 to 50 | 1.5:1 | Single or Dual | 500 | 50 | Connectorized | -55 to + 85 | 5G, 5-200Hz |

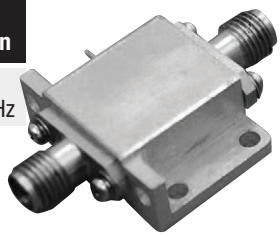
# AEI POWER DIVIDERS



## POWER DIVIDERS

AEI Standard and Custom low-power and high-power 2, 3, 4, 6, 8, 12, 16, and 32-way Wilkinson power dividers/combiners are available with operating frequencies from 1 MHz to 18 GHz. They have low Insertion loss, high isolation, high power handling ability, and can withstand hostile environmental conditions. AEI also offers a full line of standard power dividers tailored for wireless communications applications that have insertion loss of less than 1 dB, up to 25 dB of isolation, and RF power handling ability up to 100 W. All power dividers are available in connectorized and surface-mount packages or special configurations depending on frequency range.

| Cutoff Freq. range | Number of Sections | VSWR (Typ.) | Impedance (Ohms) | Maximum power (W) | Package styles | Operating temp. (deg.C) | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|
| 2 TO 2000 | 2 to 32 | 1.5:1 | 50 | 400 | Connectorized | -55 to +85 | 20G, 11ms | 20G, 5-200MHz |

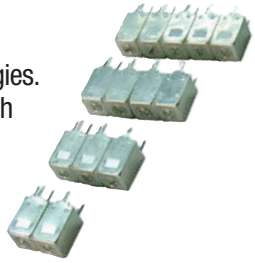


# LOW NOISE AMPLIFIERS (LNA)

Our LNA extends in frequencies from 0.01-40GHz with superb performance, and stability. The operating temperature extremes are from -55 to +85 deg. C. and storage temperature extremes of -65 to +105 deg. C. Our Thin film process leads to a very low noise characteristics, excellent temperature stability, and most of all excellent repeatability due to our mature thin-film process. They are available in gains from 10-50 dBm, and use a supply voltage of 5, 10 and 12 Volts DC depending on the particular product.

| Frequency Range (GHz) | Gain (dB) | Gain Flatness (dB) | Noise Figure (dB) | P1dB | VSWR (typ.) | Impedance (Ohms) | Power Supply | Package Style |
|---|---|---|---|---|---|---|---|---|
| 0.1 to 40 | 10 to 50 | 0.3 to 3.0 | 0.5 to 6.0 | 2 to 32 | 2.0:1 | 50 | 12 V | SMA or 2.92mm |

# HELICAL FILTERS



Anatech Electronics designs Helical filters which promotes low profile products hard to achieve in other technologies. The Helical band pass filters uses ¼ wavelength wire resonators looped around non-magnetized carriers which miniaturizes the size of the resonator. Our Helical band pass filters can handle anywhere from 10 to 60 watts, and are also available as duplexers. They are used in multiple applications such as Digital broadband satellite, Wireless communication, GPS, GSM, Wi-Fi, WCDMA, LTE and more. Frequency ranges for VHF up to about 3000 MHz Their small size make them ideal where real estate is an important criteria.

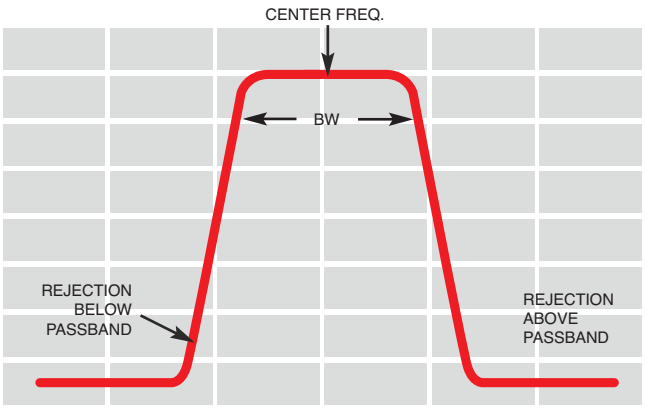
| Frequency Range (MHz) | Tuning Range (MHz) | Bandwidth (MHz) | Insertion Loss (dB) | Return Loss (dB) | Impedance (Ohms) | Max Input Power (W) | Package Styles |
|---|---|---|---|---|---|---|---|
| 30 to 1300 | CF+/- 4MHz | 3 to 90 | 1.5 to 4 | 12 to 15 | 50 | 1 to 10 | PC Mount |

# HYBRID DIRECTIONAL COUPLERS

Our Hybrid directional couplers are broadband designed in either 3dB 90 or 100 deg phase, with phase balance between +/-5 to +/-12 deg. The frequency range extends from 0.5 to 45 GHz, with an operating temperature of -35 to 105 deg. C, and a storage temperature of -55 to +125 deg. C. Our Directional Couplers are available in 1-10 dB, 20dB and 30dB, and a directivity between 10 and 20 dB depending on the specific product. All our Hybrid Directional couplers, and Directional couplers, can handle an average power of 20 watts.

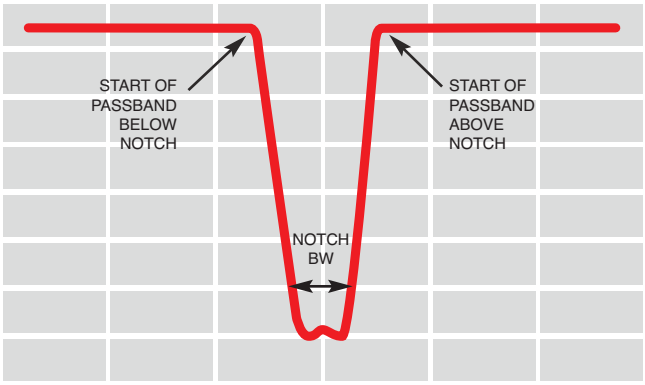
| Frequency Range (GHz) | Insertion Loss (dB) | Isolation (dB) | Amplitude Balance (dB) | Phase Balance (Deg) | VSWR (typ.) | Max Input Power (W) | Package Styles |
|---|---|---|---|---|---|---|---|
| 0.5 to 45 | 0.5 to 2.0 | 10 to 30 | 0.4 to 0.7 | 5 to 12 | 1.2 to 1.8 | 20 | SMA |

# TYPE OF FILTERS



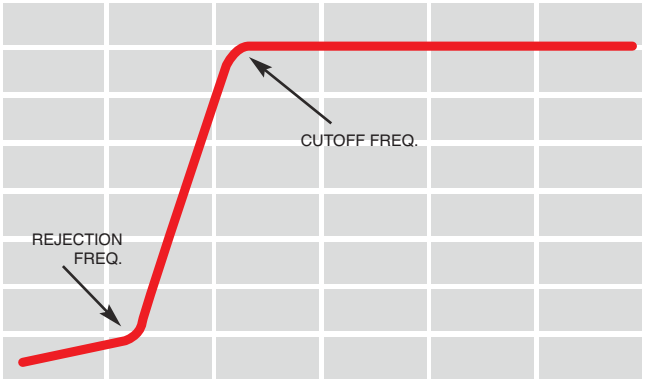

## BANDPASS FILTER

A bandpass filter passes energy within a certain bandwidth and rejects frequencies below and above this bandwidth.



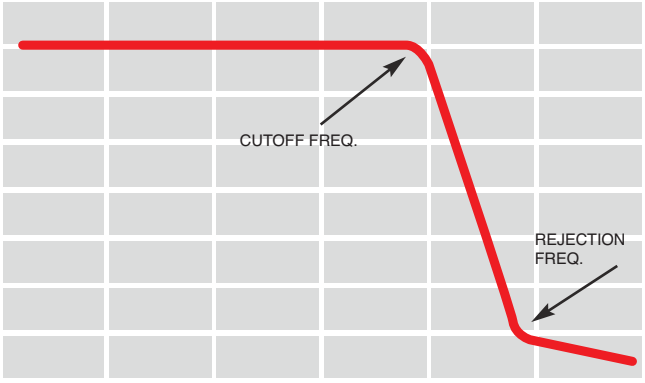

## BANDSTOP/NOTCH FILTER

A bandstop or band-rejection filter passes most frequencies without disrupting them but significantly attenuates frequencies over a specific region. A bandstop filter is essentially the opposite of a bandpass filter. A notch filter is a specific type of bandstop filter that has a narrow stopband.



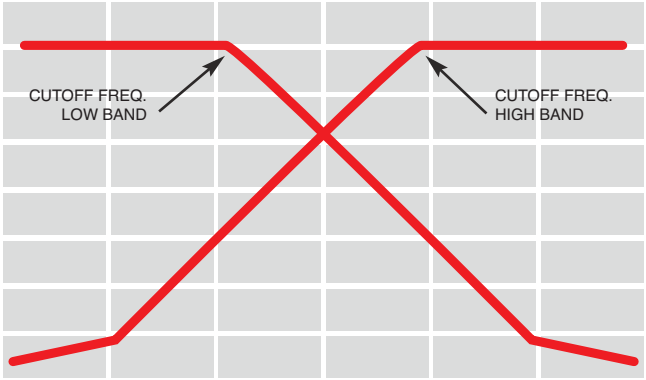

## HIGHPASS FILTER

A bandpass filter passes energy within a certain bandwidth and rejects frequencies below and above this bandwidth.



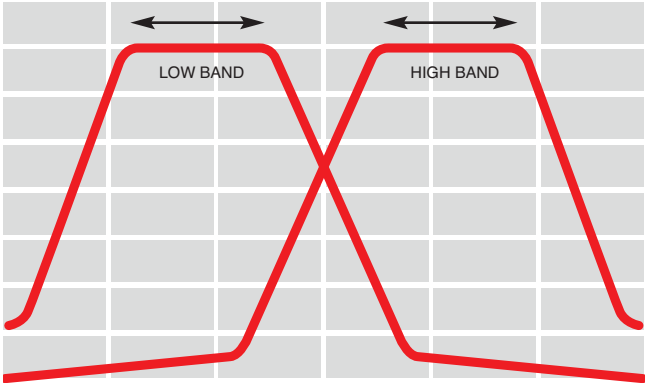

## LOWPASS FILTER

A bandpass filter passes energy within a certain bandwidth and rejects frequencies below and above this bandwidth.




## DIPLEXER

A diplexer is used to combine signals or channels at widely different frequencies. Consequently, diplexers are used to combine channels in wireless base station transceivers (for example




## DUPLEXERS

A duplexer can accommodate frequencies or channels that are much closer to each other. Duplexers are used to combine signals in radar or other systems in which the two frequencies are far apart.

# SUMMARY OF AEI STANDARD PRODUCTS

## BANDPASS FILTERS
- Cavity Bandpass
- Ceramic Bandpass
- Saw Bandpass
- Crystal Bandpass
- LC Bandpass
- Helical Bandpass

## RF FILTERS FOR WIRELESS COMMUNICATION
- Cellular 850
- GSM 900
- LTE 700 MHz
- WiFi Wireless Lan

## DUPLEXERS
- Cavity Duplexers
- Ceramic Duplexers
- Saw Duplexers
- LC Duplexers

## POWER DIVIDERS
- 2 Way Power Dividers
- 3 Way Power Dividers
- 4 Way Power Dividers
- 6 Way Power Dividers
- 8 Way Power Dividers
- 12 Way Power Dividers

## BAND STOP-NOTCH FILTERS
- LC Bandstop-notch
- Cavity Bandstop-notch
- Crystal Bandstop-notch

## CIRCULATORS AND ISOLATORS
- Circulators
- Isolators

## LOWPASS FILTERS
- LC Lowpass

## DIRECTIONAL COUPLERS
- Directional Couplers

## HIGHPASS FILTERS
- LC Highpass

## HYBRID COUPLERS
- Hybrid Directional Couplers

## TRIPLEXERS
- Triplexers

## LOW NOISE AMPLIFIERS
- Low Noise Amplifiers

# KEY RF FILTERS DEFINITIONS

**These definitions are important to understand when specifying filters of any type.**

**CENTER FREQUENCY (CF).** The midpoint between the two 3-dB (half-power reduction) points in the passband of a bandpass filter (or band-stop filter), and is normally expressed as the arithmetic mean of the 3-dB points.

**CUT-OFF FREQUENCY (FC).** The half-power reduction point in the passband of a lowpass or highpass filter, and it occur at the passband edge of the lowpass or highpass filters, and is expressed as the 3-dB point, or knee of the filter passband.

**DISSIPATION.** This is the energy loss in a filter that results from the non-ideal characteristics of its individual components, such as the resistivity in an inductor or capacitor, core saturation, resistance of connecting wires, and metal conductivity.
This specification becomes very important with filters designed to handle high RF input power levels because energy loss or high dissipation can cause the filter to fail.

**IMPEDANCE.** This value, specified in ohms, is the filter's source (input) and the terminating (output) impedances. Input and output impedance should match the impedance of the transmission path in which the filter is placed. An impedance of 50 ohms is almost universal throughout RF and microwave system designs, although an impedance of 75-ohms is used in cable television systems, and other consumer/commercial communication systems.

**GROUP DELAY (GD).** This specification relates to the phase linearity of a filter versus frequency. Since a phase delay occurs at the output of a filter it is important to know if this phase shift is linear with frequency. If the phase shift is nonlinear with frequency, the output waveform will be distorted. Linear phase shift will result in constant group delay since the derivative of a linear function is a constant.

**INSERTION LOSS (IL).** This is the ratio of signal amplitude before a filter to the amplitude at its output. At any frequency it is defined as: IL=10Log(Pl/Pin), where Pl is the load power and Pin is the power from the input source. Insertion loss should be as low as possible regardless of the power-handling ability of the filter. For example, heat dissipation increases at higher power levels, and lower insertion loss can help reduce it. When signal levels are low, high insertion loss can reduce the output after the filter to an unacceptable level.

**ISOLATION.** This relates to the ability of a diplexer or duplexer to reject the transmit (Tx) frequency without affecting the receive (Rx) frequency, and the ability to reject the receive (Rx) frequency without affecting the transmit (Tx) frequency. This is called Rx/Tx isolation and the greater the isolation the more effectively the filter can isolate the Rx from the Tx and vice versa. Higher values of isolation translate into cleaner transmit and receive signals.

**PASSBAND.** The spectral region in which a filter has the least attenuation and thus allows the most signal to pass. Passband is usually defined at the 0.5 dB, 1 dB, or the 3 dB (half-power) points or others depending on the requirements of the host system design.

**POWER HANDLING.** This is the RF input power beyond which the performance of the filter may degrade or fail, expressed in watts (W). It is typically specified as a continuous wave (CW) value, as an average value that is usually 10 times its CW rating, or both.

**Q FACTOR.** This is the ratio of a filter's center frequency to its bandwidth. For a bandpass filter, Q factor is actually the loaded Q factor since the driving and terminating load impedances are connected to the filter when it is inserted into a network. In contrast, unloaded Q factor represents the performance of the components used to make the filter. Unloaded Q is not a key element of filter specification because it is adequately represented by the filter's other characteristics

**REJECTION.** The level, expressed in decibels, at which a filter will attenuate a signal outside its passband. It is specified either at a single frequency or frequencies or a range of frequencies. A filter's rejection is often also often referred to as its attenuation

**RELATIVE ATTENUATION.** The attenuation difference measured from a filter's minimum attenuation point to its desired rejection point. Relative attenuation is usually specified in decibels related to the carrier (dBc). Higher values of attenuation are desirable

**RETURN LOSS (RL).** Return loss is an indicator of how close the input and output impedance of the filter is to an ideal impedance value. Return loss at any frequency is defined as: RL=-10Log(Pr/Pin) where Pr is the power reflected back to the input signal source. Higher values of return loss indicate a better impedance match.

**RIPPLE.** This specification relates to how flat a filter's response is in its passband and is normally expressed in decibels. The amount of ripple in a filter will affect its return loss: the greater the ripple the worse the return loss and vice versa.

**SHAPE FACTOR.** The shape factor of a bandpass filter is the ratio of its stopband bandwidth to its 3-dB bandwidth and is a measure of its rejection characteristics. For example, if a filter's 40-dB bandwidth is 40 MHz and the 3-dB bandwidth is 10 MHz, the shape factor will be 40/10=4. It is generally more useful to simply refer to the filter's stopband rejection and bandwidth.

**STOP BAND REJECTION.** The ratio of the unwanted frequency components at the input of the filter to those after it. It is a key filter performance specification because it equates to its rejection capability. Values can range from 20 to 100 dB.

**VSWR (VOLTAGE STANDING WAVE RATIO).** This is the ratio between the maximum and minimum values of a standing wave on a transmission line. It indicates the impedance mismatch between ideal and actual values. Return loss and VSWR are related, as RL=-20Log[(VSWR-1)]/(VSWR+1)]. An ideal (although unattainable) VSWR is 1:1.

# MORE ABOUT AEI

## DEFENSE
Our broad range of filters and related products are designed to meet the tough requirements of EW, ECM, ESM, radar, communications, and other military systems.

## SATELLITE
We design filters to cover the uplink and downlink frequencies for satcom systems operating up to 20 GHz.

## PUBLIC SAFETY
Our RF and microwave filters and related products cover all public safety frequencies from VHF through UHF, as well as the newly assigned LTE bands. Products can be designed for indoor and outdoor installations.

## AVIONIC AND RADAR
We specialize in products designed for indoor and outdoor installation within radar, air traffic management, and avionics systems.

## WIRELESS
AEI specializes in filters, duplexers, multiplexers, multi-band combiners/separators for wireless applications, as well as directional couplers, power dividers, and circulators for use indoors and outdoors in base stations, repeaters, mini-cells, micro-cells operating in all wireless bands, such as GSM, LTE, WCDMA, GPS, WiFi, and more. Filters can be designed for indoor or outdoor applications.

## POINT TO POINT MICROWAVE COMMUNICATION
AEI designs filters, power dividers/combiners duplexers, and couplers for every microwave point-to-point radio band up to 38 GHz.

## INDUSTRIAL, SCIENTIFIC, AND MEDICAL
From industrial telemetry and automation system to precision scientific and measurement set-ups, and MRI or patient monitoring, AIE's products deliver high-performance and reliability.


**Our Website is the ultimate source of information about our products, please visit us frequently.**

# IT'S EASY TO ORDER

## CUSTOM AND STANDARD PRODUCTS

**Step 1**: On Anatech Electronics Home page (www.anatechelectronics.com), click the standard products navigation, or the specific category you're interested in.

**Step 2:** Browse and locate the product(s) that matches your requirements and click on the part number or anywhere in the row of the product.

**Step 3:** A technical datasheet page will appear, and on the top of the page you can enter the quantity you're interested in in the "Add to Quote" box, and click.

**Step 4:** If you are a new user, please register, and if you are already registered please log in. In the Request for Quote page, click on Submit.

You will receive an Email confirming that you placed a request for quote. A quote proposal will be sent to you within 48 hours. You can ask for multiple products quotes just by going to the appropriate product, and click on add to quote. All the items in the add to quote cart will be listed, and you will be able to submit a Request for Quote for the multiple items listed in you Cart quote.

## CUSTOM PRODUCTS

**Step 1**: E-mail, place a Request for Quote on our website the specific category request quote form, or submit a general request technical info or request a quote standard form.

**Step 2:** An AEI sales engineer will review your specifications and provide technical feedback.

**Step 3:** Once the final specifications are agreed on, AEI will give you a unique model number, a quotation for the product in the quantity desired, and a projected delivery date.

**Step 4:** Once all details have been finalized, submit a purchase order to us by e-mail or Call it in.

**Step 5:** We will ship most products in 4 to 6 weeks ARO via UPS unless specified otherwise.

## FROM-FIT REPLACEMENT

AEI can also supply filters that match those offered by other manufacturers at very competitive prices. Just provide the competitor's full part number, a specification control drawing, or measured response and mechanical information. The more information you can give to us the more precisely we can match the specifications of the filters.

## PAYMENT

**Accepted forms of payment are**: Credit Cards: **Visa**, **MasterCard**, or **American Express**. **Corporate Check**, **Wire Transfer**, **Bank Check**.

All orders must be prepaid unless your company has an open account with AEI. In order to be approved for an open account, AEI requires the following: **1)** A minimum of three business credit references. **2)** Bank information.

Time required for approval depends on how quickly your business references and bank respond to our inquiries. Once approved, a letter or e-mail of approval will be sent to you by our finance department advising you of payment terms and your credit limit (if applicable).

**Note:** Anatech Electronics (AEI) is a business-to-business organization and will not sell to private individuals. Correspondence (e-mail, written, or fax) must indicate a company affiliation. Referencing a company website will be appreciated.

# YOUR NOTES

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RF & Microwave Filters & Products

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