

# rf & microwave components and systems selection guide





*Spectrum Control was founded in 1968 as a solutions-oriented company designing and manufacturing products to suppress or eliminate Electromagnetic Interference (EMI). Since that time, Spectrum has evolved into a world leader in the design and manufacture of control products and systems used to condition, regulate and govern electronic performance.*

*Spectrum products are used in virtually all industries worldwide including telecommunications, medical, government, military, aerospace, computer and industrial controls.*

## Frequency Control Group

Spectrum Control's Frequency Control Group is a microwave technology leader with a proven track record in military applications. We design high performance, custom solutions addressing your bandpass, duplex and multiplex requirements. Our microwave filter line ranges from surface mount to rack mount in frequencies from DC to 40 GHz. Spectrum FSY Microwave offers filters in lumped element, cavity, waveguide, tubular, ceramic resonator and monoblock types. Spectrum SEI Microwave provides microwave systems including switchable filter banks, low noise amplifiers, local oscillator multipliers, microwave synthesizers and integrated assemblies.

## Worldwide Presence

Spectrum Microwave has established a worldwide sales, manufacturing and distribution network that provides our customers with responsive, time critical service. Our global reach gives us a presence in North America, Europe and Asia. This commitment to supporting our customers' logistical requirements is further evidenced by our recent opening of a new manufacturing plant in Guang Dong, China.



We have a **WORLD** of microwave filter solutions

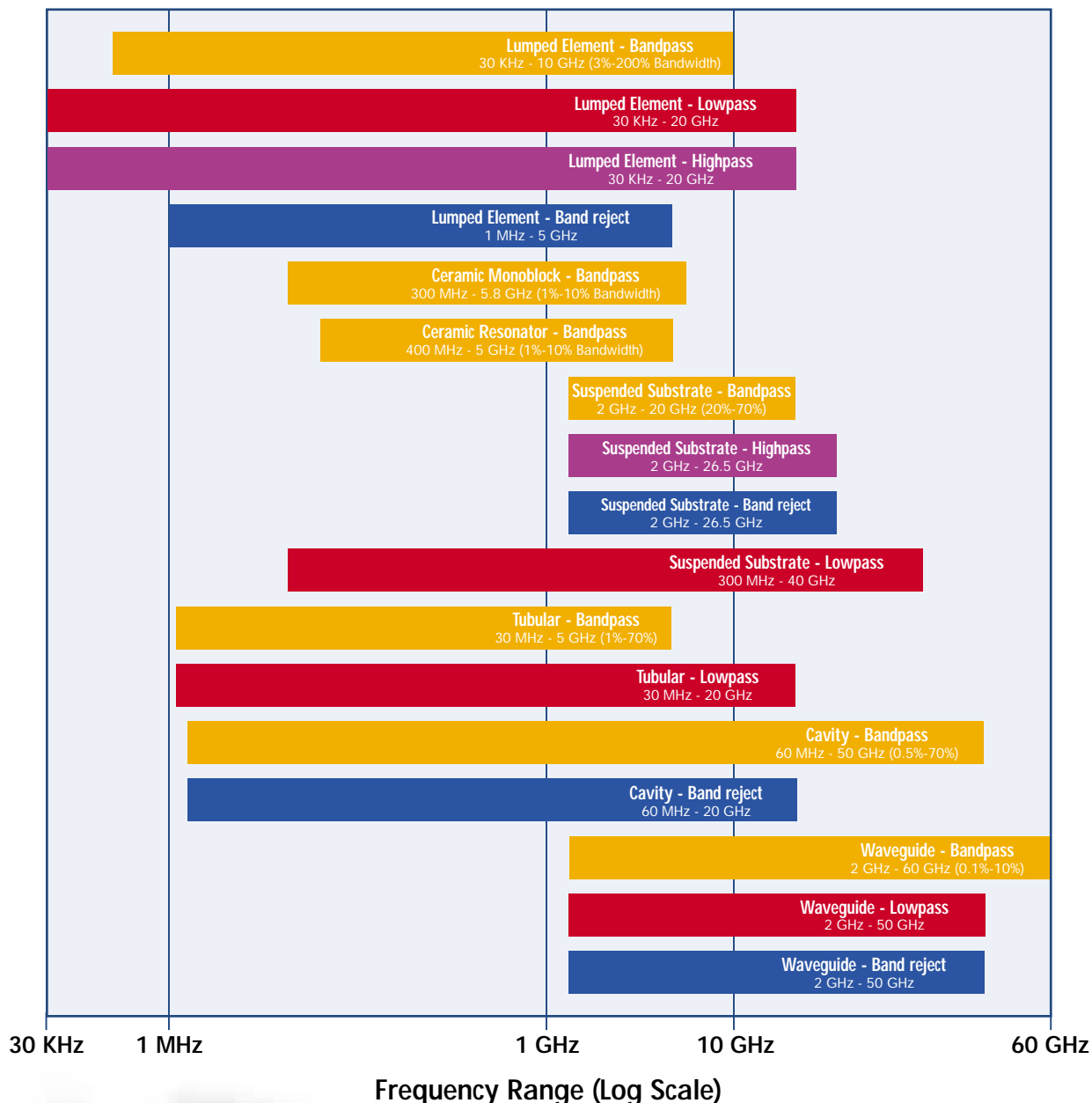
## Design Capabilities

Spectrum Microwave utilizes a wide range of tools in developing or modifying product designs. Our engineering teams apply filter synthesis software to model and design components, and subsequently verify and qualify these designs through sophisticated test equipment, methodology and software. ISO 9001 certified Spectrum Control offers its customers engineering expertise throughout the entire design process.

## Manufacturing Capabilities

Our strategically located, low-cost, high-volume manufacturing centers feature cross-trained resources and standardized production procedures conforming to rigid ISO 9001 standards. In addition, Spectrum Microwave support facilities around the globe provide the highest quality ceramic fabrication, metal fabrication and plating, qualification and environmental testing to help ensure manufacturing excellence.

### Filter Topology Frequency Ranges





# RF & Microwave Components and Assemblies

## ANTENNAS

## CERAMIC RESONATORS

### Chip Antennas



Bluetooth, LAN, WLL, custom applications

#### ■ Design flexibility

Small size and low profile:  
 • 6mm x 4mm x 1mm  
 • 10mm x 7mm x 1mm

#### ■ Performance

High gain  
 Wide frequency range  
 Omnidirectional radiation pattern

#### ■ Frequency range

2 GHz to 3 GHz  
 Custom frequencies available upon request

### Patch Antenna Elements



E-911, telematics and vehicle navigation, GPS handsets, aviation, marine and surveying equipment, WLL, Bluetooth, SDARS (Satellite Digital Audio Receiver Service)

#### ■ Design flexibility

Various size configurations:  
 • 13mm x 13mm x 3mm  
 • 16mm dia. x 6mm  
 • 18mm x 18mm x 4mm  
 • 25mm x 25mm x 4mm  
 • 27mm x 27mm x 6mm  
 • 37mm x 37mm x 4mm  
 • 50mm x 50mm x 3mm

#### ■ Easy installation

Surface mount  
 Silver plated electrode and probe

#### ■ Performance

Low frequency drift vs. temperature  
 Low return loss  
 Offset single-point feeding method

#### ■ Frequency range

1 GHz to 6 GHz  
 Custom frequencies available upon request

### Patch Antenna Assemblies



Cellular, GPS, amplifier, SDARS (Satellite Digital Audio Receiver Service), custom applications, SENS

#### ■ Design flexibility

Designed for optimal performance on customer ground plane  
 Value-added services available  
 Engineering support from concept through production to ensure optimal antenna and system design  
 Wide range of materials for optimizing antenna

#### ■ Frequency range

500 MHz to 6 GHz  
 Custom frequencies available upon request

#### ■ Impedance

Determined by design

#### ■ Environmental

Determined by material

### Ceramic Resonators Chip and Leaded Type



DTMF generators, remote control units, clock oscillators, automated office equipment, automotive electronics, DVD, CD-ROM, HDD, other automation equipment

#### ■ Design flexibility

Surface mount or leaded mounting

#### ■ Easy installation

Bulk and tape and reel packaging  
 Reflow solderable

#### ■ Features

Ceramic resonators feature built-in load capacitance  
 Wide frequency range  
 Enable design of oscillator circuits requiring no adjustment  
 Low cost

#### ■ Frequency range

1.8 MHz to 50 MHz

#### ■ Temperature stability

±0.3% from -20°C to +80°C

#### ■ Frequency tolerance range

±0.5%

### Dielectric Resonators Disc and Cylinder Type



Microwave filters, military radar, satellite communications, base stations, combiners, duplexers

#### ■ Design flexibility

Available in disc and cylinder  
 Various diameters available (consult factory)

#### ■ Features

Operating frequency up to 26 GHz  
 High Q  
 Low frequency drift vs. temperature  
 Dielectric constant: 20 - 90

#### ■ Frequency range

800 MHz to 26 GHz

#### ■ Q range

6,000 - 35,000

#### ■ Temperature stability

±6 ppm/°C

#### ■ Temperature range

-55°C to +125°C



[www.specwave.com/patch](http://www.specwave.com/patch)

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[www.specwave.com/chipres](http://www.specwave.com/chipres)

[www.specwave.com/discres](http://www.specwave.com/discres)

Applications

Features / Benefits

Performance Characteristics

## NATORS

### Ceramic Resonators Coaxial Type



Wireless equipment, voltage controlled oscillators, cordless phones

- **Design flexibility**  
Available in 2mm - 12mm sizes (standard)  
Custom sizes available
- **Rugged construction**  
Easy handling and assembly
- **Easy installation**  
Surface or tab mounting  
Tape and reel packaging
- **Features**  
Low frequency drift vs. temperature  
High Q  
Sharp frequency response  
1/4 and 1/2 wave design  
Dielectric constant: 21 - 90

- **Frequency range**  
400 MHz to 5 GHz
- **Q range**  
200 - 800
- **Temperature stability**  
±5 ppm/°C
- **Temperature range**  
-55°C to +125°C

[www.specwave.com/coaxres](http://www.specwave.com/coaxres)

### Bandpass Filters Ceramic Resonator Type



Cellular telephones, cellular base station transceivers, land mobile radios, cordless telephones, satellite transceivers, WLL, DSST, GSM, ISM, PCS, modems, CATV, GPS



- **Design flexibility**  
Available in 2-7 poles  
Notch filters available
- **Easy installation**  
Surface mount or thru-hole mounting  
Tape and reel packaging
- **Features**  
Low frequency drift vs. temperature  
High Q  
Tape and reel available

- **Frequency range**  
400 MHz to 5 GHz standard  
Other frequencies available (consult factory)  
Custom specifications available
- **Q range**  
400 - 2,000
- **Impedance**  
50 Ω and 75 Ω
- **Temperature stability**  
±5 ppm/°C
- **Temperature range**  
-30°C to +85°C

[www.specwave.com/resband](http://www.specwave.com/resband)

### Duplexers Ceramic Resonator Type



Cellular telephones, cellular base station transceivers, land mobile radios, cordless telephones, satellite transceivers, wireless LANs, modems, CATV, GPS, GSM



- **Design flexibility**  
Available in 4-9 poles
- **Easy installation**  
Surface mount  
Tape and reel packaging
- **Features**  
Low frequency drift vs. temperature  
High Q  
Excellent isolation between transmit and receive frequencies  
Tape and reel available

- **Frequency range**  
400 MHz to 6 GHz  
Custom specifications available
- **Impedance**  
50 Ω and 75 Ω
- **Temperature stability**  
±5 ppm/°C
- **Temperature range**  
-30°C to +85°C

[www.specwave.com/resdup](http://www.specwave.com/resdup)

### Bandpass Filters Monoblock Type



Cellular telephones, cellular base station transceivers, land mobile radios, cordless telephones, satellite transceivers, wireless LANs, PCS, modems, CATV, GPS, GSM, DCS, IMT-2000



- **Design flexibility**  
Smaller size  
Lower cost  
Low profile
- **Easy installation**  
Surface mount  
Tape and reel packaging
- **Features**  
Low frequency drift vs. temperature  
High Q  
Tape and reel available

- **Frequency range**  
300 MHz to 5.8 GHz standard  
Custom specifications available
- **Q range**  
100 - 1200
- **Impedance**  
50 Ω and 75 Ω
- **Temperature stability**  
±5 ppm/°C
- **Temperature range**  
-30°C to +85°C

[www.specwave.com/monoband](http://www.specwave.com/monoband)

### Duplexers Monoblock Type



Cellular telephones, cellular base station transceivers, land mobile radios, cordless telephones, satellite transceivers, wireless LANs



- **Design flexibility**  
Small size
- **Easy installation**  
Surface mount  
Tape and reel packaging
- **Features**  
Low frequency drift vs. temperature  
High Q  
Excellent isolation between transmit and receive frequencies  
Tape and reel available

- **Frequency range**  
400 MHz to 6 GHz  
Custom specifications available
- **Impedance**  
50 Ω
- **Temperature stability**  
±5 ppm/°C
- **Temperature range**  
-30°C to +85°C

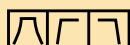
[www.specwave.com/monodup](http://www.specwave.com/monodup)

# MICROWAVE FILTERS

## Standard Lumped Element



Base stations CDMA, PCS, WLL, IMT-2000, DECT, MMDS, E-911, CATV



- **Design flexibility**
  - Leaded and surface mount
  - Low profile
  - Some standards available from stock
  - Tape and reel available
- **Easy installation**
  - Reflow solderable
- **Performance**
  - 8% to 100% bandwidth
  - Lowest cost IF filter alternative

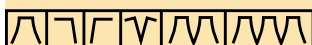
- **Frequency range**
  - 4.95 MHz to 360 MHz
  - Custom specifications available

[www.specwave.com/lcfil](http://www.specwave.com/lcfil)

## Custom Lumped Element



Avionics, radars, commercial, IF & RF, Point to Point, E-911, GPS



- **Design flexibility**
  - Smallest size
  - Surface mount
  - PC mount
  - Connectorized
- **Features**
  - Excellent size/performance ratio
  - Wide range of transfer functions available
  - Hermetically sealed packages available

- **Filter attributes**
  - Bandpass: 300 KHz - 8 GHz
  - Highpass: 30 KHz - 8 GHz
  - Lowpass: 30 KHz - 18 GHz
  - Band Reject: 1 MHz - 8 GHz
  - Duplexer/multiplexer: 30 KHz - 8 GHz

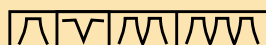
[www.specwave.com/lump](http://www.specwave.com/lump)

## Cavity Filters

- Interdigital • Combine
- Ceramic Loaded • Helical



Avionics, military, base stations, test instrumentation, communications



- **Design flexibility**
  - Easily duplexed
  - Wide range of configurations
- **Features**
  - Wide range of bandwidths - up to 100%
  - Excellent temperature stability
  - Low loss
  - High peak power
  - Low IMD designs available
  - Very high selectivity

- **Filter attributes**
  - Bandpass: 60 MHz - 50 GHz
  - Band Reject: 60 MHz - 20 GHz
  - Duplexer/multiplexer: 60 MHz - 40 GHz

### Filter Application Key:



Bandpass



Highpass



Lowpass



Band reject

[www.specwave.com/cavity](http://www.specwave.com/cavity)

## Waveguide Filters



Avionics, digital radios, repeaters, Point to Point, transmit filters, satellite communications



- **Design flexibility**
  - Flanges or connectorized
- **Performance**
  - 0.1 to 20% bandwidth
  - Extremely low loss
  - High power handling
  - Extremely low loss
  - High power capacity

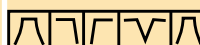
- **Filter attributes**
  - Bandpass: 2 GHz - 65 GHz
  - Lowpass: 2 GHz - 65 GHz
  - Band Reject: 2 GHz - 50 GHz
  - Duplexer: 2 GHz - 50 GHz

[www.specwave.com/waveg](http://www.specwave.com/waveg)

## Suspension Substrates



ECM, ECCM, ELIN, broadband receiver



- **Design flexibility**
  - Ideal for multiple
- **Features**
  - Multi-octave band
  - High selectivity
  - Low profile

- **Filter attributes**
  - Bandpass: 2 GHz - 20 GHz
  - Highpass: 2 GHz - 20 GHz
  - Lowpass: 300 MHz - 20 GHz
  - Band Reject: 2 GHz - 20 GHz
  - Duplexer/multiplexer: 2 GHz - 20 GHz

[www.specwave.com](http://www.specwave.com)

## MICROWAVE SYSTEMS

### Tubular Filters



Instrumentation, medical, high power harmonic rejection



■ **Design flexibility**  
Rapid prototyping

■ **Features**  
Low loss  
High power handling  
Low cost  
Broad stop band characteristics

### Base Station Products



WCDMA, WLL, GSM, PCS, AMPS, Bluetooth, IMT-2000



**Combiners**

**Power Dividers**



**Delay Line Assemblies**

**Duplexers/LNA Assemblies**



**Band Reject or Notch Filters**

**Multicouplers**



Duplex  Multiplex

[www.specwave.com/tube](http://www.specwave.com/tube)

[www.specwave.com/base](http://www.specwave.com/base)

### Integrated Microwave Assemblies



GPS positioning systems, airborne and ground radars, test verification sets, microwave sources for test sets and RF communications systems

#### ■ Modular Functions

GPS Low Noise Amplifiers with pre and/or post filtering  
Frequency multipliers  
Frequency translators, single-ended and multiple conversions  
Local Oscillator dividers  
Switched IF filtering

#### ■ Features

Improves performance  
Reduces cost  
Reduces size  
Cascadable  
Multi-function

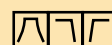
- Linear and non-linear transfer functions
- Internal voltage regulation
- DC input and logic protection
- High-reliability

[www.specwave.com/integrate](http://www.specwave.com/integrate)

### Switched Filter Banks



Communications and navigation systems, microwave receiver front ends (including preselection and amplification), radar and electronic warfare assemblies



#### ■ Enhanced system performance

Filter optimization into switch manifolds.  
Improved amplitude ripple  
Improved phase response  
Lower overall amplitude losses or better noise figure performance  
Reduced size

#### ■ Reduces processing cost through less:

Less documentation  
Fewer incoming inspections  
Easier implementation  
Less maintenance

■ **Passbands:**  
DC to 26 GHz

■ **Rejections:**  
DC to 40 GHz

[www.specwave.com/sfb](http://www.specwave.com/sfb)



# a control products systems company

## signal & power integrity products

Ferrite beads & inductors  
Surface mount filters  
Discrete EMI filters  
Filter plates  
Filter connectors  
Gaskets & shielding  
Ceramic capacitors  
Single line filters  
Filtered terminal blocks  
Power entry & power line filters  
Military/multisection filters  
EMC testing

[www.spectrumcontrol.com](http://www.spectrumcontrol.com)

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NEW



## frequency control group

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NEW



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NEW

## frequency control products

Lumped element filters  
Cavity filters  
Bandpass filters & duplexers  
Tubular & waveguide filters  
Tower mounted amplifiers  
Coaxial resonators  
Patch antennas & assemblies  
Switchable filter bank assemblies  
Low noise amplifiers  
Local oscillator doublers  
Microwave synthesizers  
Couplers  
Integrated microwave sub-assemblies

[www.specwave.com](http://www.specwave.com)

## power management systems

AC/DC power distribution units  
& remote reboot power management systems  
Circuit protection  
Custom assemblies  
Power strips  
[www.specpower.com](http://www.specpower.com)

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