

MARKETS

# Critical communications

Precision RF components and sub-systems for ultra-reliable and secure first-responder communication networks.





# When clear communication matters – trust Filtronic to perform

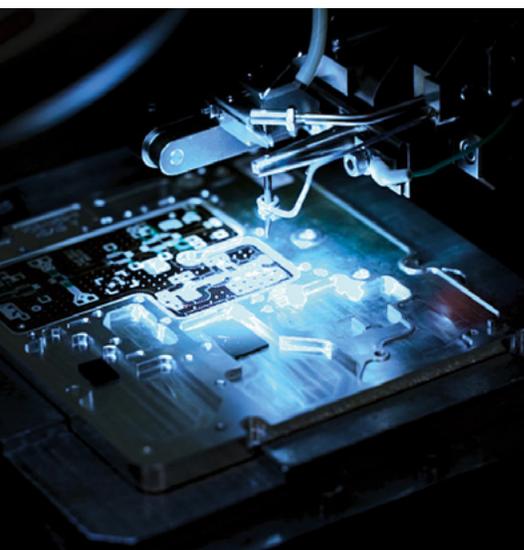
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As a world-leading radio frequency (RF) technology specialist, Filtronic designs, manufactures and tests advanced products that transmit, receive and condition radio waves for mission-critical communications networks worldwide.

Filtronic is the partner of choice for leading OEMs supplying public safety communications systems for the emergency services, helping to build a more resilient and secure communications infrastructure.



### First-responder radio system specialists

Reliability, availability and security are critical attributes for first-responder communication systems. Filtronic is recognized as a thought leader, innovator and problem solver in the sector, helping to overcome complex RF challenges such as combining, filtering, and mitigating dynamic interference. We have >30 years experience delivering high performance communication products for the public-safety market, including: ceramic filter/combiners and RF conditioning products.

### Experts in legacy and emerging technologies

For more than 30 years we have supported Land Mobile Radio (LMR) networks with innovations across the RF spectrum. We continue to apply our intimate knowledge of the telecommunication infrastructure market to create advanced products for public safety LTE-based communications. These support the speed and data requirements of new technologies used by the emergency services, such as body-worn cameras, drones and automated vehicles.

Filtronic is well placed to support the market as it develops hybrid solutions, with mission-critical voice communications continuing over LMR public-safety networks, while non-critical data communications are carried over commercial-grade LTE networks.

### Innovation for mission-critical communications

Our precision products for public-safety applications include tower top amplifiers, filters, cross-band/in-band combiners, power amplifiers and multiplexers. We are specialists in interference mitigation to improve radio communication performance and clarity. Our innovations and technical skill have improved miniaturization, reducing the footprint and weight of our components, while increasing power and amplification to improve connectivity.

### World-leading RF specialists

Our innovative products are developed by our team of skilled engineers and designers, typically educated to PhD level, who understand the challenges of RF communications. We have the expertise to create subsystems involving complex electronic control and calibration, delivering world-class performance and reliability.



2021





# Design, manufacturing and testing

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Filtronic offers complete design, manufacturing, assembly and testing capabilities for complex electronic components used in critical communications networks. As well as designing and manufacturing our own range of high-performance products, we offer contract services for clients, working in collaboration to design, manufacture, assemble and test products to client specifications in our state-of-the-art facilities in the UK and US.

## Advanced design capabilities

Our team of highly experienced engineers liaise with clients to find the optimum technology and filter type depending upon the requirement, for example, filter response, band pass, band stop, low pass or high pass, power handling, insertion loss, rejection. We have a full range of Computer Aided Design (CAD) systems for microwave circuit design, system simulation, thermal design, mechanical design and automated test program development.





### High-volume, precision manufacturing

Our precision manufacturing facilities offer high-volume microelectronic production capabilities. With investments in hybrid assembly, advanced test systems and full traceability, we have created high-quality, high-security manufacturing environments. Our automated assembly lines enable unique build processes such as MMIC die attach, wire and ribbon bonding, combined with skilled manual assembly and hermetic sealing – all to IPC standards.

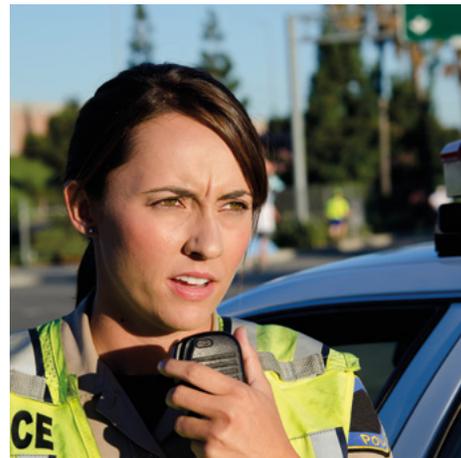
Our robust web-based manufacturing and process control system (MaRS) provides real-time access to material traceability, inventory management, WIP tracking, statistical process control (SPC), yield reporting and on-time delivery.

### Cost-saving contract assembly

We have a dedicated contract assembly facility in Salisbury, Maryland, offering quick-turn electronics assembly in industry leading manufacturing and testing facilities. Contract assembly services enable clients to produce exceptional quality components in the US, without the need to purchase capital equipment or incur additional overheads – removing cost from their operations and reducing time to market.

### Rigorous testing for complete quality assurance

Our exhaustive testing procedures ensure that Filtronic products meet the toughest regulatory standards and customer specifications. Every element of every component that goes into our complex products undergoes rigorous testing, that may include electrical testing (DC to 100GHz), thermal HASS (Highly Accelerated Stress Screening) and life testing, destructive and non-destructive tests, and other application-specific assays.





# Components engineered for high performance

In the public-safety market, Filtronic devises and manufactures high-performance RF products for both LMR and LTE communications systems. We have a track record of developing tailored solutions, designed to engineer out specific communications problems for the public-safety sector.



## Tower top amplifiers (TTA)

Our TTA system operates in the 700MHz and 800MHz public-safety bands, providing an integrated high performance system for mission-critical radio networks. These products are compact, lightweight, and comply fully with the most stringent public-safety RF specifications.

The amplifiers have excellent system flatness across the passband and low system noise figure, while retaining linearity and out-of-band rejection. This gives radio system operators the confidence that their networks will operate reliably with resilient connections and higher quality audio, especially in congested environments.

A key feature of the platform is smart redundancy, which continuously monitors the health of the balanced quadrature-coupled amplifiers. If one amplifier fails, the system can continue to operate using the redundant amplifier. If both amplifiers are lost, the system will function in a bypass mode – ensuring continuous uptime.

## RF filters

We have extensive expertise in developing a wide range of microwave filters, including metal cavity filters, ceramic, combline, interdigital, lumped element, suspended substrate, waveguide and thin-film filters. We are experts in filter topology, offering rapid prototyping and reduced development cycles.

## Combiners (cross-band/in-band)

Our cross-band combiners enable signals from multiple base stations of different frequency bands to be combined to a single feeder cable or antenna. They are optimized for a combination of different technologies with very low loss, optimum EVM and high isolation.

In-band combiners enable multiple continuous or in-continuous channels within the same frequency band to be combined. They have a very narrow guard band, low insertion loss and high isolation to minimize the total effect on the combined signals, and to lessen the loss of valuable spectrum.

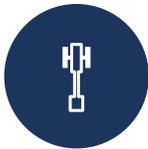




# Applied expertise for multiple markets

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As well as being a long-established supplier to the public-safety communications sector, we design and manufacture advanced RF technologies for critical communication applications in other key markets.



## Telecommunications infrastructure

Filtronic is a valued supplier to leading players in the mobile telecommunications

infrastructure market, and we are the partner of choice for advanced mmWave applications. In the 5G backhaul market, we offer highly integrated, fully calibrated transceiver modules, which eliminate the need for clients to develop in-house mmWave expertise.



## Aerospace and defence

Filtronic is a trusted long-term partner to clients supplying the defense and aerospace industry. We supply transmit and receive modules (TRMs) for the latest generation radars, as well as filters and other RF components and subsystems where our engineering, design and highly specialized manufacturing capabilities add significant value.



## Track-to-train communications

We work with partners in trackside-to-train communications to deliver high-speed,

high-capacity, high-reliability internet connections on rail journeys, enabling communication speeds of up to 10Gbps.



## Space (High altitude pseudo-satellites (HAPS) / low earth orbit (LEO) satellites)

Providing internet connections to under-

served communities is a high priority for many countries. Filtronic is an expert in the design, development and delivery of next-generation, high-performance transceiver modules, enabling high-capacity HAPS-to-ground and inter-HAPS data transmission using E-Band frequencies.



## Test and measurement

The specialist manufacturing capability and know-how Filtronic has developed over many years of manufacturing

its own products are highly valued by many companies in our market. We have worked on a range of test and measurement devices across the spectrum, enabling our clients to test with rigor their own products. We have a range of expertise, but our core competency is for test equipment 20 – 55GHz.





Space



Test and measurement

### Where we excel

- We help our clients get to market quicker – increasing their sales revenues and market share.
- Our capabilities and technologies reduce the overall cost of data communication, lowering the cost per Gbps.
- Taking unique challenges & providing a customised solution, we lower development & NRE costs, minimising the cost of quality for our client.
- We solve problems, engineer to engineer, we drive down whole life costs.
- We like to know our clients inside out, identifying ways to improve their products, increasing their premium & providing them with a competitive advantage.



Aerospace and defence





# Pushing the boundaries

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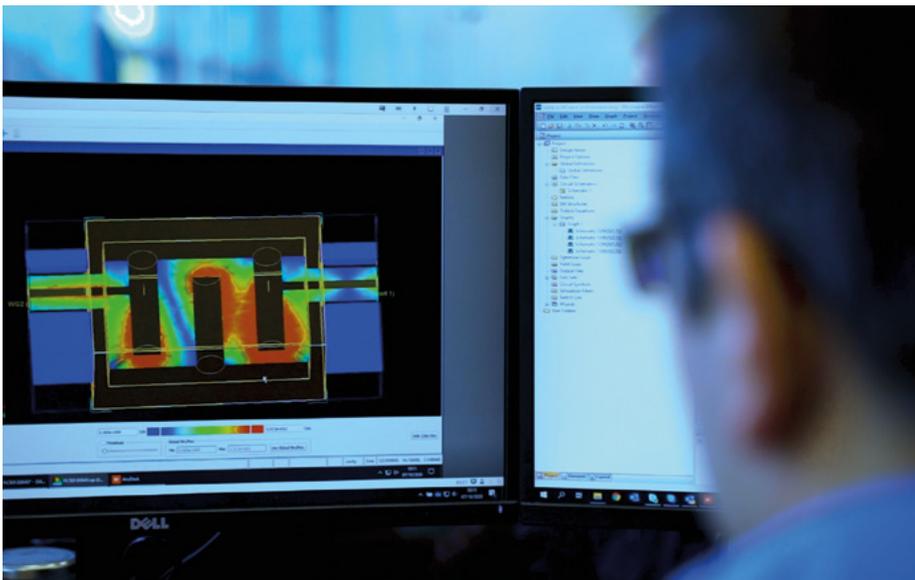
## MaRS empowers decisive action to eliminate non-conformance

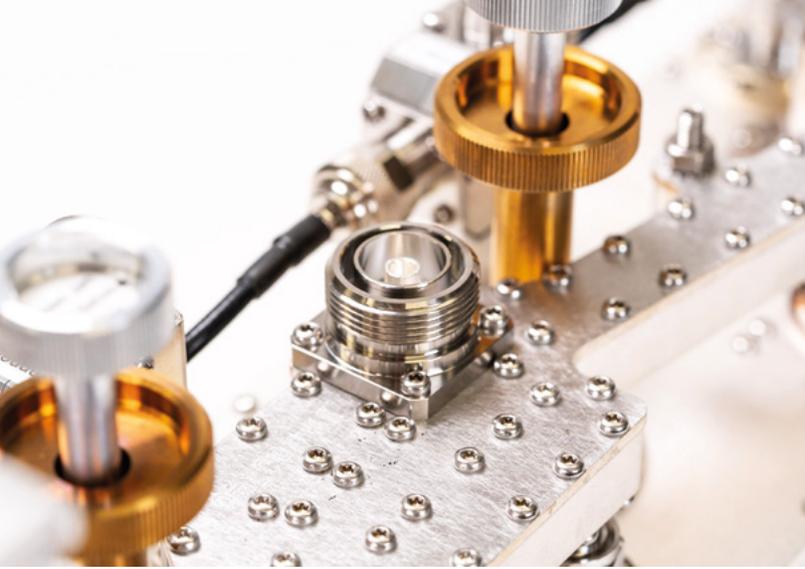
The Filtronic manufacturing execution system, MaRS, provides full tracking and traceability of all components at an individual and batch level. When a potential non-conformance issue was identified in one newly qualified component, we worked closely with our critical communications clients to isolate every component before any issues developed.

By combining the powerful reporting functions and statistical analysis of MaRS with our own engineering knowledge and RF diagnostic skills, we were able to quickly identify the non-conforming part. We used our best practice logistics controls to identify where the problem existed and minimize logistical costs. Working with our client, we dispatched our team into the client's hub to screen and isolate all non-conforming parts.

We qualified a replacement component in record time. A process that usually takes up to six months was accelerated to ten days, thanks to excellent supply chain collaboration. Using MaRS we were able to quarantine and repair all non-conforming parts and proactively swap them for the new solution, without any defective products entering the field. The new solution was also applied to all work-in-progress components. We tracked all shipments that had been dispatched and worked collaboratively with the client to ensure any components in transit were diverted to our Salisbury manufacturing plant for repair.

MaRS provides Filtronic with outstanding insight, allowing us to understand the root cause of any issues and apply our RF expertise to identify a solution. By working smartly with our client, we quickly solved the problem – minimizing any disruption and saving time and money through decisive action.





### TTA innovation fulfils challenging specifications

When a leading OEM in the public-safety market needed a new supplier for its Tower Top Amplifiers (TTAs), only Filtronic could meet the client's challenging specifications. The client's existing supply chain was unable to achieve the required product enhancements, which included more consistent site-to-site performance, reduced time to market, and simpler installation.

We deployed agile and lean philosophies to develop a new TTA solution in less than six months, from inception to product qualification. Our engineers incorporated smart redundancy into the product to enable it to continuously monitor its amplifiers and ensure continuous uptime, even if both amplifiers were lost.

One of the client's goals was to reduce inventory and increase the speed of deployment, with order-to-shipment times reduced from four to two weeks. To achieve this, we designed modularization into the product and simplified the ordering process, with single part numbers for the complete system.

Our solution not only exceeded the client's performance requirements, but also delivered a smaller, lighter weight product, enabling better utilization of communication towers.

### US relocation optimizes process flows and cuts costs

A leading OEM asked Filtronic to help meet its country-of-origin objectives by relocating critical product assembly from China to the US. With our global footprint, we were able to rapidly move manufacturing to our plant in Salisbury, Maryland, allowing full US-based assembly for the North American market.

Re-shoring a product supply chain is a complex process, but we were able to recruit experienced operatives with public-safety experience in the US and procure additional equipment to rapidly replicate the Chinese production line. We evaluated the existing process flows, quality and yield, and used our cloud-based MES system to mirror the Chinese processes and even introduce efficiencies.

The transition was completed in under three months, enabling the client to meet its targets without a drop in production. Process improvements reduced lead times from 12 to one week, while radically simplifying order processing through optimized logistics and direct shipping. This enabled total costs to be reduced significantly, while improving service levels through local replacement and repair services.





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**USA Office**

700 Marvel Road, Salisbury,  
Maryland, 21801 USA

**T:** +1 410 202 8811

**E:** [sales@filtronic.com](mailto:sales@filtronic.com)



**[filtronic.com](http://filtronic.com)**