

EMI/RF Considerations When Building an MRI Room or Installing an MRI Machine

Since its development in the 1970 - 1980s, MRI (Magnetic resonance imaging) has become a widely accepted and versatile imaging technique used in diagnostic medicine and biomedical research. It is estimated that there are about 36,000 MRI machines installed globally, and about 2,500 are being produced every year.

MRI is a very complex medical imaging technique used in radiology to scan body's anatomy and the physiological processes. MRI scanners employ very strong magnetic fields, gradients, radio waves and RF sensors to create images of body organs. The combination of strong magnetic fields and radio waves makes MRI machine a source of extremely high level electromagnetic emissions while making it susceptible to interference from external sources as well. This makes EMI an important consideration when building an MRI room. Even the lowest levels of noise can impact the MRI machine functionality and image quality.

The RF frequency generated inside the room can propagate through electrical and signal cables or through the air causing interference with other (medical / patient / lab) equipment in the facility. Similarly, noise from other sources can reach MRI machines and digital circuit through cable and air. This necessitates noise mitigation for both conducted (cables) and radiated (air) emissions.



EMI/RF SHIELDING IN MRI ROOMS

MRI rooms employ a fully shielded construction which helps stop radiated (over the air) electromagnetic waves from both entering and leaving the room. This is very effective in **shielding** the MRI system from electromagnetic waves emanating from external sources (radiated noise coming in), as well as preventing electromagnetic waves emitted by the MRI equipment from interfering with other devices outside the room (radiated noise going out). This makes **shielding** a key consideration in buildings a well-functioning MRI room and ensuring the EM integrity of the room while maintaining safe EMI environment in the medical facility.

MRI ROOM EMI FILTERS

The MRI equipment, supporting systems, light and other circuit inside the MRI room require electrical power for their operation. Furthermore, MRI rooms require various control, alarm, and data circuits such as fire alarm, dimmer control, thermostat, EPO, Oxygen sensor etc. To support these, power and signal circuit cabling must enter the MRI room. The penetration of power and signal cables can compromise integrity of MRI room shield at the point of entry (PoE) allowing both radiated and conducted emissions to enter and exit the room. MRI room filters are specially designed to address this problem. These filters are mounted at the point of entry filtering the incoming power/signal circuit. When mounted with proper shielding practices, filter creates required input-output isolation necessary to restore the shielding effectiveness.

As every incoming circuit requires an **EMI filter** at the point of entry, one MRI room can have several power and signal EMI filters up to a combined total of 20~25 filters. For most OEM devices intended for MRI rooms (lighting, alarm, thermostat, and sensor etc.), it is recommended to test the device with the MRI filter to ensure seamless operation and avoid last minute surprises / delays during installation.



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ASTRODYNE TDI'S MRI ROOM EMI FILTER SOLUTIONS

Above mentioned issues can make the design and construction of an MRI room, as well as other MRI room equipment (LED lights, control circuits, sensors etc.), quite challenging, especially the filter selection and availability. There are products that can support these applications but offer much wider frequency performance than necessary, making these overpriced and overkill.

An experienced and knowledgeable filter resource can greatly help with filter specifications and selection. It will shorten performance validation lead time for OEMs at the frontend as well as ensure right selection and availability of filters for electrical contractors on an ongoing basis allowing them to finish the job quickly and cost effectively.

Astrodyne TDI has been supplying **MRI room EMI filter** solutions for well over 10 years. Our 058 and 059 series MRI Room Filters are designed specifically for MRI room applications.

- **The 059 series power line filter** are offered in 10A to 50A rating and in 1-line, 2-line and 3-line configurations for use in AC (single and 3-phase) and low voltage DC applications. These filters provide 100dB insertion loss from 5MHz to 10GHz which fully complies with the attenuation requirements of an MRI room.
- **The 058 series signal line filters** provide 100dB from 14KHz to 10GHz for alarm and control line and different cut-off frequencies for voice and digital (data speed dependent) signals, as necessary. These come in 0.5A – 5A rating in 2-line (or single circuit) configuration.

In addition to these, for higher current power line applications (such as direct power to MRI machine), our 057/02 series filter are available in 10A to 250A rating and 1-line, 2-line, 3-line and 4-line configurations. These filters provide 100dB insertion loss from 150KHz to 10GHz which exceed the MRI room attenuation requirements, giving added isolation.

For OEM applications, modified /customized solutions can be developed to address specific requirements such as low leakage and different performance levels etc.

Most of our standard power line filter are UL recognized or UL listed, and most popular MRI room filter models are available in stock. This allows us to maintain competitive lead times and helps electrical contractors install these EMI filter solutions in the shortest possible time.

WHY PARTNER WITH ASTRODYNE TDI?

With more than 60 years of experience as a **Power Supply** and **EMI/EMC/RF Filter** manufacturer, we are known for our ability to produce highly reliable and durable products for some of the most demanding industries and end markets. Astrodyne TDI has also been providing **EMI filters** and Power supplies for a wide range of applications, including medical, MRI / shielded rooms, aerospace, semiconductor, commercial, appliances, industrial and military. Our EMI filter solutions can help achieve the required EMI performance and EMI compliance for your devices to relevant EMC standards.

We offer standard, modified, and custom EMI filters for any application. We work closely with our customers to determine the ideal EMI filtering solutions for their applications. We offer a wide range of filter types, from small IEC inlets, power entry module and single-phase options to **high current three-phase filters**. We have full engineering and design expertise for developing custom EMI solutions to help your equipment meet applicable EMI requirements, if necessary.



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An experienced and knowledgeable EMI filter resource like Astrodyne TDI's engineers can greatly help with filter specifications for MRI applications.

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