3 KEY STEPS TO THE EUROPEAN HOUSEHOLD APPLIANCE MARKET

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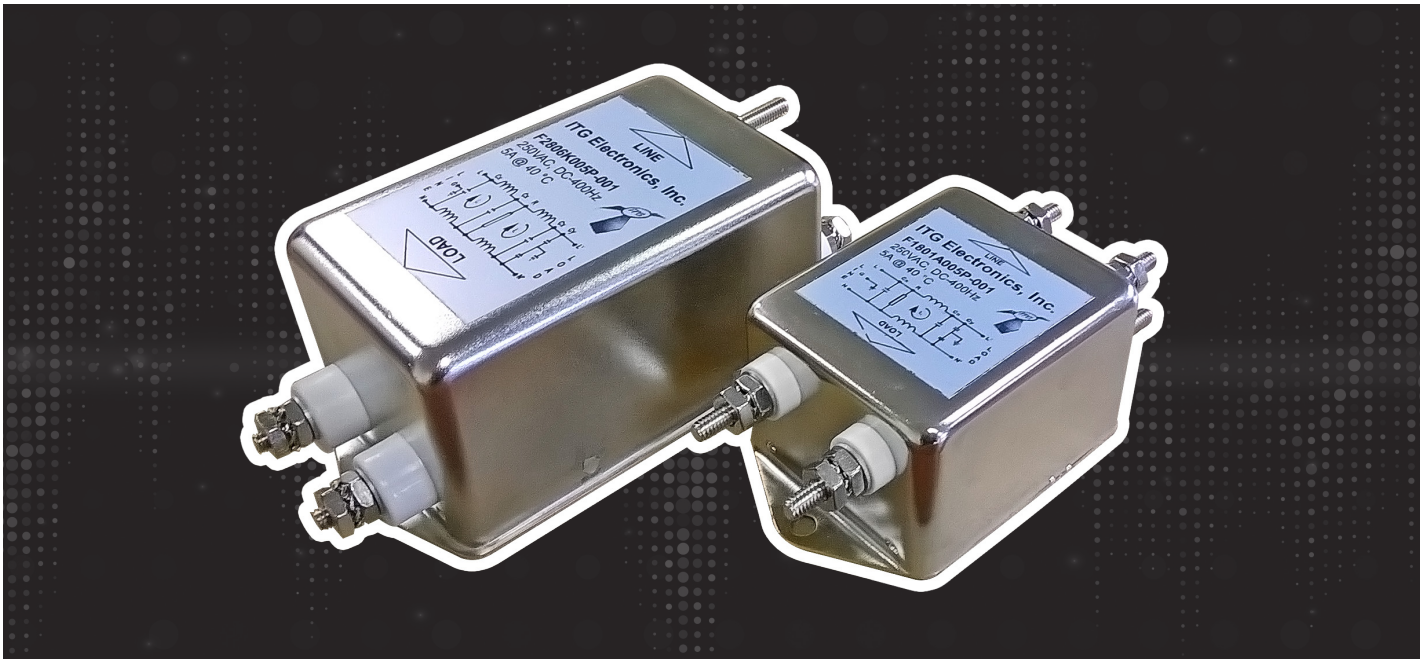
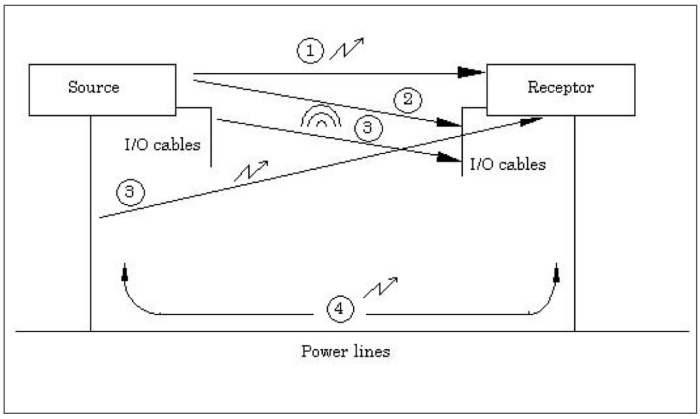


INTRODUCTION

Appliance companies may decide one day to export and sell their product to the European Union (EU) market especially if their product sales in US meet or exceed expectations. However, such household appliances, electric tools, and similar type apparatus (products are commonly referred to as HHA) being exported to the European Union (EU) countries must comply with the harmonized European standard EN55014 EMC requirements. This standard is composed of two parts: (a) Part 1 (EN55014-1) covers conducted and radiated emissions requirements (b) Part 2 (EN55014-2) covers the immunity requirements. Typical products would include office machines, electric drills, blenders, vacuum cleaners and toasters. Conducted emissions may also include emissions determined to be discontinuous disturbances, often referred to as "clicks", line harmonic emissions, limitation of voltage changes/fluctuations and flicker. Immunity requirements include Electrostatic Discharge (ESD); Electrical Fast Transients (EFT); Conducted Disturbances; Radio frequency electromagnetic fields; Surge; and Voltage Dips, Interruptions and variations.

Why do we need AC/Mains EMI filters? One reason is that regulatory agency requirements dictate that conducted and radiated emissions be constrained below specified limits, but the unit must also pass immunity/transient requirements as well. Designers often forget that an EMI filter not only assists in meeting conducted emission requirements, but assists in immunity and transients requirements and control radiated emissions as well. Even military/aerospace equipment must be protected from failure due to EMI noise, and security requirements may call for filters to protect classified data.



1. Radiated coupling from device to device
2. Radiated coupling from device to cables
3. Radiated coupling from cables to cables
4. Conducted noise coupling from device to device

THE 3 KEY STEPS

1 | EMC REQUIREMENTS

Essentially, an AC power or mains EMI filter is a low pass filter that blocks the flow of "EMI noise" while passing the desired input 50/60/400 Hertz power line frequency. An ideal EMI filter will reduce the amplitude of all frequency signals greater than the filter's cut-off frequency. The measure of a filter's ability to reduce a given noise level is insertion loss or attenuation. A power line or mains EMI filter is placed at the power entry point of the equipment that it is being installed into to prevent noise from exiting or entering the equipment. The EMI filter chosen for a product must meet and exceed the limits with an adequate margin to allow manufacturing minor inconsistencies.

The simplest type is called a first-order filter consisting of just a single reactive component. To achieve greater attenuation or insertion loss, a second or higher-order filter consisting of two reactive components or more is required. A third-order filter, of course, consists of three or more reactive elements. These types of filters are sometimes referred to as "L" or "PI" filters. The disadvantage of a higher order filter is that their physical size increases. Companies with experience selling in the EU design their products for universal voltages (where possible) and allocate space for an EMI filter in products.

As mentioned in the Introductory section above, filters are not only just for conducted emission issues, but also help in meeting radiated emissions levels, immunity issues and electrical fast transients (EFT). In all circuits both common-mode (CM) and differential-mode (DM) currents are present. There is a significant difference between the two. Differential-mode currents flow out-of-phase on the line conductor and return on the neutral conductor. Common-mode currents flow in-phase on the line and neutral conductors together and return on the ground/earth path. Common-mode currents are the primary source of EMI. Because of having two different noise current modes of propagation, it is important to determine which type of noise current exists so that proper filtering can be implemented for maximum efficiency and cost.

These HHA products must either be tested in a certified lab or self-certified by the product manufacturer and provide adequate test results to meet or exceed the EN55014 requirements.

2 | SAFETY REQUIREMENTS

Once a product passes the EMC requirement, the next step is to obtain safety certification for the whole product. The following parameters are essential design elements that must be considered as part of designing a safe product:

(1) Rated Voltage
The maximum AC mains voltage (actual value) allowable within a designated operating temperature range. Rated voltage of 250VAC is common. As for power transmission and distribution wiring systems, the major systems in use are single-phase systems and three-phase systems.

(2) Rated Current
The maximum load current amount (actual value) allowable within a designated operating temperature range. When used in a high ambient temperature, the allowable load current amount should be de-rated accordingly.

(3) Input Power Frequency
The input power voltage frequency is generally 50Hz/60Hz. However, a higher frequency such as 400Hz is sometimes used for special application which is the aviation related field.

(4) Test Voltage (withstanding voltage)
This test is to apply several times higher voltage than the rated voltage between lines, or between the line and case (ground), and observing that no failure (breakdown) occurs or not. The test voltage that is typically applied in the tests is usually 1500VAC, 2000VAC or 2500VAC or (equivalent voltages in DC) for a few seconds on most commercial products.

(5) Insulation Resistance
This is the insulation strength of the filter. This

value is found by applying a DC voltage between the lines or between the line and case (ground), and measuring the amount of current flowing. Applied voltage is usually 100VDC or 500VDC.

(6) Leakage Current
Leakage current is the current "I" from input power lines to case (ground). This value is essentially determined by capacitance between the line and case (ground). If this value is large in the EMI filter or ground terminals are not connected to earth ground, a shock can occur.

(7) DC Resistance
The DC resistance is the sum of the resistances between each Line/Load terminals of the filter. Most all of this is the wire resistance of the coils used in the filter, but also includes resistance from the connection to the terminals. The value calculated by multiplying the DC resistance to the load current corresponds to the voltage drop value across the EMI filter.

(8) Temperature Rise
This is the temperature rise of the internal components and filter case when the rated current is passed through the filter. In general, this value is the one measured in a condition where a product is directly exposed to specified ambient air temperature. If the product is attached to a metal board or forcibly cooled by fans, etc., then the value will be lowered.

EMC testing may be required for compliance for certain devices to the associated safety requirements for HHA products under EN60335 electrical product safety testing and subsequent compliance for the EU Low Voltage Directive. Additional testing for electromagnetic field emissions of household appliances and similar apparatus with regard to human exposure, found under EN 62233 may also be applicable. It should be noted that the CE conformity mark certifies not only electromagnetic compatibility but also the observance of all EU Directives relevant to the product in question. The most important general directives are, in addition to the EMC Directive, the Low Voltage and Machine Directives. Some of these directives also include EMC requirements. Examples are the RED (radio and telecommunications equipment) and the Medical Products Directive. The EMC Directive does not apply to products lying within the scope of these directives. The manufacturer is responsible for taking steps to observe all the applicable directives.

3 | UL/VDE COMPONENT CERTIFICATIONS

It is perceived that the EMI filter used in an appliance should be UL recognized (UL 1283), CE, VDE or similar safety certification standalone which is a costly proposition. The major components (capacitors, plastic insulation and encapsulation material, etc.) used in EMI filters have worldwide certification or have a UL certification number which is accepted by certified bodies. Filters can be certified as an integral part of any appliance as long as the filter manufacturer has done their due diligence and provided proper parts certification for the filter components.

International standards (IEC) are often implemented in Europe (EN and national standards (e.g. VDE/DIN for Germany). For EMC filters, it is EN 60939, the general specification for passive filter units for electromagnetic interference suppression. This created the basis for standardizing the tests. For use on the US market, many of our filters carry the UL or CSA test mark. A filter additionally approved by the US certification authority UL for the Canadian market carries the UL and cUL test marks or the combined cULus test mark.

The buyers of electronic components desire the use of the CE mark. An erroneous assumption that the use of CE-marked parts guarantees that CE compliant equipment is produced in another word CE+CE does not equal to CE. This overlooks the fact that the component manufacturer cannot guarantee the level of protection required by the directives, despite every care, even for components certified by third parties (EMC capacitors, inductors and filters). The tests only allow the safety of the components to be assessed under standardized test conditions.

This cannot cover faults in the construction of equipment. This leads unavoidably to the manufacturer's responsibility for any equipment used directly by the end user. The manufacturer alone can assess, test and ultimately certify its conformity, i.e. any marking of individual parts is irrelevant to the conformity status of the end product.

CONCLUSION

To reduce testing and certification cost and lead time on a final product, it is important to partner with an EMI filter manufacturing company with EMI testing and filter design services capabilities during product design and prototype built. Testing and incorporating EMI solutions into the product (if necessary) prior to presenting to a third party certification lab reduces cost and product launch lead times. Because, should a product fail EMI testing, all tests stops until a suitable EMI filter solution is incorporated into the product. This, in some cases, possibly means product redesign and/or enclosure modification to incorporate EMI filter solution/s.

ITG Electronics, Inc. not only can provide off the shelf EMC filter solutions but can also support manufacturers with their EMC layout from the early stages of new product ideas or designs. ITG Electronics, Inc. can also offer EMI testing and filter design solutions to help manufacturers meet any unique electrical, mechanical or EMC challenge. Contact your nearest ITG Electronics, Inc. representative for assistance.

REFERENCES

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2. Testing for EMC Compliance, Mark I. Montrose and Edward M. Nakauchi, John Wiley & Sons, Inc. 2004.

ITG | The Source for EMI FILTER and COMPONENT Solutions!

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