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Some Procedures in Mitigating Conducted Electromagnetic Interference

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Abstract. In our opinion, the problem of conducted interference generated by power converters, represents not a simply mater of harmonics or even interharmonics, as usually is considered, but really a broader issue, which requires a careful treatment of a continuous spectrum of frequency, extending until 30MHZ. The following paper presents a conducted electromagnetic interference problem in the case of a power converter, included in one kinetic therapy equipment (actually a treadmill).
Analysis is made, considering only conducted emissions at the mains supply port of the equipment. Tests carried out, outlined a few procedures in the analysis and mitigation of electromagnetic conducted interferences using electromagnetic interference mains filters.
Virtually all products contain a power supply filter as the last circuit that noise currents pass through before they exit the product through the power cord. Sometimes, properly designed transformers can provide inherent filtering, and so can obviate the need for an intentional filter. In other cases, like the one presented in the paper, mains filters are not enough for mitigating conducted interferences and they must be replaced, or simpler retrofitted by an additional one, the filters' cascade being able more often to mitigate perturbations. Mains passive EMI filters carry potentially high currents at dangerously high voltages, so the choice of these filters is an essential issue.
From the paper it can be seen that the EMI filter issues should be considered with careful attention by designers, because they are not only ancillary devices, as they are more often treated.

Keywords

Electromagnetic compatibility EMC, electromagnetic interference EMI, conducted emissions, EMI filter, common mode, differential mode.

1. Introduction

Technical literature is abounding in definitions for electromagnetic compatibility (EMC), but perhaps the most synthetic and eloquent one is that EMC consists is the absence of effects due to electromagnetic interference (EMI) [1].
Because electric and electronic systems penetrate more deeply into all aspects of society, both the potential for interference effects and the potential for serious EMI-induced incidents increase.
It is well known that the threat of EMI is controlled by adopting the practices of EMC, which include the intra-system and inter-system EMC. Difficulty arises when intra-system meets inter-system, when the two approaches are confused one with the other, or at the interface where they meet.
Further the transfer of electromagnetic energy (with regard to the prevention of interference) is broken into four subgroups: radiated emissions, radiated susceptibility, conducted emissions, and conducted susceptibility.
There are basically two classes of EMC requirements that are imposed on electric and electronic systems; those mandated by governmental agencies and those imposed by the product manufacturer.
The legal requirements are imposed in order to minimize the interference produced by the product. However, compliance with these EMC requirements does not guarantee that the product will cause no interference. On the other hand, EMC requirements that manufacturers voluntarily impose on their products are intended to result in customer satisfaction (in order of reliable). Compliance with both of these EMC requirements is critical to the success and the good reputation of the product in the marketplace.
Regulatory agencies impose limits on these conducted emissions because they are placed on the utility power system net of the installation.
The utility power distribution system in an installation is a large array of wires connecting the various power outlets from which the other electronic systems in the installation receive their AC power. It therefore represents a large "antenna" system from which these conducted emissions can radiate quite efficiently, causing interference in the other electronic systems of the installation. Thus the conducted emissions may cause radiated emission, which may then cause interference. Ordinarily, the reduction of these conducted emissions is somewhat simpler than the reduction of radiated emissions since there is only one path for these emissions that needs to be controlled: the unit's power cord. However, it is important to realize that if a product fails to comply with the limits on conducted emissions, compliance with the limits on radiated emissions is a