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Q-Zorb™ Microwave Absorbers for Collision Avoidance System Applications

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Application Note

Microwave absorbers consist of materials that contain coatings whose electrical and/or magnetic properties have been altered in order to allow for the absorption of microwave energy at discrete or broadband frequencies. These absorbers have traditionally been used for EMI reduction, antenna pattern shaping, and radar cross section (RCS) reduction.

With the rise of wireless electronics and the movement to higher frequencies, microwave absorbers, or "noise suppression sheets" (NSS), have been incorporated into systems designs to reduce EMI inside of wireless electronics assemblies. They now resolve such issues as internal cavity resonances, antenna pattern shaping, and high-frequency interference.

With the miniaturization of electronics systems, Q-Zorb™ microwave absorbers can solve electromagnetic interference (EMI) problems without additional shielding. They can resolve a wide variety of issues in advanced technologies involving automotive radar, which is utilized in automotive collision avoidance systems (CASs).

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Q-Zorb™ Microwave Absorbers for Collision Avoidance System Applications

Microwave absorbers have been used in a variety of applications for several decades. They have been traditionally used for EMI reduction, antenna pattern shaping, and radar cross section (RCS) reduction. More recently with the rise of wireless electronics and the movement to higher frequencies, microwave absorbers or “noise suppression sheets” (NSS) are used to reduce electromagnetic interference (EMI) inside collision avoidance system (CAS) applications.

Types of Noise Suppression Sheets

Magnetic absorbers are thin polymeric materials filled with magnetic particles. These materials have both high permeability (magnetic loss properties) and high permittivity (dielectric loss properties). This combination of properties makes these materials very effective in eliminating high frequency EMI. Laird Technologies has two (2) product types of magnetic absorbers that are used for CAS applications:

- Q-Zorb™ HP (high permeability) uses novel magnetic fillers to achieve extremely high permeabilities at low frequencies. This allows for relatively thin materials to provide EMI reduction at frequencies below 2 GHz. The material comes in thicknesses of .15 mm and .5 mm.
- Q-Zorb™ HF (high frequency) is the optimum choice for cavity resonance problems from 2 to18 GHz and higher. The material is available in thicknesses from .5 mm to 3.2 mm and is supplied in sheets or as die cut components.

Both materials are UL VO and ROHS compliant, and can be supplied with pressure sensitive adhesive (PSA) for ease of installation.

Magnetic Absorbers versus Lossy Foam

In these enclosure applications, the designer needs to understand the tradeoffs between using a magnetic absorber versus a lossy foam-type absorber. The foam absorber is a more cost-effective solution, provided it will meet the performance goals. However, there are a couple of major reasons to use magnetic sheet absorbers (Q-Zorb™).

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- Foam absorbers can breakdown over time, causing resistive particles to drop onto the circuit traces.
- Energy along the side walls of cavity are H-field (magnetic) dominated currents. The electric field is at a minimum along the walls and materials with only dielectric loss (resistive foams) will not perform very well in these applications. The magnetic absorbers have high H-field loss and attenuate these currents.

Tuned Frequency versus Surface Wave Absorbers

Laird Technologies offers two types of Q-Zorb™ materials: tuned frequency and surface wave absorbers. Tuned frequency materials are used in far-field applications such as direct radar reflections off of an object.

Surface wave absorbers are used for high angle of incidence applications and for cavitynoise suppression. Many design engineers that have a cavity noise problem at a certain frequency want to use a tuned frequency absorber tuned specifically to that frequency. However, that is not the best performance they can achieve.

Note that the tuned frequency materials offer good performance at normal angles of incidence but perform more poorly at higher angles of incidence. Inside the cavity, the noise generated is at a number of angles of incidence, along with a significant amount of surface wave energy. In these applications, the surface wave materials offer better performance.

Electronics Operation

Electronics operating at high frequencies can have problems with emissions of high frequency noise. Once placed inside an enclosure, the energy will increase in phases at certain frequencies to cause resonances which will hinder the performance of the device. This is especially true in CAS applications.

Collision Avoidance Definition

Collision avoidance technology is defined as “Technologies that actively scan for other vehicles or personnel and take automatic action to render the equipment to a safe state,” (Snape, 2010, p 7).

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Collision Avoidance System Operation

The Front Collision Avoidance System, also known as adaptive cruise control, uses 77 GHz transmitters which make the use of Q-Zorb™ absorbers ideal. These systems detect slower vehicles and adjust the cruise control so the manual changing of the cruise control and/or braking are all done automatically. Each one of these sensors has an absorber in the back of them. High frequency absorbers such as the Laird Technologies Q-Zorb™ line are an integral part of CASs. (See: Figure 1)

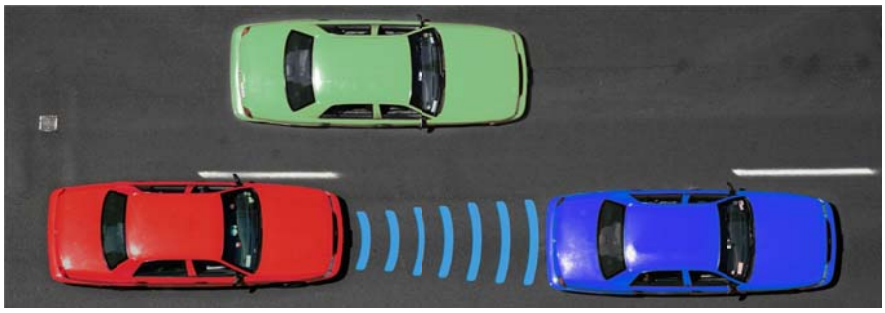

Figure 1: Front Collision Avoidance System

Side-looking Collision Avoidance Systems (SCASs), also known as Lane Change Collision Avoidance Systems, use 24 GHz systems. These are typically installed in the side mirrors and work very similar to the CASs. Each of these sensors also has an absorber in them as well. (See: Figure 2)

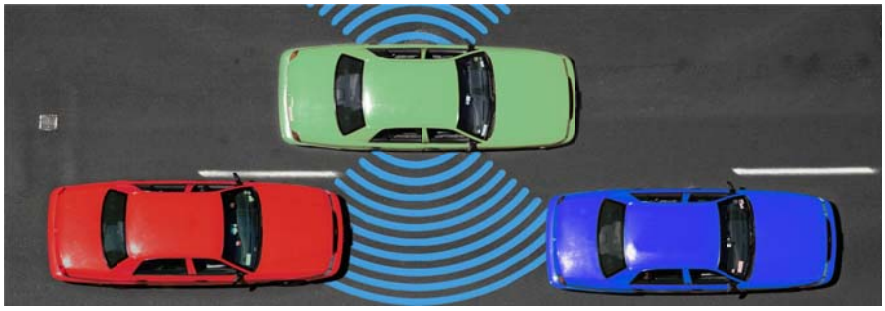

Figure 2: Side-looking Collision Avoidance Systems

Summary

With the miniaturization of electronics systems, Q-Zorb™ microwave absorbers can solve electromagnetic interference (EMI) problems without additional shielding. They can resolve a wide variety of issues in advanced technologies such as automotive radar, which is utilized in automotive CASs. These systems are not for just over the road vehicles, as they are starting to

be used in large earth moving vehicles in open pit mines. As the costs of these units decrease and safety becomes mandated, the use of these units will become more widespread.

Laird Technologies offers a wide range of microwave absorber products including die-cut elastomers, foam, thermoplastics and custom solutions to aid in a variety of problems such as internal cavity resonances, antenna pattern shaping and high frequency interference.

References

Snape, J. (2010). Collision Avoidance, Xstrata Coal. Retrieved from http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/368753/John-Snape-proximity-detection-at-xcq.pdf.

About Laird Technologies, Inc.

Laird Technologies designs and manufactures customized, performance-critical products for wireless and other advanced electronics applications.

The company is a global market leader in the design and supply of electromagnetic interference (EMI) shielding, thermal management products, specialty metal products, signal integrity components, and antenna solutions, as well as radio frequency (RF) modules and wireless remote controls and systems.

Custom products are supplied to all sectors of the electronics industry including the handset, telecommunications, data transfer and information technology, automotive, aerospace, defense, consumer, medical, mining, railroad and industrial markets.

Laird Technologies, a unit of Laird PLC, employs over 12,000 employees in more than 49 facilities located in 16 countries.

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