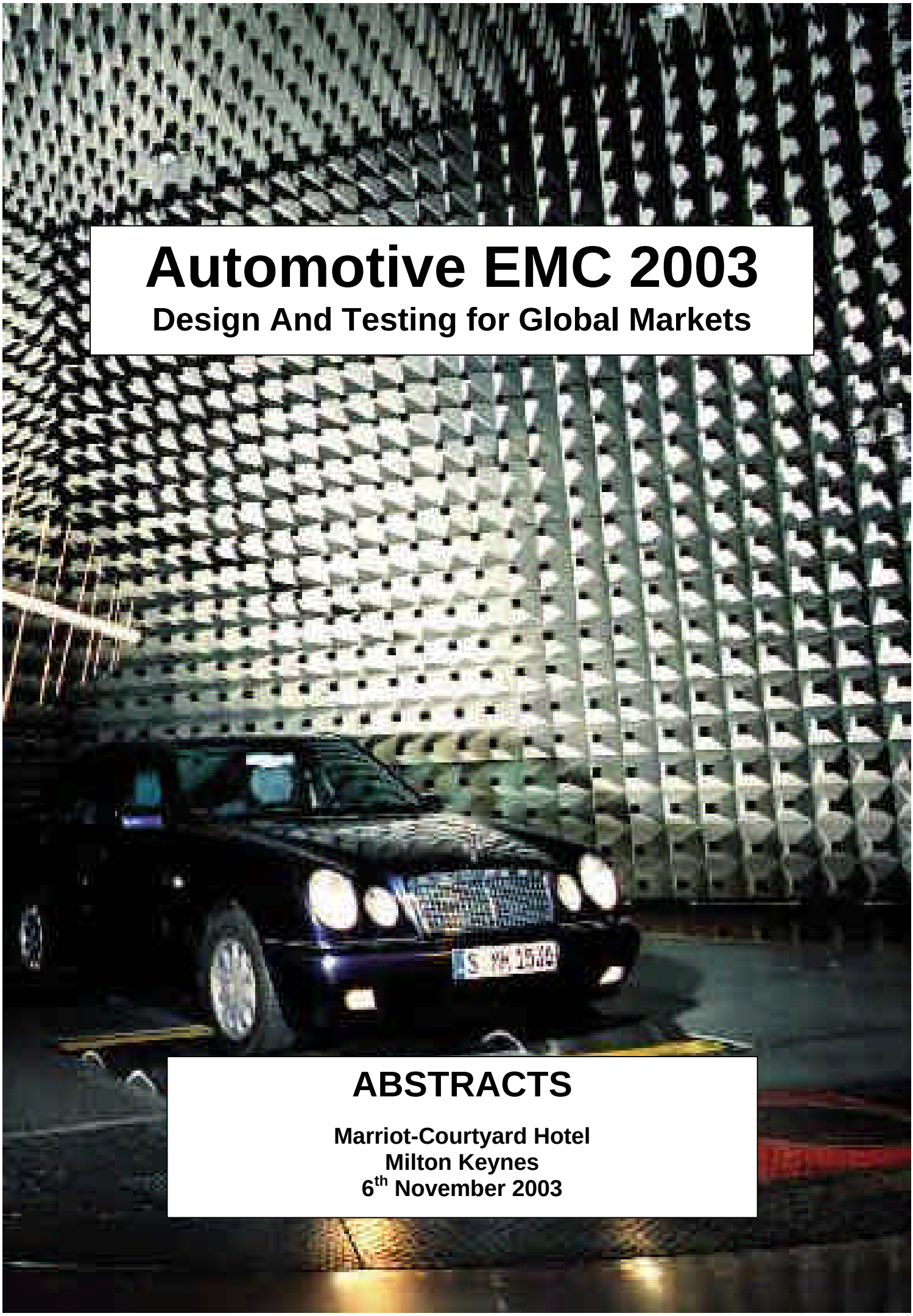

Automotive EMC 2003

Design And Testing for Global Markets

ABSTRACTS

Marriot-Courtyard Hotel
Milton Keynes
6th November 2003

CONTENTS

Introduction

The Automotive EMC 2003 conference was organised to bring together OEM's, their suppliers, EMC test houses and electronic circuit designers involved with automotive electronic design. Many of the existing EMC conferences are too generic for the practitioners of automotive EMC to gain useful information from, consequently a niche conference aimed at this specific market sector was devised after the launch of the Automotive EMC professional network in April 2003 (www.autoemc.net).

The conference aim was to bring together design engineers, EMC specialists and test service providers to share information on the latest standards, test methods and design practices for achieving EMC compliance in the automotive environment.

Papers

This portable document format (PDF) file contains the abstracts of the papers available on the conference proceedings CD-ROM.

The proceedings CD-ROM contains a single combined copy of all the papers presented at the Automotive EMC 2003 conference and that document is considered the official proceedings of the conference. Individual copies of the papers in PDF form are also available on the CD-ROM.

Presentations

Presentations are included on the proceedings CD-ROM in both a combined PDF presentation document containing all the presentations and in individual PDF files for each speaker. The presentations copies are in 2-per-page thumbnail format are not sequentially numbered.

Proceedings

The CD-ROM proceedings include a HTML index and is easily navigable using any standard internet browser. The conference and exhibition details, contact information for exhibitors and authors, biographies of authors as well as the above papers and presentations are all included on the CD-ROM.

The CD-ROM of the Automotive EMC 2003 proceedings is available to order post-conference. The order form and pricing is posted on the Automotive EMC network web site (www.AutoEMC.net), follow the CONFERENCE link.

95/54/EC - Past, Present And Future

Dr Ian Noble
Engineering Consultant

Abstract
This paper discusses the origins of 95/54/EC and the products to which it is applied. It then describes some of the disparities in implementation across the different EU Member States, presenting some of the results from an EU-funded study carried out by the University of York from 2000-2001. Finally, the probable future direction of 95/54/EC is discussed in terms of the likely changes for the next edition of 95/54/EC.

Revision of the Vehicle Transient Test Specification ISO 7637

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Abstract
Modern vehicles are more and more equipped with high density electronic modules. The importance of Electro Magnetic Compatibility therefore is constantly increasing. New technologies and communication systems in vehicles require extensive testing and evaluation before electronic modules are used in real installations to ensure safety and reliability.

The area of transient testing of vehicles is covered by ISO 7637. This standard includes four parts:

- ISO 7637	part 0	General and Definitions
- ISO 7637	part 1/1990	Commercial vehicles with 12V nominal supply voltage Electrical transient conduction along supply lines only
- ISO 7637	part 2/1990	Commercial vehicles with 24V nominal supply voltage Electrical transient conduction along supply lines only
- ISO 7637	part 3/1995	Vehicles with 12V nominal supply voltage Electrical transient transmission by conduction as well as by capacitive coupling via lines other that supply lines.

The standard was first issued in 1990 and the revised standard is expected to be issued later in 2003.

CE & e for Vehicle EMC

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Abstract
The automotive EMC directive, as 95/54/EC is known, is frequently identified as the only EMC legislation applicable to any vehicle. For a variety of reasons other directives affect vehicles and some result in the need to “CE” mark already and others may call for this in the future.
Automotive “e” marking legislation for EMC is compared with the horizontal “CE” marking legislation requirements for EMC assessment and testing.
The differences between functional performance, functional safety, radio spectrum management, and road safety EMC requirements are explored as the requirements of the separate directives are reviewed.
Directives considered are those for general EMC, Low Voltage, Machinery Safety, Radio & Telecommunications Terminal Equipment, Automotive EMC and Automotive Anti-Theft, together with relevant guidance documents from both the United Kingdom as well as Europe. As the general EMC directive, the Low Voltage directive, and the Automotive EMC directive are each in the process of being reviewed and updated by Europe the proposed contents of the new directives are used as guidance to the interpretations of the current ones.

Interactive Questions and Answers on “e”-marking

Rob Nixon
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Abstract
Rob Nixon of the VCA's Component and ESA Testing section provided an open questions and answers (Q&A) session on certification of products to the "e"-marking requirements of 95/54/EC and any other issues relating to the role of the VCA.
There is no formal paper enclosed in the proceedings as the Q&A session was for the delegates to direct, but we have included the VCA's reference document on "Automotive Type Approval for Electromagnetic Compatibility".

EMC Issues of Electric Drives in Automotive Applications

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Abstract
From the EMC point of view, the integration of electric drive systems into today’s cars represents a substantial challenge. The electric drive system is a new component consisting of a high-voltage power source, a frequency converter, an electric motor and shielded or unshielded high-power cables. Treating this new electric drive system or its components as a conventional automotive component in terms of EMI test procedures and emission limits would lead to substantial incompatibility problems. In this paper the EMC issues related to the integration of an electric drive system into a conventional passenger car are investigated. The components of the drive system have been analyzed being either noise sources or part of the coupling path within the new electrical system of the car. The obtained results can also be used to determine the acceptable noise levels on a high voltage bus of an electric drive system.

Using FEKO and CableMod for the Combined Analysis of Electromagnetic Field / Cable Harness Problems

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Abstract
One critical aspect of EMC modelling in the automotive industry is the interaction of electromagnetic fields with cable harnesses. This includes both the radiation of electromagnetic fields (for instance a mobile phone operated inside the car or an external antenna) and coupling into cables, but also the radiation of the cable currents and interference with other electromagnetic devices. These problems are typically too demanding for any type of traditional electromagnetic field solver due to the complexity of the cable harness (multiple leads, dielectric insulations etc.). On the other hand, pure transmission line codes are not able to cope with the 3-D environment in the electrodynamic case (3-D car body with currents at high frequencies). To facilitate the analysis of such problems, the 3-D electromagnetics code FEKO (based on the Method of Moments with hybrid extensions for higher frequencies) and the cable harness analysis tool CableMod have been combined. We discuss some details of this combination, and also present a number of validation and application examples.

Battery Supply Simulation

Roland Spriessler[1], Harald Kunkel[2],
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Abstract
Apart from EMC testing such as transient testing on vehicle battery supply lines and RF conducted and radiated immunity, battery supply simulation for electrical loads connected to the 12V, 24V or future 42V supply is becoming more and more important. Vehicle manufacturers specifically do a large number of such tests exceeding by far what ISO 7637 requires. Pulse 4 (motor start-up pulse) and pulse 2b (motor shut down pulse, introduced in ISO 7637:2003) are suggested.

The field of battery supply simulations is not a fundamental question of EMC. It also has something to do with electrical load functions, failure criteria and acceptance criteria and therefore is also mixed up with typical EMC test procedures. In various manufacturers' specification there is no difference between EMC testing and battery supply simulations.
Looking at vehicle manufacturers' specifications there are a large number of additional tests like micro-interruptions, dips and drops, all with considerable fast rise and fall times, voltage variations, over voltage and under voltage tests and reverse voltage tests. With each edition of manufacturers' specifications it is possible that you could find some modified or new test requirements.

Looking at such extensive requirements, it is obvious that manufacturer's consider battery supply simulation to be at least as important as transient testing to ensure proper, save and reliable function of all parts and systems in a vehicle. We will give an overview of such requirements and make cross references between international standards and manufacturer requirements.

The New Principle E-Field Sensor for Automotive Immunity Test

Shigenori Torihata[1] , Benjamin Loader[2]
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Abstract
NEC-TOKIN in Japan and National Physical Laboratory in UK has developed an E-field measurement sensing system, using new principles, for automotive immunity tests. The sensor head of this system consists of $LiNbO_3$ crystal and optical fibre. No metal parts are used except for the antenna elements.
This sensor can measure not only E-field strength but also frequency and phase. The feature of this system are: minimal disturbance of the surrounding E-field, high-accuracy (uncertainly within 1dB), wide dynamic range up to 80dB, small sensor head (8mm dia.25mm length), measurement ability of any kinds of modulations such as AM, FM, CDMA and so on and wide frequency range such as 100kHz to 10GHz.
We introduce the design principles, the structure of this sensor, specifications of sensitivity, directivity, isotropy, linearity, stability against temperature change and spatial resolution. Some measurement examples adapted to automotive immunity testing are reported, the measurement results of AM modulation waveform such as 1kHz 80% modulation, actual mobile phone RF signals, time domain signal measurement and so on. We think this system is very useful for many kinds of modulation signals and fast changing signals such as reverberating chamber tests. And it can measure an E-field in a confined space such as vehicle dashboard and engine space.

An Overview Of Automotive EMC Testing Facilities

Martin Wiles
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Abstract
Automotive EMC standards are varied in their requirements for testing in anechoic chambers. They are also different to other EMC standards and depend on the need to test at component or vehicle level .The most common Automotive standards are under CISPR, SAE, ISO and 95/54 EC and are usually are copies of each other with small differences. With full vehicle test chambers being some of the largest EMC test facilties in existence a good understanding of the requirements of the current standards is important before embarking on such a project.

Study into the TETRA Electromagnetic Environment within Motor Vehicles

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Abstract:
QinetiQ Ltd. has carried out a study for the Home Office to evaluate the Electromagnetic (EM) effects of Terrestrial Trunked Radio (TETRA) transmissions within police vehicles. The TETRA system is currently being introduced in the UK under the Airwave Project. Police officers will use TETRA to make voice and data transmissions. The TETRA radios will also make automatic data transmissions whilst registered with the Airwave network. These voice and data transmissions may be required whilst the officer is working or travelling within a motor vehicle. Studies carried out by QinetiQ have found that the electric field from a TETRA transmitter may be boosted or enhanced within a motor vehicle[1]. An enhancement is defined as the difference between the peak fields measured within the vehicle compared with the field produced at the same distance in free space. A large number of measurements would be required to provide a high degree of confidence that the maximum value had been measured. This paper presents the results of several studies into vehicle enhancement measurements including the use of the mode-stirred technique. Details of a study into the damping effects of humans occupying a motor vehicle are provided. Some results of the damping effect created using of Radio Frequency Absorbing Material (RAM) for mitigation of enhancement are also included.

Automotive Electromagnetic Environment and Requirements of Vehicle Manufacturers

Ayhan Günsaya,
Ford motor company, Dunton Engineering centre, 3B-D08-B, Basildon, Essex, SS156EE, UK e-mail: agunsaya@ford.com

Abstract:
The automotive electromagnetic environment faced by electronic modules is very challenging as it contains intentional transmitters, accidental sources of RF emissions as well as conducted transients and electrostatic discharges. It is necessary to put in place certain requirements both at vehicle and component levels to ensure electronic equipment can operate in harmony with each other and without interfering with broadcast and radio communication services. There are minimum levels of legal requirements in Europe [1], but these are not sufficient to ensure product quality and customer satisfaction. Subsequently vehicle manufacturers have their own requirements to meet customer expectations. A benchmark of radiated immunity, conducted immunity and ESD requirements is presented to show that there is a common approach to ensuring electromagnetic compliance in the automotive industry.

Transient Test Requirements for “e”- Marking – Necessity or Bureaucracy?

James Gordon-Colebrooke and Alex McKay
3C Test Ltd, Lawn Farm Business Centre, Grendon Underwood, Bucks, HP18 0QX.

Abstract
The results of a practical investigation into “real world” transients on board passenger vehicles and their relationship to current standards and proposed amendments.

EMC: Who’s Job Is It Anyway?

Peter Hartnett.
Transparent Engineering Ltd. Venture House, Fifth Avenue, Letchworth, Herts, UK. peter.hartnett@treng.biz

Abstract
Who should take responsibility for achieving the best EMC performance for a vehicle? Suppliers are, as always, under pressure to meet increasingly difficult emissions and susceptibility targets. Can or should, the vehicle manufacturers do anything to help the suppliers? This paper discusses the correct balance between a macroscopic and microscopic approach to design responsibilities.

The EMC Implications of 42V Powernet

Martin O'Hara
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Abstract
The proposed changing of the vehicle primary power system from a 14V power network (12V battery) to a 42V Powernet (36V battery) system has implications for the EMC of vehicles and their components. This paper examines where the existing EMC standards may be affected and which will need revising or updating for the new 42V Powernet system, if and when it is implemented.

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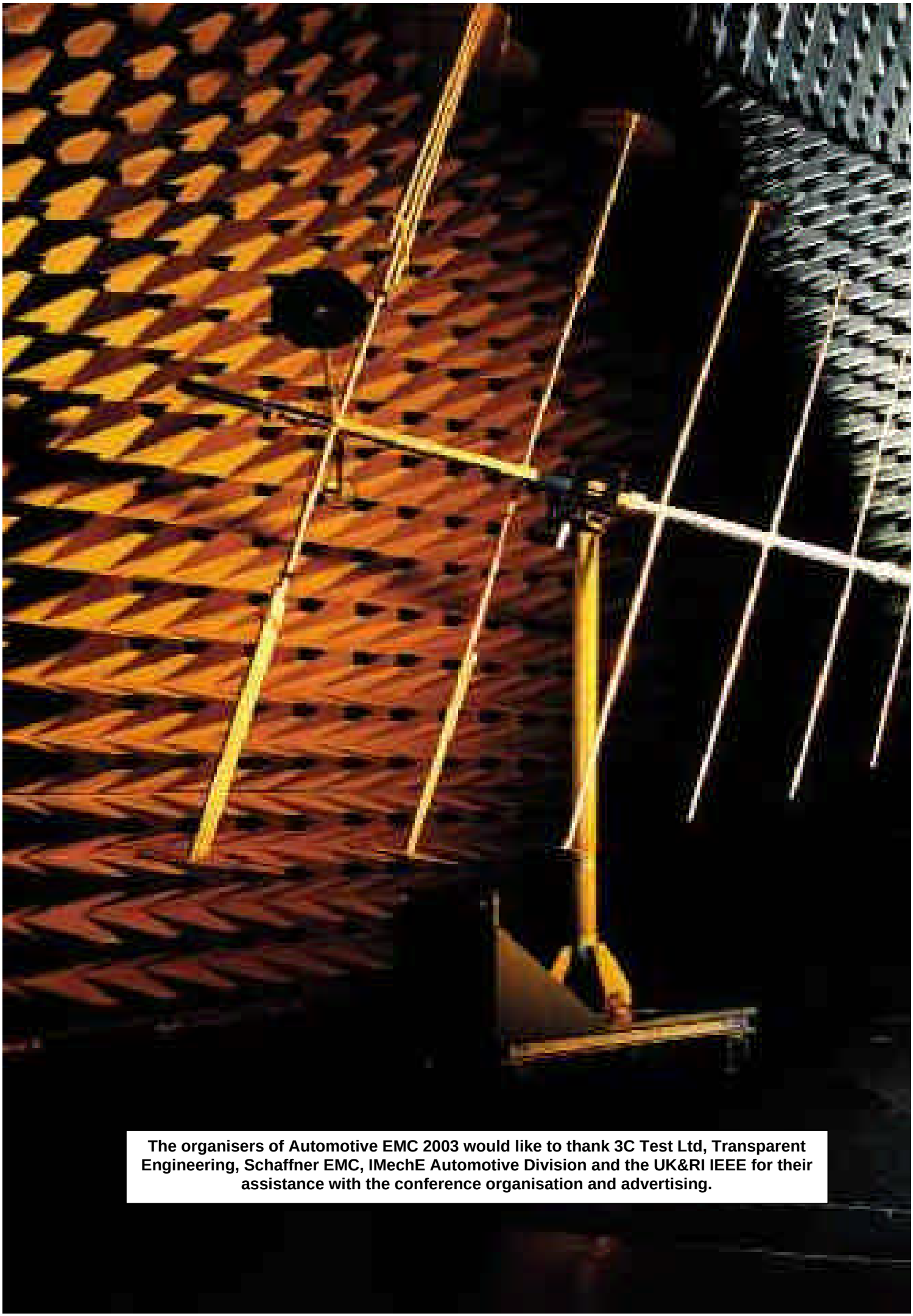

The organisers of Automotive EMC 2003 would like to thank 3C Test Ltd, Transparent Engineering, Schaffner EMC, IMechE Automotive Division and the UK&RI IEEE for their assistance with the conference organisation and advertising.