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Introduction to EMC for Functional Safety, EMC Society of Australia

Helping you solve your EMC problems

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EMC Society of Australia NEWSLETTER

The official newsletter of the Electromagnetic Compatibility Society of Australia
ENGINEERS AUSTRALIA 11 National Circuit Barton ACT 2600

Issue Number 30 A SOCIETY OF **ENGINEERS** AUSTRALIA *June 2005*

EMC SOCIETY OF AUSTRALIA EMC SYMPOSIUM 2005

As Chairman of the EMCSA I am pleased to announce the Society's fourth Annual EMC Symposium which will be held in Melbourne over 6-8 September 2005. The venue will be the Metropole Hotel Apartments & Conference Centre in Fitzroy, Melbourne. This was the venue for the 2004 Symposium and it proved a convenient meeting place with modern facilities, central location and easy access to Melbourne CBD. Accommodation is available on site for delegates at favourable rates.

Papers have been received by the organising committee on various aspects of EMC. Emerging "themes" include EMC in Defence systems, computer simulation, and biological hazards of EMR. The Symposium attracts delegates from a wide cross-section of the EMC Community, from Defence industry to commercial users, from academic researchers to EME/EMR interest groups.

The symposium provides an opportunity to meet with EMC practitioners from different areas of industry and government and to share ideas on solving EMC problems. Along with research papers, tutorial papers are included in the program allowing attendees to gain an instant update on particular EMC topics.

Trade displays will again be a feature of the Symposium, and offer an opportunity to obtain information on EMC products and services and raise questions with equipment and service providers directly.

Workshops
Following the success of the EMC Workshops introduced in 2004, the Symposium again includes workshops on EMC related topics. The half-day practical workshops will be held on Tuesday (Sept 6) and Thursday (Sept 8) and will cover topics such as

- EMC in Defence Systems,
- EMR and Human Health,
- Do it yourself EMC Pre-compliance Testing,
- Managing EMR Assessment and Risk, and
- Computer Simulation for EMC.

Invitation
On behalf of the Symposium organising committee I invite all Society members and colleagues, and all with an interest in EMC to attend the Symposium and associated workshops. We are confident you will find much of interest, and will enjoy the atmosphere of the Symposium and the opportunity to meet with others having similar interests.

We also extend an invitation to exhibitors to join the trade displays. The organising committee recognizes the value of the trade displays in providing essential information on EMC products and services, and encourages suppliers of EMC related items to join in the displays. As an incentive to suppliers to exhibit, the organising committee provides display space free of charge.

Students
Again this year the organising committee issues a special invitation to tertiary students to attend the Symposium and Workshops. As an incentive, the committee has again decided that bona fide students in relevant disciplines students can attend the Symposium and all Workshops for the one small inclusive fee ($50). This represents tremendous value and allows students to be introduced to professional level EMC topics at a very reduced rate, while meeting experienced EMC professionals.

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The EMCSA Symposium brings together the highest calibre EMC presenters at one place, once a year. It provides an educational opportunity for people involved with EMC at all levels. It also represents the best possible value for money because it is run by a non-profit organisation.

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... Please ensure your membership fees are paid ...

INDUSTRY BRIEFS

Symposium details
Dates:
Symposium paper sessions Wednesday 7 September 8.30 am – 5.00 pm. Workshops Tuesday 6 September, Thursday 8 September.

Venue
Metropole Hotel Apartments & Conference Centre, 44 Brunswick Street Fitzroy VIC, 3065 Phone (03) 9411 8100

Registration
By mail, phone, fax or email to address shown on form. Registrations close 31st August 2005.

Symposium Fees
(Prices are in Australian Dollars and include GST.) Fee includes Symposium Record, lunch and teas.

Non-members	300.00
IEAust. members	270.00
EMC Society members	198.00
Additional delegate	270.00
Students	50.00
Dinner (optional extra)	50.00

Enquiries
General enquiries:
enquiries@emcsa.org.au

The search for truth is more precious than its possession - Albert Einstein

Technical Program
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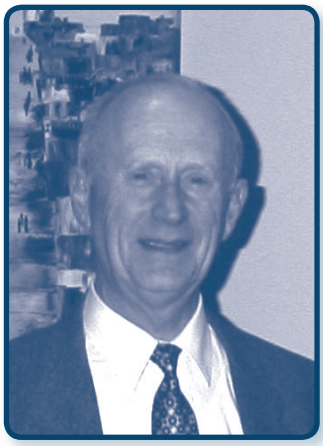
Organisation
Kingsley McRae Phone: 0419 518 303
kingsley.mcrae@hard.net.au

Dinner
The EMC Society invites all delegates and friends to the Symposium Dinner. Following drinks at 6.00 pm, the dinner will be an opportunity for socialising, networking, and relaxing after the Symposium.

Accommodation
Accommodation is available onsite at the Symposium venue at attractive rates for Symposium delegates. Ideally situated on the outskirts of Melbourne's CBD, with easy access to public transport, the Metropole Hotel Apartments and Conference Centre has established itself as an ideal conference venue.

Trade Displays
Trade displays and demonstrations are an additional feature of the Symposium providing information on EMC products and services.



John Hyne
Chairman

EMC RESEARCH IN PERTH

Dr. Franz Schlagenhaufer (franz-s@watri.org.au)

Perth. The focus is on gaining an understanding of field phenomena and the connection between field theory and circuit models. The PhD project of Joe Trinkle gave a deep insight in the electromagnetic characteristics of power-ground planes and the interaction between via ports and the surrounding substrate. His papers attracted the attention at several international conferences. Matthew Wood will continue research in this direction, but will look more closely on the interaction between details structures on a board, such as via holes, edges, and traces, and radiation. Other PhD projects at WATRI look at radiation from traces on printed circuit boards (Bert Wong) and the correlation between near and far fields around printed circuit boards (Gladys Hongmei Fan).

EMC at WATRI is done with a strong consideration of electromagnetic theory aspects. The letters 'E' and 'M' are just as important as the 'C', after all. And without a safe theoretical basis achieving EMC is guesswork at best, but not science. At the same time it is important not to loose connection to reality. There is nothing wrong with sitting in an ivory tower, but that tower must have doors and windows, and those doors and windows must be open. In the case of our research that means, we are looking at existing problems in the design world. How to control electromagnetic emission from printed circuit boards is such a problem which will keep designers and researchers busy for years to come. To be able to do this we have to understand what is going on around boards in electromagnetic terms. Emphasis is placed on analytical solutions because they lead generally to shorter computation times, thus allowing parameter studies, and give a better insight in the role of particular parameters. These solutions have to be tested in two directions:

- Whether the model is realistic is best checked with comparison to measured data. The importance of this step is to establish that all assumptions have been reasonable, e.g. assuming uniform field around vias, or no fringing effects on board edges;

- Whether the solution is correct can often better be checked by comparison with numerical solutions, where shortcomings in the measurement setup can be ruled out.

The approach of EMC problems with a combination of analytical and numerical solutions and with measurements is the strength of the research at WATRI. This is also reflected in the choice of partners for Memoranda of Understanding. WATRI has formal links with the Dresden University of Technology (Institute for Electromagnetic Compatibility), and with the Technical University Hamburg-Harburg (Institute for Electromagnetic Theory, and Institute for Electromagnetic Measurements). These institutes have a sound background in numerical field computation, measurements in TEM and GTEM cells, and EMC on a system level.

Prof. Gonschorek helping with an on-site field measurement during his stay in Perth

The co-operation between WATRI and its German partners is more than just wishful thinking. WATRI had so far high profile visitors from both universities. Prof. Karl Gonschorek of Dresden was in Perth for 5 months during Summer 2003/2004, and Dr. Heinz Brüns of Hamburg spent 6 weeks here earlier this year. Karl has many years of practical experience in dealing with EMC on a system level, combined with a strong theoretical knowledge. He was the main presenter at a series of workshops organized by the Australian Electronics Development Centre (AEDC) in 1996, and gave also some two talks at the 2003 EMC Society Symposium in Melbourne. Heinz has a vast experience in numerical field computation with the Method of Moments, and is involved in the development of a sophisticated software package, CONCEPT. There were many fruitful discussions between him and WATRI researchers about the implementation of analytical models in numerical methods, and the treatment of PCB structures. The team in Hamburg has spent much effort in the last years on hybrid methods: combining the Method of Moments with Physical Optics, applying Huygens principle on PCB structures, and using theoretical solutions for shielding problems are just some of the topics Heinz explained in detail during his visit.

Dr Brüns (right) and his son together with WATRI PhD candidates enjoy a barbecue after a hard day's work.

The link between Australia and Germany works also in the other direction, and Dr. Franz Schlagenhaufer is visiting the University in Dresden in June and July this year.

The pursuit of truth and beauty is a sphere of activity in which we are permitted to remain children all our lives. - Albert Einstein

WORLD SUMMIT PREPARATORY MEETING CONVENES SESSION ON 'TELECOMS FOR DISASTER RELIEF'

Geneva, 23 February 2005 - The second Preparatory Meeting for Phase Two of the World Summit on the Information Society included a special session on Telecoms for Disaster Relief. The session focused on key elements of the Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations, which came into effect on 8 January. Until now, regulatory barriers that make it extremely difficult to import and rapidly deploy telecommunications equipment for emergencies often impeded the trans-border use of telecommunication equipment by humanitarian organizations.

In the absence of an agreed multilateral framework that temporarily waived formalities, delays meant the loss of lives. "In emergency situations, telecommunication saves lives," said Yoshio Utsumi, Secretary-General of the International Telecommunication Union, the United Nations specialized agency for telecommunications, which, along with the UN Office for Coordination of Humanitarian Affairs (OCHA), has been a driving force in drafting and promoting the Convention.

The special session, held in Salle XI of the Palais des Nations in Geneva, 18h15 - 19h30 22 February, included an overview of ITU work in Telecoms for Disaster Relief, which is outlined at ***http://www.itu.int/***.

FELS WHITE PAPER - ONLINE DOCUMENT DELIVERY

Allan Fels, one of Australia's pre-eminent figures in the field of regulatory affairs and compliance management, has written his white paper "Managing Compliance Through Online Document Delivery". This paper discusses the operational need for companies and other organizations to have in place an effective compliance management program to address the various laws, regulations and standards they encounter. It also suggests that online document distribution can provide a solution to a key compliance need. The paper is available at ***http://www.standards.com.au/***.

PROPOSED VARIATIONS TO THE LIPD CLASS LICENCE AND PROPOSED REVOCATION OF THE SPREAD SPECTRUM CLASS LICENCE

The ACA is seeking comments from interested persons on several proposed variations to the Radiocommunications (Low Interference Potential Devices) Class Licence 2000 (the LIPD Class Licence).

The proposed variations are:

- an addition to authorise operation of medical implant communications systems (MICS) and medical implant telemetry systems (MITS);
- an expanded frequency range for low power transmitters in the 2.5 GHz band;
- updated provisions for radio local area networks (RLANs) operating in the 5 GHz band;
- an addition to authorise operation of devices in the 60 GHz band to support development of very wide bandwidth, short range broadband communications; and
- an addition to authorise operation of spread spectrum devices previously authorised under the Radiocommunications (Spread Spectrum Devices) Class Licence 2002 (the Spread Spectrum Class Licence).

The ACA also proposes to revoke the Spread Spectrum Class Licence as it is proposed to move its contents into the LIPD Class Licence. Interested persons can download the current LIPD Class Licence and Spread Spectrum Class Licence, the proposed variations, and a background paper. Alternatively, copies of these documents can be obtained by contacting: Christine Allen, Space and Terrestrial Regulation Team, Australian Communications Authority, PO Box 78, BELCONNEN ACT 2616, Telephone: (02) 6219 5333, Facsimile: (02) 6219 5133, Email: ***Christine.Allen@aca.gov.au***

Interested persons are invited to make written representations about the proposed variation and/or revocation addressed to: The Manager, Space and Terrestrial Regulation Team, Australian Communications Authority, PO Box 78, BELCONNEN ACT 2616, Facsimile: (02) 6219 5133, Email: ***radiocommunications.licensing.policy@aca.gov.au.*** Closing date for comments: 28th June 2005.

ABA FINDS DESPERATE HOUSEWIVES PROMO BREACHED TV CODE

The Australian Broadcasting Authority has found that Channel Seven (Sydney) Pty Ltd, the licensee of commercial television service ATN Sydney and Channel Seven (Adelaide) Pty Ltd the licensee of commercial television service SAS Adelaide, breached the Commercial Television Industry Code of Practice 2004, by broadcasting a program promotion classified M during sporting coverage.

In February and March 2005 the ABA received four complaints regarding the broadcast of a promotion for the M classified program Desperate Housewives on ATN and SAS.

The promotion was shown throughout the Seven network and was broadcast during the men's final of the Australian Open Tennis tournament after 8:30pm on Sunday 30 January 2005. The depiction of concern was one in which a female character was implied to have committed suicide. The promotion was preceded by a visual and audio warning that the promotion was classified 'M'.

The period from 8:30pm is generally an M classification zone, however the commercial television code provides that, during certain programs, including live sporting events, program promotions must comply with the PG classification requirements. This is in recognition of the fact that, during such broadcasts, children are likely to comprise a higher percentage of the viewing audience than would generally be the case at this time. Additional safeguards are therefore needed to ensure material is suitable for younger audiences. The relevant code provisions are clauses 3.11 and 3.12.

Seven Network Ltd had acknowledged that the broadcast of M classified material was in breach of the code and had apologised to complainants. The complainants had, however, come to the ABA to further express concern about the suitability of the promotion material, particularly the treatment of suicide themes, for broadcast during a program in which large numbers of children were likely to be viewing.

The ABA is aware that suicide is a matter of considerable concern in the Australian community, and believes that particular care is necessary in dealing with this subject matter. This is especially the case at times when children are likely to be viewing.

The ABA therefore asked Seven Network Ltd to take further action to ensure that clause 3.11 is understood by network staff. This action included giving an undertaking to the ABA that Seven Network Ltd would provide the investigation report along with an explanation of the ABA's findings to staff and implement information sessions across the network to discuss provisions of the code relating to the placement of promotions, particularly with regard to restrictions in G and PG programs. The ABA requested Seven Network Ltd undertake this action within a six month period and report back to the ABA on its compliance.

Seven Network Ltd has accepted the ABA's request for an undertaking. It has also advised the ABA that it took action soon after the promotion was broadcast and prior to the ABA's investigation, to conduct training with promotions staff in scheduling requirements, particularly those under clause 3.11.

ABA FINDS TRIPLE J BROADCAST INAPPROPRIATE AND GRATUITOUS LANGUAGE AND FAILED TO RESPOND TO COMPLAINT

The Australian Broadcasting Authority has found that the Australian Broadcasting Corporation breached the ABC Code of Practice 2004 by using inappropriate and gratuitous language on the Triple J Breakfast Show and failing to to provide a response to a complaint.

On 10 February 2005, the ABA received a written complaint alleging that the Breakfast Show broadcast on the ABC's Triple J network on 23 November 2004, used inappropriate language. The complainant also alleged that the broadcaster failed to respond to his complaint.

The ABA determined that the broadcaster:

- breached clause 2.2 of the ABC Code of Practice 2004 (use of inappropriate and gratuitous language); and
- breached clause 9.2 of the code (failing to provide a response to the complainant within 60 days of receipt of complaint).

The ABA notes that in response to the breach finding, the ABC has taken the following steps:

- apologised to the complainant in relation to the use of inappropriate and gratuitous language;
- apologised to the complainant for the failure to deal with his complaint;
- introduced a system to monitor complaints and will train staff to remind them of correct complaints handling procedures.

The ABA considers these actions address the compliance issues raised by the investigation and will continue to monitor the broadcaster's performance in this regard.

A copy of the investigation report is available on the ABA website at ***www.aba.gov.au***.

ISO LAUNCHES FREE E-MAIL NEWSLETTER

ISO announces the launching of a new, free-of-charge e-mail newsletter providing concise information on ISO 9000 and ISO 14000 developments worldwide and new developments such as standards for the service sector and for social responsibility. The e-newsletter is called IMS Alerts after ISO's magazine ISO Management Systems (IMS). It will carry advance news of upcoming articles in the magazine, such as recent surveys on the concrete results of implementing quality and environmental management systems based, respectively on ISO 9001:2000 and ISO 14001.

ISO Secretary-General Alan Bryden commented: "The launching of the IMS Alerts e-newsletter is an example of ISO's forward-looking stance since it will make it easier for people to acquire early news of developments on the 'new frontiers' of ISO and its members - such as standards for services, management practice and social responsibility. It also shows our firm commitment to communication and to using IT to communicate more efficiently."

The e-newsletter will represent an added value to ISO Manage-

ment Systems, a colour magazine published six times a year in English, French and Spanish editions. The magazine's comprehensive coverage includes implementation case studies from around the world.

IMS regularly carries early news of management system-related standardization, such as ISO 22000, Food safety management systems, and ISO 10014, which will give guidelines for realizing financial and economic benefits from quality management, as well as new ISO publications, such as the e-brochure, ISO 9001:2000 - What does it mean in the supply chain?

ISO Management Systems also covers the expanding area of standards for the service sector, with articles on innovative work of ISO and its members that pioneers international standardization in areas such as market, opinion and social research (ISO 20252) and mediation between organizations and their customers (ISO 10003).
ISO's recently launched development of guidance for social responsibility (ISO 26000) and the vital to trade area of conformity assessment complete the coverage provided by ISO Management Systems.

While IMS is available by paid subscription, there is no charge for subscribing to the IMS Alerts e-newsletter. In addition to advance news of ISO Management Systems articles, subscribers to IMS Alerts will benefit from alerts to new ISO press releases and fresh material on ISO's Web site.
Subscription to IMS Alerts is online via the ISO 9000/ISO 14000 section on ISO's Web site. For the launching of the e-newsletter, this section, one of the most-visited on ISO's Web site, has been completely redesigned and re-structured to make it both more attractive and easier for visitors to navigate to the information they need. Press contact: Roger Frost, Press and Communication Manager, Public Relations, Tel. +41 22 749 01 11
Fax +41 22 733 34 30, E-mail ***frost@iso.org***.

ENGINEERS AUSTRALIA - NEWS

Sydney office building named Australia's best construction project
The Bond commercial building, at Millers Point in Sydney, was named Australia's most outstanding example of construction excellence at the 2005 Australian Construction Achievement Award, presented at a gala dinner at Doltone House Pyrmont in Sydney last week. The award was presented by Australian Constructors Association president Wal King and Engineers Australia national president Professor Andrew Downing. In announcing the winner, judging panel chair Dr John Nutt said "The Bond is a sophisticated city office building with many innovative features. We were impressed by the determined focus on energy efficiency and by the depth of research that underpinned each innovation - natural ventilation and lighting, an active façade, and state-of-the-art building services. It was extraordinarily well engineered." The award was accepted by Bovis Lend Lease Asia Pacific chief executive officer Bob Johnston.

New chair for Young Engineers Australia
Rebecca Barker, a civil engineer with Maunsell Australia, has taken over the role of Young Engineers Australia national chair. "As the incoming chair of YEA, I feel privileged to be a member of both the national and the Victorian YEA committees, as those young engineers I work with, who volunteer their time, never cease to inspire or amaze me," she said. The other young engineers on the National Committee are:

- Vice national chair and Western Australia Division representative - Brandon Lee, an electrical engineer with the Water Corporation
- Queensland Division representative - Kym Wilkinson, a civil/structural engineer with Wilkinson Shaw and Associates, and a PhD candidate at the Queensland University of Technology
- Sydney Division representative - Anny Joseph, an environmental engineer with the NSW Department of Commerce and a student at the University of Technology Sydney
- Newcastle Division representative - Sam Wong, an electrical engineer with Airforce
- Tasmania Division representative - Nick Dwyer, a civil engineer with Hobart City Council
- Victoria Division representative - Carla Cher, an electrical/electronics engineer with Accenture
- South Australia Division representative - Nick Harley, a mechatronics/economics student at the University of Adelaide
- Northern Division representative - Ben Hawkes, a structural engineer with Connell Wagner
- Australian Capital Territory Division representative - Nathan Munro, a mechanical engineer with Northrop Engineers.

Agreement strengthens commitment to professional development
ASC Pty Ltd (formerly Australian Submarine Corporation) has signed an agreement with Engineers Australia to ensure all ASC engineers become chartered professionals in their field. "The agreement guarantees all technical staff will be rigorously trained in their lead-up to chartered status and further reinforces ASC's commitment to managing Australia's largest naval high-end skilled repository," the company said. Engineers Australia national president Prof Andrew Downing said the Institution's contribution to the professional development of the nation's engineers is one of its most important roles. "Former CEO Steve Gumley introduced the PDP program at ASC three years ago. This new agreement reinforces ASC's continuing commitment to this program and to the development of its staff," he said.
"The PDP partnering arrangements with industry bring significant benefits to the graduate, the company, the profession, and the community. Engineers Australia will be launching a new enterprise partnership program later this year, and we look forward to ASC being in the first cohort of members."

Engineers have more baby boys
The offspring of couples of whom one or both are employed in a "masculine" profession such as engineering are more likely to be boys, according to a report by the London School of Economics. The conclusion comes from a survey of 3000 people from various professions printed in the Journal of Theoretical Biology. In the population as a whole in Britain, roughly 105 boys are currently born for every 100 girls. But according to calculations by chief researcher Satoshi Kanazawa, for engineers and other "systemisers" the ratio is 140 boys per 100 girls. Nurses, teachers and others in "caring" jobs produce around 135 girls for every 100 boys, the study found. The study did not say why this phenomenon occurred, but The Sunday Times quoted a specialist in evolutionary psychology as saying it could be because the children of "systemiser" parents appeared to encounter more testosterone in the womb, making their gender more likely to be male.

If you are out to describe the truth, leave elegance to the tailor.
- Albert Einstein

FCC/OET CLARIFIES HEARING AID STANDARD MEASUREMENT PROCEDURES

In the Hearing Aid Compatibility Report and Order, the Commission required that digital wireless phones be capable of operating effectively with hearing aids based on certain performance measurement standards contained in the 2001 version of ANSI C63.19, "American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids, ANSI C63.19-2001." On April 13, 2005, the American National Standards Institute (ANSI) Accredited Standards Committee C63 for Electromagnetic Compatibility Subcommittee 8 (Medical Devices) (ANSI ASC C63 SC8) (the ANSI Committee) informed the Commission that it recently adopted and released a draft version of an updated hearing aid compatibility standard, ANSI C63.19-2005.

The ANSI Committee requests that the Commission: (1) adopt the updated standard after its final approval by ANSI, and (2) accept testing to the draft ANSI C63.19-2005 standard prior to ANSI's final approval of the standard. Today, we provide for the second action. As set forth below, the Office of Engineering and Technology (OET) has determined that applicants for hearing aid compatibility certification may rely on either the 2001 or draft 2005 version of ANSI C63.19.

Pursuant to the Hearing Aid Compatibility Report and Order, the Commission encouraged the relevant stakeholders to review the standard periodically to determine whether improvements to the standard are warranted. The Commission also delegated to the Wireless Telecommunications Bureau in coordination with OET, the authority to approve future versions of the hearing aid compatibility standard. The ANSI Petition indicates that the revised standard is the result of cooperative efforts among the various parties to clarify the testing methods and to better ensure repeatability of test results.

In addition, the ANSI Petition states that the updated standard incorporates a new nomenclature for specifying the radio frequency interference and inductive coupling ratings of wireless phones to make the ratings easier for consumers to understand. Finally, the ANSI Petition reports that ANSI must complete several administrative steps prior to formally adopting the updated standard. Although the draft standard will now be reviewed by the IEEE, and then will be subject to a public review process before being published by ANSI, the ANSI Petition requests that the Commission immediately accept use of the revised standard for equipment certification given ANSI's belief that use of the draft standard will yield more consistent and reliable measurement results.

The Commission's rules require that manufacturers certify compliance with the test requirements under the equipment approval procedures in Part 2 of its rules. OET has reviewed the draft standard and determined that the technical criteria used to determine compatibility have not changed from the 2001 version of the standard. Further, OET finds that the various clarifications and improvements in the standard will advance the Commission's objective of ensuring hearing aid compatibility for digital wireless phones.

If we knew what it was we were doing, it would not be called research, would it? - Albert Einstein

Accordingly, consistent with 47 C.F.R. §§ 0.241(b) and 2.947(a), OET will accept applications for certification of equipment tested and rated under the revised draft standard "American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids, ANSI C63.19-2005" for all wireless phone hearing aid compatibility testing and rating, as specified in Section 20.19 of the rules, effective immediately.

Applicants for certification may rely on either the 2001 or 2005 version of ANSI C63.19 and must identify which version they are using for compatibility testing and for rating wireless phones, consistent with 47 C.F.R. § 2.947 (b). OET will certify equipment that meets the compatibility requirements which has been tested and rated using the procedures specified in either version of the standard, pending further action by the Commission to modify the rules to reference the revised version of ANSI C63.19. Allowing the use of the new measurement and rating procedures now should assist manufacturers and carriers in meeting the September 16, 2005, deadline for providing handset models that comply with the radio frequency interference requirements of § 20.19(b).

The Commission will permit Telecommunications Certification Bodies (TCBs) to review and issue grants for such devices after the planned training session on May 10-13, 2005. If a device is submitted for certification prior to the May training, the TCB should seek guidance from Commission staff.

Finally, with respect to the ANSI Committee's request that the Commission adopt the updated standard after final approval by ANSI, the Commission, and the Wireless Telecommunications Bureau in coordination with OET, will consider whether to incorporate the updated standard into the Commission's rules after ANSI's final approval and publication of the updated standard.

Office of Engineering and Technology Contact: Martin Perrine (301) 362-3025 or ***martin.perrine@fcc.gov***.

THE NEW EMC DIRECTIVE 2004/108/EC

A summary of the differences between the new EMC Directive (2004/108/EC) and the old EMC directive (89/336/EEC)

General. The EMC directive 89/336/EEC has been subject to a review under the initiative known as Simpler Legislation for the Internal Market (SLIM). The directive now covers both fixed installations and apparatus; separate provisions should be made for each of these. The directive does not regulate equipment that is inherently benign in terms of electromagnetic compatibility.

Transitional provisions and implementation. Equipment that complies with directive 89/336/EEC can be placed on the market until 20th July 2009. All member states must adopt and publish the laws and make the administrative provisions necessary to comply with this directive by 20th January 2007. They shall apply those provisions from 20th July 2007.

Fixed installations. The directive will cover fixed installations, large machines and networks which may generate electromagnetic disturbance or be affected by it. It should be possible to use harmonised standards to demonstrate conformity with the essential requirements. Due to the nature of fixed installations, placing the CE mark on the equipment and creating a Declaration of Conformity are not required.

Apparatus. The directive now states where apparatus is capable of taking different configurations, the EMC assessment should take into account the different configurations foreseeable by the manufacturer as representative of normal use in the intended applications. Certain components or subassemblies should, under certain conditions, be considered to come under the directive if they are made available to the end user.

Marking. The directive has clarified the marking requirements. The apparatus must now be identified in terms of type, batch, serial number or any other information allowing for the identification of the apparatus. Each apparatus must carry the name and address of the manufacturer, or agent, or the person placing the equipment on the community market. Information shall be provided on any specific precautions to be taken when the equipment is assembled, installed, maintained or used to ensure that when the equipment is put into service conformity is still achieved. All information required to enable the apparatus to be used in accordance with the intended purpose must be contained in the instructions.

Essential requirements. The essential requirements have not changed. However, requirements for fixed installations have been included. Good engineering practices should be used and documented, the documents shall be held available for the relevant national authorities for as long as the fixed installation is in operation.

Conformity assessment procedure for apparatus. The directive now has two methods to demonstrate compliance for apparatus;

1. Internal production control (more commonly known as 'self-certification')
2. Internal production control and inspection by a Notified Body

Technical Documentation. The technical documentation required by the directive must enable the conformity of the equipment to be assessed - it should cover the design and manufacture of the equipment.
The documents should include the following information;

1. A general description of the equipment.
2. Evidence of compliance with the harmonised standards where applied.
3. Where the harmonised standards have not been applied or only partly applied, a description and explanation of the steps taken to meet the requirements of the directive should be included. This must include the EMC assessment, design calculations, examinations performed and test reports.
4. A statement from the notified body (if used).

EC Declaration of Conformity. The requirements for the EC declaration of Conformity have altered. It now should contain the following information:

1. Reference to this Directive.
2. The identification of the equipment.
3. The name and address of the manufacturer and, where applicable, the authorised representative in the community.
4. A dated reference to the standards used to support a claim of compliance
5. The date of the declaration.
6. The identity and signature of the person empowered to sign the declaration.

http://www.conformance.co.uk/

EMC SOCIETY COUNCIL

The EMC Society is a technical and learned society within **Engineers** Australia, established to promote the science and practice of Electromagnetic Compatibility throughout Australia and the region.

NATIONAL COUNCIL

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Introduction to EMC for Functional Safety

Presented at the EMC-UK 2004 Conference, Newbury, UK, 12 + 13 Oct 04

EurIng Keith Armstrong C.Eng MIEE
Cherry Clough Consultants

Summary

This paper addresses a gap in safety and electromagnetic compatibility (EMC) regulations and standards, in the commercial, industrial, transportation, healthcare and many other industries (including security and military). The gap exists because existing safety and EMC regulations and standards do not correctly address the issue of electromagnetic interference (EMI) from the viewpoint of lifecycle safety ('EMC for Functional Safety'). Where errors or malfunctions in electronics could possibly have safety implications the resulting safety risks can fall right through these gaps, leaving users at risk from unsafe products or systems and manufacturers at financial risk from liability lawsuits, product recalls, and loss of customer confidence.

This is an increasing problem because of the huge increase in the use of electronics (especially computer-based technology) in safety-related applications, and because the developments in electronics that make them more cost-effective also make them more likely to suffer EMI. This paper briefly describes the problem, and then introduces an engineering method (based on the IEE's guidance document [1]) that deals with EMI correctly to help reduce functional safety risks in a cost-effective manner – over the lifecycle of a product, equipment, system or installation (abbreviated to 'equipment' in the rest of this paper). Similar 'gaps' appear in regulations and standards for legal metrology, security, military and other areas where high reliability is required in situations where there are no direct safety implications. Only a little adjustment would be required to apply the engineering method introduced here to these areas.

Introduction to the problem

Most safety regulations and standards concentrate their efforts on *intrinsic* safety – the possibility that injury or damage could occur due to electric shock, fire, mechanical instability, sharp edges, etc. In this paper we are concerned with *functional* safety – where the hazards and risks depend upon the correct *operation* of devices, equipment, systems or installations. IEC 61508 [3] is the basic standard covering the functional safety requirements of complex electrical, electronic, or programmable electronic equipment, and requires a quantified risk assessment approach. A number of sector-specific functional safety standards are being developed, based on [3]. Electronic technology is increasingly used where its accuracy or reliability is important for functional safety. This is mainly due to the useful amounts of processing power now becoming available in low-cost digital devices. The accuracy and reliability of such safety-related electronics is a functional safety issue. Unfortunately, *all* electronic technology is inherently prone to suffering from inaccuracy, errors in operation, or even damage, due to EMI.

The electromagnetic (EM) environment of an item of equipment is the totality of all of the electromagnetic disturbances that exist at its operational location. It is generally becoming more 'polluted', due to increased use of electronic technologies, especially wired datacommunications, wireless communications, and switch-mode power conversion. As a consequence, existing equipment designs are more likely to suffer errors or fail. The integrated circuits (ICs) and transistors used to construct electronic products and systems are becoming more vulnerable to interference and damage from EM disturbances as their feature size decreases, operational speed increases, and operating voltages fall. These developments make their internal electronic signals 'weaker' and more easily corrupted by a given EM disturbance, and that actual damage to their internal structure is more likely. Software employs electronic signals and ICs, of course, and when they suffer from interference or damage the software can suffer from errors or malfunctions, causing the equipment controlled by the software to suffer errors or malfunctions.

Regulations on EMC are becoming commonplace in many countries around the world – but except for the European Union's (EU's) EMC Directive they generally do not cover EM immunity. However, the EMC Directive's immunity requirements are generally inadequate anyway for EMC for Functional Safety, as I shall show later. Regulations on product safety are becoming commonplace in many countries around the world. But most (if not all) present-day safety regulations and safety standards provide very poor control of EMC for Functional Safety, as I shall show later. So, neither EMC nor safety regulations nor standards correctly address the reliability and EMI performance needs of electronics when used in safety-related applications. This is the 'gap' mentioned in the Summary above. The overall result is that users and third parties are being exposed to increased risks of safety hazards, and suppliers are exposed to higher risks of product liability claims, as shown by Figure 1.

A man's ethical behavior should be based effectually on sympathy, education, and social ties; no religious basis is necessary. Man would indeed be in a poor way if he had to be restrained by fear of punishment and hope of reward after death. -Albert Einstein

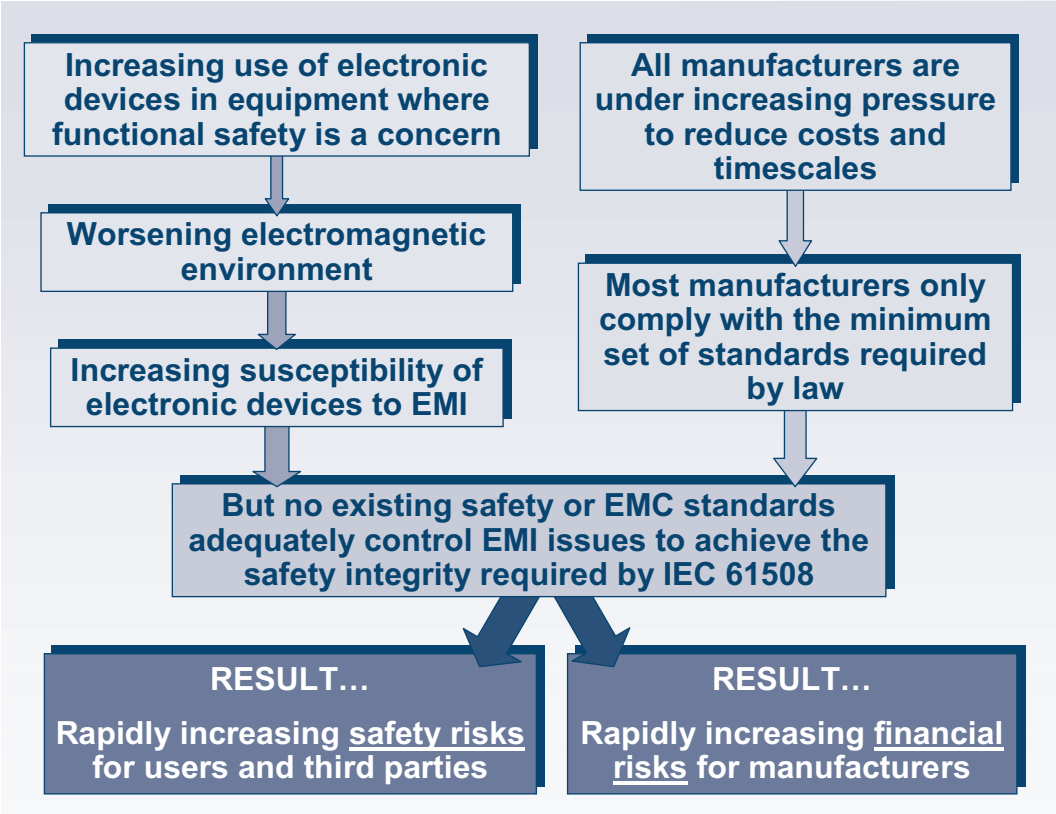

FIGURE 1 Increasing risks due to EMI

Some people assume that all of the hazards are covered by safety standards, so no extra work is needed for EMC. But even if all of the possible hazards were actually covered by safety standards, this approach ignores the fact that inadequate EMC can dramatically change the risks (probabilities) that those hazards will occur, possibly making the health or safety provisions in the existing standards inadequate.

This is best illustrated with an example. There is no backup system for the mechanical steering of a motor vehicle (e.g. rack and pinion, worm and nut, etc.), because although loss of steering can give rise to a very serious hazard, the risks of failure of the traditional steering systems are very low But do you think a single 'steer-by-wire' electronic system would be just as safe? The correct answer is *no*, because the reliability of the electronic system is much lower than the traditional mechanical steering system (for example, IEC 61508 would require redundant systems plus special software techniques). The steer-by-wire example shows that, because equipment is increasingly employing complex electronic technologies both in functional control and safety systems, e.g...

- surgery by robots controlled remotely via the Internet
- 'fly-by-wire' and 'drive-by-wire' technologies
- hazardous plant controlled by computers

…then a detailed hazards assessment and risks analysis is always required for all new designs, instead of simply applying the latest versions of the most relevant safety standards. Some safety standards are decades out of date, in some areas, and all safety standards are out of date on the day they are published, due to the many years that it takes their committees to agree.

IEC 61508 and IEC/TS 61000-1-2

This standard [3] covers the "Functional safety of electrical, electronic and programmable electronic safety-related systems" and is used by the HSE (Health and Safety Executive, UK) as an example of good engineering practice for complex safety-related systems. It has also been adopted as an EN standard (EN 61508) but is not 'notified' or listed under any EU Directives. [3] requires EMC to be taken into account for safety reasons, although many practitioners (and some authors) seem to be ignoring this. Unfortunately, it contains no *specific* EMC requirements, a lack that IEC 61000-1-2 [4] hopes to make good in due course.

IEC 61000-1-2 is intended to become the IEC's 'basic standard' on EMC for Functional Safety, but at the moment it is not a full IEC standard, but an IEC Technical Specification. Like the IEE's guide, and like MIL-STD-464 it adopts a risk-based approach in its main text, but its examples and appendices rely too much on guessing the EM environment and applying normal (IEC 61000-4-x) immunity testing methods, instead of focussing on good EMC design and assembly techniques and appropriate verification tests. The author is a member of the maintenance team currently working on modifying IEC/TS 61000-1-2 with the aim of making it a full IEC standard in a few years time.

Appropriate methods

The military have a lot of experience in the area of EMC for reliability and functional safety (for example, as

expressed in MIL-STD-464 [5]) but they don't (yet) use a quantified risk assessment process such as that required by IEC 61508. Military methods of controlling EMC for safety or mission criticality would be excessive for many manufacturers but they might be quite reasonable for some projects, e.g. commercial passenger transport vehicles or systems (train, plane, etc.) or dangerous plant (e.g. nuclear power). So this introduction to EMC for Functional Safety is aimed at raising the general awareness, in industry as a whole, so that people can design and implement the procedures that are most appropriate to their business, based on realistic assessments of lifecycle costs and risks and their exposure to liability claims.

The IEE's Guide and training course

The Institution of Electrical Engineers (IEE), based at Savoy Place, London, Great Britain has been concerned with EMC-related functional safety issues for many years. In 1998 they established a working group (WG) to develop some professional guidance on this issue. This WG produced the *"IEE Guidance Document on EMC and Functional Safety*" [1], published by the IEE in September 2000; believed to be the first such guide ever published. EMC and safety experts from a wide range of industries, along with representatives of the UK's Health and Safety Executive (HSE), were represented on the WG. Care was taken in the composition and management of the WG to ensure that the Guide it produced was relevant to real engineering, safety, and financial issues.

A paper on this IEE guide was presented at the IEEE EMC Symposium in Montreal, August 2001 [6]. The IEE's guide was subsequently employed by the EMC Test Labs Association in their Technical Guidance Notes on the EMC requirements of the Low Voltage and Machinery Safety Directives [7] [8]. The IEE created a training course on "EMC for Functional Safety, Legal Metrology and High-Reliability Systems" in 2004 [2]. It is based on [1], with a great deal of additional material useful for real projects. The purpose of the IEE's guide [1] and training course [2] is partly to help…

- comply with professional institutions' ethical guidelines
- comply with EU Directives and Health and Safety laws. But their main purpose is to help manufacturers and others to use new technology whilst saving money by reducing financial risks...
- by reducing exposure to liability claims
- by maintaining customer confidence
- by making safety incidents less likely to occur.

Liability

Exposure to liability claims is reduced if the 'state of the art' in safety was applied in the design and manufacture of an item of equipment – and this now includes 'EMC for Functional Safety' issues. Liability claims can be very costly indeed. There is no limit to the civil damages that can be awarded under the Product Liability Directive (85/374/EEC) in the UK and some other EU member states. Even a single liability award can be very costly indeed, but loss of customer confidence can cost a great deal more than a liability claim, because it is possible for a company to lose the good reputation it has built up over generations, and for some companies this can be worth billions. We don't hear a great deal about liability cases because most of them are settled out of court, because the company fears the negative publicity. But safety incidents that attract media attention (such as rail or plane crashes) cannot be kept quiet in this way.

It is often difficult to persuade directors and managers to release the funds and resources needed to do safety-related work correctly. The costs of doing the work can be accurately estimated, but many engineers are uncomfortable with quantifying the benefits to the company of correct safety design. In such situations, engineers need to learn the language (jargon) of financial risk exposure. This easily enables those engineers who are experienced in quantifying safety risks to describe financial cost/benefits to management in terms they understand.

High-reliability, mission-criticality, legal metrology, military and security applications

This paper introduces EMC for Functional Safety – but the methods it describes are also appropriate to high-reliability, mission-critical and legal metrology applications, and also to military and security applications. They just need a little tweaking to replace 'safety hazards' by 'financial hazards' (or other 'hazards' to be risk-reduced). Achieving high reliability can be much more difficult than functional safety. Safety designers often use 'fail-to-safe' methods such as 'controlled shut-down' and 'emergency stop' which protect human health, but cause downtime (some methods can even damage the equipment). But 'high-rel' or mission-critical equipment often cannot use such methods, and life-support equipment may not be able to either.

Why normal EMC immunity testing methods are inadequate, on their own, for achieving Functional Safety

Safety standards are always based on the use of well-proven safety engineering techniques, which take account of….

- all credible faults
- environmental extremes and ageing
- reasonably foreseeable use, or misuse
- *over the whole lifecycle of the equipment.*

This is quite different from normal EMC immunity testing – which ignores everything to do with the equipment lifecycle. Some safety standards are beginning to add 'EMC for functional safety' requirements, but instead of employing the IEC's (future) basic standard on EMC for Functional Safety, IEC/TS 61000-1-2, they are following the approach used for the safety of medical devices and automobiles instead [9]. They are simply applying EMC immunity tests in much the same way as is done for compliance with the EMC Directive, usually with some sort of 'safety margin' (e.g. 6dB) – despite the fact that this approach is clearly inadequate when dealing with functional safety issues, as shown below.

Normal immunity testing only covers one type of disturbance at a time, whereas in real life equipment is usually subjected to a number of electromagnetic disturbances (threats) simultaneously. Tests have shown [10] that when one disturbance is applied (e.g. a radiated RF field) the immunity to a simultaneous disturbance

(e.g. fast transient burst, ESD, etc.) is often seriously compromised.

Normal immunity testing does not simulate real-life EM exposure. Traditional EMC test methods are designed for accuracy and repeatability and do not simulate real-life exposure very well. For example, normal radio frequency (RF) immunity testing uses a single modulation frequency (e.g. at 1kHz) – but an equipment is much more vulnerable to RF threats when they are modulated with a frequency that is close to one of its control frequencies, as real-life threats can sometimes be. This fact is well known to practitioners of electronic warfare.

EMC 'risk analysis' is not normally done for normal immunity testing. "EMC Directive" immunity tests are supposed to simulate the 'normal' EM environment, but…

- they ignore the close proximity of mobile radio transmitters (e.g. walkie-talkies, cellphones, Bluetooth, Wi-Fi, etc.)
- and they ignore almost all EM disturbances at less than 150kHz and more than 1GHz (e.g. due to traction currents; cellphones at 1.8 - 2GHz, wireless datacomm's and ISM equipment at 2.45 and 5GHz, radar, etc.)
- and they ignore the ±6kV overvoltages known to occur annually on normal low-voltage AC supplies in Europe and the USA (due to thunderstorms and reactive load-switching). See [11] for more on this issue.

Normal immunity testing uses one RF test frequency at a time, but multiple RF threats are not uncommon in real life (e.g. when near a broadcast transmitter, or cellphone basestation) and intermodulation within circuits and equipment will create new noise frequencies inside the equipment. For example, two RF channels at 5.000 and 5.001 GHz will create 1MHz interference inside circuits even when it is 100% shielded and filtered against external 1MHz threats.

Normal immunity testing uses a limited range of transient waveshapes, whereas real-life transient threats can have a wide range of very different waveshapes – hence they expose the equipment to very different frequencies simultaneously. Intermodulation (IM) inside the equipment generates multiple "IM product" frequencies that are almost impossible to predict, with effects that are also difficult to predict.

Normal immunity testing does not simulate foreseeable EM exposure, they only cover 'normal' EM environments, not low-probability EM disturbances or unusual environments. But where high levels of safety integrity are required, even very low-probability risks may be unacceptable – so low-probability EM threats should be considered.

Normal immunity testing might use inappropriate compatibility margins. All electromagnetic disturbances vary from place-to-place and time-to-time according to some statistical basis. Normal immunity tests set compatibility limits that are appropriate for commercial and industrial reliability, often at the 'two-sigma' statistical level, which corresponds to 95%. For example, IEC 61000-2-2 permits 5% of EM events to exceed the tested levels. But these compatibility levels will probably not be tough enough where safety is a concern, depending on the safety integrity required by the application. Some safety systems will need the confidence that at least 99.9% of EM disturbances do not cause errors or failure.

Faults are not addressed by normal immunity testing. The normal EM activity in an environment must be withstood all of the time, but normal immunity testing does not simulate common faults that can affect EMC, for example….

- a broken electrical connection in a filter capacitor, or in a filter's ground bond, that could ruin the filter's EM performance
- a circuit component that is accidentally short-circuit, open-circuit, out-of-tolerance, or the wrong type or value has been fitted
- a broken spring finger gasket (not an uncommon fault) or broken electrical bond that could ruin the shielding effectiveness of an enclosure.

Normal EMC immunity testing takes no account of the foreseeable physical environment, or ageing. The physical environment of an item of equipment includes exposure to mounting stresses, shock, vibration, condensation, dusts, liquids, ageing, ultra-violet light, temperature extremes and temperature cycling, corrosion, supply voltage extremes, etc. All of these can all have a bad effect on EM vulnerability [12], for example by…

- reducing shielding effectiveness through poor contact at EMC gaskets
- reducing filtering by ageing of filter capacitors and temperature variations of inductors' values.

Filter performance can be badly affected by higher than nominal ambient temperatures, supply voltages, and load currents, because they can affect the parameters of the filters' inductors. Up to 20dB overall filter degradation due to its physical environment has been measured [13].

The performance criteria used for normal immunity testing might be inappropriate for safety purposes. Degraded performance during interference that is considered to be perfectly acceptable for an individual item of equipment might result in unsafe behaviour of the system it is employed in. For example, the IEC 61000-4-4 fast transient burst immunity test allows any amount of performance degradation *during* the test – so it is not uncommon for the d.c. output of a power supply unit to collapse to zero during a burst. The d.c. power supply manufacturer can claim that his unit fully meets IEC 61000-4-4, but when it is used to power a circuit (especially microprocessor) the system as a whole can fail the IEC 61000-4-4 test, due to a microprocessor's software crashing, due to the DC power supply's performance.
So the performance criteria for the individual items of equipment – when they are tested for immunity to EMI – depend upon the specific application. They must satisfy the needs of the final safety system as identified by a hazard assessment and risk analysis [11].

Only a representative sample is tested for EMC. Most companies design their equipment, test it using

'black box' EMC test methods, then modify it as required until it passes its EMC tests. But most of them have no real idea whether the final version passed because of good design, or because of a fluke that might not be repeated in future manufacture. Maybe an altered cable routing or a different batch of ICs would make the EMC performance worse? Many companies introduce 'small' changes in production, software 'bug fixes', and substitute components – without re-qualifying EMC – and many don't routinely test EMC in serial manufacture either, so they have no real knowledge of the actual EM performance of the items of equipment they supply to their customers. Compare this with the approach typical of safety standards, which require testing of the basic safety features of *every item of equipment manufactured*, and a pass result documented for every item supplied to a customer. The fact that an item of equipment once passed an EMC immunity test proves nothing at all about the quality of its EM design, or the EM immunity performance of the items actually supplied.

EMC testing does not address maintenance, repair, refurbishment, upgrades (e.g. software) In real life, equipment is subject to cleaning, maintenance, repair, refurbishment and upgrades. Safety test standards take some of these issues into account as a matter of good safety engineering practice – but no EMC testing standards do.

Safety requires good EMC techniques in design, assembly and maintenance

Safety over the lifecycle of an equipment requires the use of good EMC techniques in design, assembly, QA and maintenance – in the same way that well-proven safety design methods are required for all other safety issues, including software (see IEC 61508-3 [14]). EMC testing is necessary for verifying the EMC design techniques that were used (or are to be used), but the normal "EMC Directive" test methods (e.g. the IEC 61000-4-x series) are inappropriate on their own. Special test methods are required, which take the foreseeable EM and physical environments into account. For more on the inadequacy of normal EMC immunity testing (including that used for automotive, rail and medical safety) and what should be done instead when verifying EMC for Functional Safety see [15] and [16]. [2] has a lot of detail on this issue.

Safety shortcomings in EU EMC directives and their standards

The **EMC Directive** (EMCD) does not cover safety. EMC for functional safety is covered by safety directives instead, see CENELEC R0BT-004:2001 and [6]. The **Radio and Telecommunication Terminal Equipment Directive** (R&TTE) does not cover safety-related communications systems. The various **road vehicle EMC Directives** (e.g. 95/54/EC) are inadequate for EMC-related functional safety because they rely solely on normal immunity testing methods. The **EN 50121 series of railway EMC standards** also rely solely on normal immunity testing methods. The following EMC immunity standards notified under the EMC Directive all state that they *do not cover safety issues.* Most of them also state that they do not cover the close proximity of hand-held radio transmitters, even though this is now a normal part of the EM environment.

- EN 61000-6-1 (generic immunity for the residential commercial and light industrial environments)
- EN 61000-6-2 (generic immunity for the industrial environment)
- EN 55024 (information technology and telecommunications)
- EN 61326-1 (measurement, control, and laboratory equipment)
- EN 50130-4 (security systems).

EMC shortcomings in 'CE marking' EU safety directives and their standards

All the 'New Approach' EU directives are considered to be 'Total Safety' directives, and this is made clear in their 'essential requirements' Articles. EN standards notified (listed) under these Directives are supposed to deal with all of their essential requirements, but they usually do not cover all possible safety issues – so additional testing, skills or expertise may be required to fully comply with the directive's essential safety requirements. Compliance with a "CE marking" EU Directive requires…

- a declaration about the conformity assessment (usually based on testing to notified safety standards)
- and a declaration that the essential safety requirements are complied with.

So each design requires a thorough analysis of the hazards and assessment of the risks, with the results checked against the most relevant harmonised standards to see if any hazards/risks need additional standards, or skills or expertise, to be applied. Most manufacturers assume that all they have to do to comply is test to the most relevant standard(s), and most test laboratories encourage this error. But where a safety incident has occurred, official investigators will be looking for evidence of good safety engineering practices, such as the use of hazards and risks assessments to guide design and verification to help ensure the equipment really is safe, and doesn't 'slip through the gaps' in the usual test standards.

Medical equipment is covered by one of the following…

- the Medical Devices Directive: 93/42/EEC
- the Active Implantable Medical Devices Directive: 90/385/EEC
- the In-Vitro Diagnostics Directive: 98/79/EEC

For all three of them, the relevant standard for the EMC-related safety of medical devices and equipment is EN 60601-1-2. But this standard relies on normal immunity testing methods, using IEC 61000-4-x standards with EM threat levels which could easily be exceeded in real-life, and does not test at all for some common EM threats. Also, its immunity tests and test levels are almost identical to those used by the EMCD's immunity standards – which state that they do not cover safety. EN 60601-1-2 does not employ quantified risk analyses, as required by IEC 61508 for safety-related systems, and the 2002 version allows manufacturers to pass significant responsibility for the EMC-related safety of their medical equipment on to the user. This seems to assume that all healthcare premises employ the necessary EMC expertise and resources to fully manage

their EM environments on a day-to-day basis – which is very far from the real situation.

The Low Voltage Directive (LVD, 73/23/EEC amended by 93/68/EEC) does not even mention functional safety at all, much less 'EMC for Functional Safety', so some manufacturers assume that it does not cover this issue. But the LVD does cover EMC for Functional Safety, because it is a 'total safety' directive. The result is contradictory guidance from experts and Notified Bodies. Two well-known safety standards that are notified under the LVD are…

- EN 60950:2000 (computers and telecoms)
- EN 61010-1:2001 (measurement and control)

…but they both state that they do not cover functional or performance issues.

EN 60335-1 (household appliances) *does* cover functional issues, but has no requirements for preventing EMI from creating safety problems. There is an amendment under discussion which would add a few normal EMC immunity tests, to a subset of possible operational conditions, which (as shown above) is inadequate. Why does it not apply the same safety-engineering design-based approach to EMC, that it applies to all its other safety issues?

The Machinery Directive (98/37/EC) and its notified standards *attempt* to cover 'EMC for functional safety', but does so only in the most general terms and fails to be explicit about what work it really requires. One of the most relevant Machinery Directive safety standards is EN 60204-1 (electrical equipment of machines). This *tries* to cover EMC for Functional Safety – but is not comprehensive – and in the end simply refers to EMC Directive immunity standards despite the fact that they state in their text that they do not cover safety issues (see above). EN 954 (machine control systems) does not address electronics at all. It has no EMC requirements for the electromechanical control systems that it does cover – despite the fact that they are not immune to all EM disturbances and have particular problems with supply dips, dropouts and interruptions, and with surge overvoltages and overcurrents. The result of all this is contradictory guidance from machinery safety experts and Notified Bodies, as shown by Figure 2.

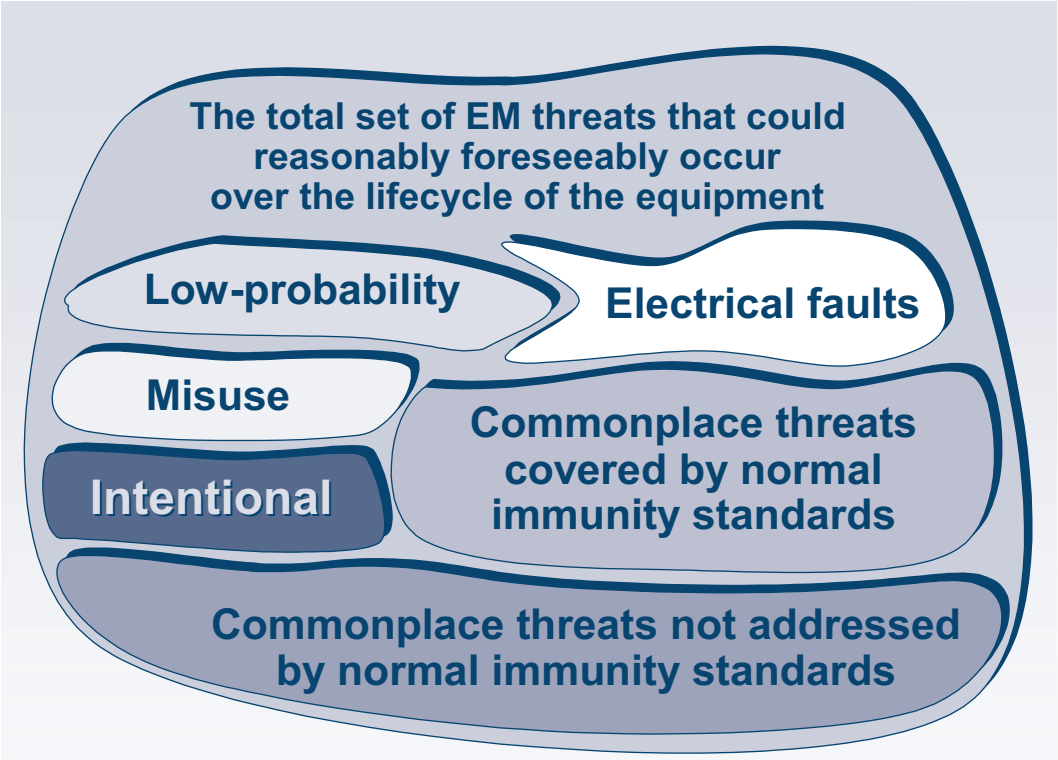

FIGURE 2 Conflicting EMC guidance from machinery safety experts

There are many other EU safety directives, such as for **Potentially Explosive Atmospheres**; **Personal Protective Equipment**; **Gas Boilers**; etc., but despite the fact that the functional safety of the equipment they cover often, these days, depends upon the correct functioning of electronics – they make little (or no) mention of EMC at all, leading people to believe that all EMC aspects, including safety, are covered by the EMC Directive (which they are not, as described earlier).

The **Measuring Instruments Directive** (MID, 2004/22/EC) is not concerned with safety at all, but it is concerned with legal metrology. It is quite robust in requiring that EMI does not affect measurements, but it doesn't use words like foreseeable and it doesn't specify how the EM environment is to be assessed – and therein lies a problem. It specifies three EM environments: the first two basically equivalent to the two types of generic EMC standards; with a third for vehicular applications. It doesn't say which EMC standards apply but people are going to turn to the IEC series, which of course only

specify the 'normal' environments and not reasonably foreseeable extremes. So I'm sure that manufacturers will tend to treat the immunity of equipment covered by the new MID just as they would for the EMC Directive, since it gives them no guidance on how to assess foreseeable EM environments – or what to do to ensure reliable accurate measurements if they had that EM knowledge anyway.

How EMC should be controlled for functional safety

Now that the problem has been briefly explained, it is time to introduce the solution.

The IEE's Guide [1] and associated training course recommends using a hazards and risk assessment approach as follows…

A) What EM threats could the equipment foreseeably be exposed to?

B) What could foreseeably happen as a result of the EM threats identified by A) above?

C) Could the foreseeable EM emissions from the equipment affect other equipment?

D) What are the foreseeable implications of A) - C) above for functional safety?

E) What actions are needed to achieve the required integrity of functional safety?

F) What documentation is required to show that due diligence has been applied?

These six activities will now be briefly described…

A) What EM threats could the equipment (foreseeably) be exposed to?

EM 'threats' are more correctly called EM disturbances, or EM phenomena. EMI is what happens when the equipment is not compatible with its EM environment – i.e. when EMC has not been achieved in real life, over the equipment's lifecycle. An 'EM threat assessment' is required for the foreseeable EM environment of the equipment's intended operational site, taking into account low-probability EM threats over the lifecycle of the equipment. Figure 3 gives an overview.

There is a lot of published information on various EM environments, but it is rarely gathered in one place. [17] is a useful resource.

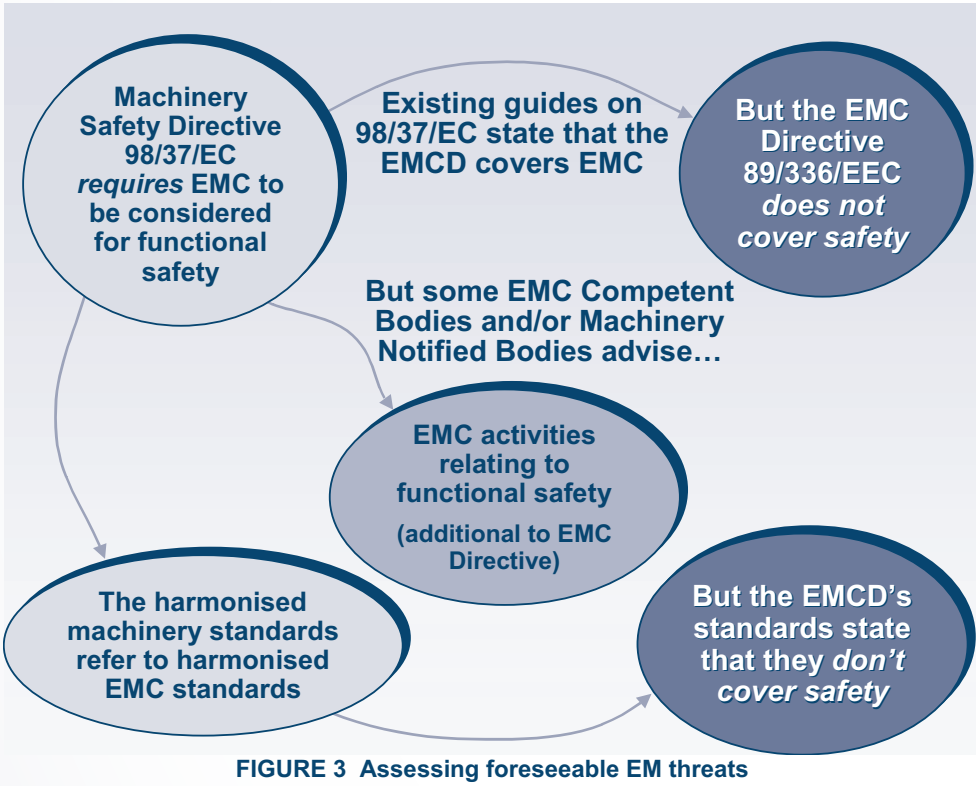

FIGURE 3 Assessing foreseeable EM threats

B) What could (foreseeably) go wrong ?

Electromechanical devices can malfunction and/or be damaged, and this is especially a problem for (so-called) 'hard-wired' safety systems. Analogue circuits can suffer erroneous signals and/or be damaged, and this is especially a cause of errors in instrumentation. Digital circuits and programmable devices can change operational mode, malfunction, and be damaged, especially a problem for control and automation. All of these possibilities should be considered in the hazards assessment and risk analysis.

C) Foreseeable effects of equipment emissions

Emissions standards are not intended to protect nearby radio receivers or other sensitive circuits and some permit very high levels in specified circumstances, enough to...

- be a direct hazard to human health
- cause serious interference with electronic devices

So the foreseeable effects on existing equipment of the emissions from the new equipment should be considered in the hazards assessment and risk analysis.

D) What are the reasonably foreseeable functional safety implications of A-C above?
This should take into account the severity of the possible safety hazard, and the scale of the risk. It is best to employ the quantified risk assessment approach of [3], remembering that exposure to EM disturbances, and the equipment's responses to those EM 'threats', both have statistical probabilities. It is a bit like predicting the "100-year" gale or wave.

E) What actions are needed to achieve the required level of safety?
Five kinds of actions are needed, and they should be carried out in the following order...

E1) Hazard reduction by design
Design so that the safety functions have less demanding requirements, for the equipment's whole lifecycle.

E2) EMC risk-reduction by design
The EMC performance of each of the safety functions should be designed to be sufficiently reliable over the equipment's whole lifecycle, using the 'Safety Integrity Level' (SIL) approach described by [3].

E3) Verification of the design techniques employed
Testing that simulates the foreseeable EM environment, plus the foreseeable physical environment, faults, misuse, etc., over the equipment's whole lifecycle.

E4) Maintenance of safety performance in serial manufacture, maintenance, repair
EM performance can be made worse by...

- a different batch of ICs
- the surface conductivity of metalwork and its fixings
- an altered cable routing
- other small changes in assembly
- 'form, fit and function' replacement parts
- changed suppliers for parts, and processes (e.g. painting).

So a Quality Assurance (QA) system is required that controls all of the safety aspects of the equipment during manufacture (including EMC). This QA system should control…

- components, sub-assemblies, software
- (whether bought-in, or made-in-house)
- in-house processes (e.g. plating) and subcontractors
- manufacturing concessions, design changes
- the final build standard of the equipment.

E5) Maintenance of safety performance despite modifications and upgrades
A Quality Control (QC) procedure is required that controls all of the safety aspects of the equipment, including EMC-related safety for the above activities. It will be very similar to the procedure used to ensure that EMC-related safety aspects were correctly addressed during the equipment's original design.
Safety design and verification activities over the "equipment's lifecycle" should take into account…

- manufacture
- storage
- transport
- installation
- commissioning
- operation
- maintenance
- repair
- refurbishment
- decommissioning
- disposal.

An incremental process is required. Achieving the necessary confidence in EMC for Functional Safety should be a continuing 'incremental' process throughout the whole project. This should create an 'audit trail' that shows how confidence is built throughout research, design, development and final verification…

- showing that the safety functions of the final design will satisfy their performance requirements in the foreseeable EM environment, with the required reliability for their level of safety integrity
- initial engineering design should be based on analysis, models and previous experience
- as hardware and software become available, testing (of components and subsystems) should validate the analysis and models used
- testing is often necessary to obtain information not amenable to determination by analysis
- the design evolves as better knowledge is achieved
- finally, whole system testing and follow-on analysis completes the incremental verification process.

As soon as 'EMC testing' is mentioned, most EMC engineers immediately tend to think of anechoic chambers and formal test methods – then wonder how these can be applied to components and subsystems. But EMC testing to verify design aspects can often use very simple test methods, which may need to be designed to suit whatever it is that is being verified.

F) What documentation is required to show due diligence?
If it isn't written down, the law assumes it didn't happen. So the project records should show that steps
A) to E) above were carried out in full, and…

- that the required EMC performance was determined and 'designed-in'
- for all safety-related areas, from the start of a project
- and verified at the end of a project.

Although [4] does not *yet* represent the 'state of the art' (see earlier), nevertheless, it is recommended to apply this standard on all safety-related equipment – whilst also heeding the guidance of the IEE's training course on EMC for Functional Safety. Because [4] is the most relevant international specification for EMC for Functional Safety, applying it will help to show 'due diligence' and may help deflect any liability claims.

References

[1] *'IEE Guide to EMC and Functional Safety'*, IEE September 2000, available for free download from http://www.iee.org/Policy/Areas/Emc/index.cfm as a 'Core' document and nine 'Industry Annexes', in either Word or PDF formats.

[2] EMC for Functional Safety, IEE (London, UK) training course (first held February 10th 2004), http://www.iee.org.uk, contact abennett@iee.org.uk for its 2005 dates.

[3] IEC 61508 *'Functional safety of electrical/electronic/programmable electronic safety-related systems'* (in seven parts). This is a voluntary standard which (it is understood) might not be adopted by the EU as an EN, or become a harmonized standard under any directives. However, it will influence some product standards which could become EN's and might become harmonized. It is now being used by the UK's Health and Safety Executive as an example of good safety engineering practice.

[4] IEC/TS 61000-1-2:2001 *'Electromagnetic Compatibility (EMC) – Part 1-2: General – Methodology for the achievement of the functional safety of electrical and electronic equipment with regard to electromagnetic phenomena'*

[5] MIL-STD-464, *'Department of Defense Interface Standard – Electromagnetic Environmental Effects – Requirements for Systems'*, typing MIL-STD-464 into the Google search engine quickly finds sites for free downloads.

[6] *'New Guidance on EMC-Related Functional Safety',* Keith Armstrong, 2001 IEEE EMC International Symposium, Montreal, Aug. 13-17 2001. Proceedings: ISBN 0-7803-6569-0/01, pp. 774-779.

[7] *'New Guidance on EMC and Safety for Machinery'*, Keith Armstrong, 2002 IEEE International EMC Symposium, Minneapolis, August 19 - 23. Conference Proceedings: ISBN: 0-7803-7264-6, pp. 680-685.

[8] The EMC Test Labs Association (EMCTLA), http://www.emctla.co.uk contact Dave Imeson (Secretary) dimeson@iee.org. The EMCTLA is an international association of test laboratories, and has been publishing their helpful technical guidance notes (TGNs) on their website for many years.

[9] *'Review of Progress with EMC-Related Functional Safety'*, Keith Armstrong, 2003 IEEE EMC Symposium, Boston, August 18-22 2003, Proceedings pp 454-459, CD-Rom: ISBN 0-7803-7836-9; Softcover: ISBN 0-7803-7835-0.

[10] *'Combined Effects of Several, Simultaneous, EMI Couplings'*, Michel Mardiguian, 2000 IEEE International Symposium on EMC, Washington D.C., August 21-25 2000, ISBN 0-7803-5680-2, pp. 181-184.

[11] *'Functional Safety and EMC'*, Simon J Brown and Bill Radasky, presented at the IEC Advisory Committee on Safety (ACOS) Workshop VII, Frankfurt am Main, Germany, March 9-10 2004

[12] *'The Case for Combining EMC and Environmental Testing'*, W H Parker, W Tustin and T Masone, ITEM 2002, www.rbitem.com, pp 54-60.

[13] *'EMC Performance of Drive Application Under Real Load Condition'*, F Beck and J Sroka, Schaffner EMV AG application note, 11th March 1999.

[14] IEC 61508-3, *Functional Safety of Electronic/Electronic/ Programmable Electronic Safety-Related Systems – Part 3: Software Requirements*

[15] *'Why EMC Immunity Testing is Inadequate for Functional Safety'*, Keith Armstrong, 2004 IEEE EMC Symposium, Santa Clara, August 9-13 2004.

[16] *'Functional Safety Requires Much More Than EMC Testing'*, Keith Armstrong, EMC-Europe 2004 (6th International Symposium on EMC), Eindhoven, The Netherlands, September 6-10 2004.

[17] *'Assessing an Electromagnetic Environment'*, Keith Armstrong, available from Cherry Clough Consultants, phone +44 (0)1457 871 605 or email keith.armstrong@cherryclough.com.

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ANSI AND EUROPEAN STANDARDS ORGANIZATIONS

ANSI and European Standards Organizations Convene in Washington DC January 25-27, 2005

Washington, DC, January 27, 2005 – Significant progress is being made between European and American interests in fostering global standards that are market relevant, stated Dr. George Arnold, chairman of the American National Standards Institute (ANSI).

Opportunities for collaboration and information sharing in key areas were the focus of the 19th meeting between representatives of the American National Standards Institute and the European standards organizations (ESOs). This annual dialogue is a platform for ANSI and the European Standards Organizations to identify and address standards related issues to avoid trade disputes.

More than 60 participants, including ranking officials of the European Committee for Standardization (CEN), the European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institute (ETSI), convened in Washington, DC, on January 25-27, 2005, to address items of mutual interest in the global standardization community.

Participants discussed security-related standards initiatives, noting a commonality of approach at the national, regional and international levels and a growing number of activities affecting citizens around the world. Effective implementation of ISO and IEC initiatives on global relevance were commended as being of critical importance.

A detailed consideration of accessibility standards and regulations on both sides of the Atlantic led to the conclusion that there was mutual interest in avoiding technical barriers to trade and therefore great value in an ongoing dialogue involving both government and private sector interests.

There were also active discussions on government standards-related initiatives, focusing on levels of funding and differences in strategic approach.

About ANSI

The American National Standards Institute (ANSI) is a private, non-profit organization (501(c)3) that administers and coordinates the U.S. voluntary standardization and conformity assessment system.

The Institute's mission is to enhance both the global competitiveness of U.S. business and the U.S. quality of life by promoting and facilitating voluntary consensus standards and conformity assessment systems, and safeguarding their integrity.

The organization's Headquarters are located in Washington, D.C.; but the New York City office is ANSI's operations center and the point of contact for all press inquiries

ANSI is the official U.S. representative to the International Accreditation Forum (IAF), the International Organization for Standardization (ISO) and, via the U.S. National Committee, the International Electrotechnical Commission (IEC). ANSI is also the U.S. member of the Pacific Area Standards Congress (PASC) and the Pan American Standards Commission (COPANT). For further information please visit: ***www.ansi.org***

About CEN

The European Committee for Standardization (CEN) is the officially recognized European Standards Organization for standardization in areas other than the electrotechnical and telecommunications fields. Its national members have been working together since 1961 to develop voluntary European Standards (ENs) in various sectors.

Today CEN has 28 Members collaborating to build a European Internal Market for goods and services. CEN works with over 60.000 technical experts and with one European Standard allows access to a market of more than 460 million people. For further information please visit: ***www.cenorm.be***

About CENELEC

CENELEC, the European Committee for Electrotechnical Standardization, was created in 1973 as a result of the merger of two previous European organizations: CENELCOM and CENEL. Nowadays, CENELEC is a non-profit technical organization set up under Belgian law and composed of the National Electrotechnical Committees of 28 European countries. In addition, 8 National Committees from Eastern Europe and the Balkans are participating in CENELEC work with an Affiliate status.

Based in Brussels, Belgium, the European Committee for Electrotechnical Standardization (CENELEC) is officially responsible for standardization in the electrotechnical field.

Its members have been working together in the interests of European harmonization since the 1950s, creating both voluntary and Harmonized Standards which have helped to shape the European Internal Market.

CENELEC works with 35,000 technical experts from 28 European countries. Its work directly increases market potential, encourages technological development and guarantees the safety and health of consumers. Detailed information is available at ***www.cenelec.org***.

About ETSI

The European Telecommunications Standards Institute (ETSI) plays a major role in global standardization of Information and Communication Technologies (ICT), including telecommunications and broadcasting.

ETSI unites around 700 member companies from nearly 60 countries, including manufacturers, network operators, administrations, service providers, research bodies and users – in fact, all the key players in the ICT arena. For more information: www.etsi.org

CENELC Press release ***http://www.cenelec.org***

Joy in looking and comprehending is nature's most beautiful gift. - Albert Einstein

STUDENT PROJECT GRANT

The EMC Society could make up to $1,000 available to one Electrical or Electronic Engineering student project. The grant is to be made to the project that in the opinion of the National Council has a novel objective that would most benefit from the conquering of a unique electromagnetic compatibility aspect. It is expected that this offer would be most suitable for final year or postgraduate students. The overall project need not be on the subject of EMC itself. Students are required to identify how the grant will be used to resolve the particular EMC issue to expedite the project's primary technical outcome. The announcement of this grant is usually made at the start of the academic year to encourage students and supervisors to formulate an appropriate avenue of electrical or electronic engineering development especially in response to this opportunity.

Students should submit a 750 word or less application as follows:

- A brief description of the project and its primary technical outcome.
- An outline of the particular EMC facet of the project.
- An engineering plan of how the grant could be used to resolve the particular EMC issue and thus enhance the outcome of the overall project.
- How use of the grant would reduce the overall engineering risks associated with the project.
- An estimate of the costs involved.
- All submissions should include the endorsement of the project supervisor.

There is no set format for grant applications, but the points listed above should be covered. Typical use of the grant may be as follows:

- Enable and determine compliance to a real world EMC specification as a project objective.
- Calibrate an unusual E or H field transducer or link.
- Commission a site survey to better understand the EM environment in which the project is destined.
- Hiring of specialised equipment to measure a radiated or conducted EM parameter.
- Development of a specialised enclosure for an instrument designed to operate in a hostile field.

Students should ensure that where external commercial goods and services are required that the cost is commensurate with the grant, as no extensions can be made. Payment of the grant is made to the winner's Engineering faculty. Submissions can be sent to to enquiries@emsca.org.au. At the conclusion of the project, a brief report is required and an article on the project may be featured in the EMC Society's Newsletter.

CALENDER OF EVENTS

12 – 17 June 2005	IEEE INTERNATIONAL MICROWAVE SYMPOSIUM, Long Beach, California, USA ***www.ims2005.org***
8 – 12 August 2005	IEEE INTERNATIONAL SYMPOSIUM on Electromagnetic Compatibility, Chicago, IL. USA ***www.emc2005.org***
15 – 18 August 2005	ICED 2005 15th International Conference on Engineering Design, Melbourne ***www.iced005.org***
6 - 8 Sep 2005	4th Annual EMC Symposium EMC Society of Australia Call for papers - ***www.emcsa.org.au***
3 – 5 October 2005	APCC 2005 The 11th Asia-Pacific Conference on Communications, Perth ***www.appc2005.com***
6 – 9 December 2005	IEEE Asia Symposium on EMC Taipai, Taiwan Contact: Han-Chan Hsieh ***Hc.hsieh@bsmi.gov.tw***
21 – 24 June 2005	International Symposium on EMC and Electromagnetic Ecology, St. Petersburg, Russia ***www.eltech.ru/EMC2005***
Feb 28 – Mar 3 2006	EMC Zurich in Singapore STAR, IHPC, Singapore ***erpingli@ieee.org***
13 – 17 August 2006	IEEE INTERNATIOAL SYMPOSIUM on Electromagnetic Compatibility Portland, USA

INTERNATIONAL ENGINEERING COMMITTEES TO MEET IN AUSTRALIA

The international SMPTE Television and Digital Cinema Technology Committees will meet at The Australian Film Television & Radio School (AFTRS) in North Ryde, New South Wales (16km North West from the center of Sydney). The meetings will run from July 11th – 15th, the week immediately preceding the SMPTE Australia Conference & Exhibition. Registration (free) is required to attend the meetings. For details and on-line registration go to ***http://www.smpte.org.au/***.

SMPTE 2005 - Conference & Exhibition
July 19-22, 2005, is the date for the Australia Section's next Conference & Exhibition. Once again, the event will be held at the Sydney Convention & Exhibition Centre in Darling Harbour - a world class venue situated on the water's edge and in close proximity to the city. Organisation for the show is again in the capable hands of Expertise Events who confirm that more than 60 percent of exhibit space is already booked.

Companies/groups wishing to exhibit should contact:

Mr Richard Frost,
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IEC SC77B WG10 Meeting in Beijing, China

Dr. Franz Schlagenhaufer
(franz-s@watri.org.au)

I. The work of WG10

Working Group 10 of IEC SC77B has the nice habit of having its meetings in countries which do not yet actively contribute to its work. In April this year, the working group met in Beijing to discuss matters related to immunity testing for high frequency phenomena as covered by the following standards:

- IEC 61000-4-3 (Radiated RF electromagnetic field);
- IEC 61000-4-6 (Conducted RF disturbance);
- IEC 61000-4-20 (TEM waveguides);
- IEC 61000-4-21 (Reverberation chambers);
- IEC 61000-4-22 (Fully anechoic rooms).

With the European Union being the only major economic area where EMC immunity is mandatory, it is not surprising, that members from the EU dominate this group. However U.S.A. and Japan had a strong presence in Beijing, and all the other WG10 meetings. Turkey had sent two observers and is planning to contribute the working group, and several representatives from Chinese standardisation and academia attended the meeting as guests.

The meeting ran from 25-29 April 2005, from Monday morning until Friday lunch time, and this summary will only highlight some major issues, raised and discussed in Beijing.

IEC 61000-4-3 is probably the most important standard under the guidance of WG10, and this standard is currently going through a maintenance cycle. A CDV (Committee Draft for Voting) has resulted in a large majority of yes votes from national committees (27 YES and 1 NO to be precise), but has also triggered many comments, most of them editorial. WG10 has decided not to include some of the technical comments in the coming revision of the standard, but will consider them for the next maintenance cycle. This includes in particular locating the uniform field area (UFA) closer to the floor (for floor standing equipment), to be more precise about the terms 'floor' and 'ground reference plane', and to include an informative annex for a pre-scan relative to the method of independent windows for testing large EUTs.

The next maintenance update of IEC 61000-4-6 is to be completed in 2010. This date seems to be far away, but topics for consideration should already now be raised and made known to working group members. WG10 plans to discuss a listing of these topics during its next meeting in October this year in South Africa.

II. Field probe calibration

As already reported earlier, in the summary of last year's WG10 meeting in Penang, the calibration of field probes is a major issue, and was again discussed in Beijing. There seems to be a lot of politics involved in the co-operation between IEEE and IEC, and the coordination of IEEE standard P1309 (regarding field probe calibration) and annexes planned for the IEC 61000-4 series is more difficult to achieve than anticipated during the WG10 Penang meeting.

In Beijing, WG10 discussed a document prepared by one of the members, which will be sent to national committees as a CD (committee draft) for comments. This document is intended as an informative annex to IEC 61000-4-3 and describes requirements for a field probe calibration. Some details of the document are:

- It addresses the frequency range from 80 MHz to 6 GHz, but states that for some product standards only a part of this frequency range may be applied;
- It suggests minimum frequency steps of 50 MHz (<1 GHz) and 200 MHz (1 – 6 GHz);
- Where linearity of the field probe is guaranteed the calibration can be performed at field strength levels close to the levels used during the test (what is 'close', how has the linearity to be guaranteed?);
- When the linearity of the field probe is not guaranteed or is unclear, the calibration shall be performed at the intended field strength level, and at 0 to -6 dB (with a step of 0.5 dB) of the intended field strength level;
- Probe linearity is a weak function of frequency. The linearity check can be performed at a spot frequency that is close to the central region of the intended frequency range, and where the probe response versus frequency is relatively flat. Calibration labs may adjust the linear response of a probe during the calibration process, and guarantee a performance to be within +/- 0.5 dB from the ideal. When the adjustment is not available and linearity cannot be guaranteed to be within +/- 0.5 dB the response of the probe under varying field strengths must be measured and a linearity table shall be created to correct for the linear response.

The document also addresses requirements on the environment, in which the calibration is performed, and gives instructions on how to determine the field strength produced by standard gain horn antennas. (Please, send me an e-mail if you wish to receive a copy of the complete document.)

III. Measurement uncertainty

The other main topic of the meeting was measurement uncertainty. In the context of IEC 61000-4-3 and -6 a better term would however be level-setting-uncertainty. There was a lively discussion about what should and what should not be considered as contributors. Difference parameters are to be considered for the field calibration and the test. The uncertainty to create a field of given field strength, that is the level setting uncertainty for the calibration procedure, is determined by: the field probe, the power meter (to measure the transmitted power), power amplifier harmonics, and the (software controlled) field strength levelling precision.

For the actual test the uncertainty can also include the influence of modifications in the setup, e.g. floor absorbers might have been moved, or the antenna position might have been changed slightly. A large EUT may also change the VSWR of the antenna. A document will be prepared by a drafting team, and will also include typical values for the individual contributors, as collected by the working group members.

Not included in the uncertainty budget are effects of the EUT setup and the field uniformity. It is understood that these two factors may have a bigger influence than uncertainties related to the test instrumentation. However, under TC77 guidance the WG10 is advised not to address these factors, at least not at this stage.

IV. EMC in China

Several Chinese guests gave presentations about the situation of EMC standardisation and research in China. An EMC regulation is in place in China, governed by the China Electricity Council (CEC), covering emission requirements. China has a policy of adopting IEC and CISPR standards, and mirror committees reflect the CISPR structure on a national level. Standards are divided in four groups: National standards, Professional standards, Local standards, and Enterprise standards.

EMC research started in the 1960s in China, and currently several university groups are working on EMC related topics. During my trip to China I had the opportunity to visit a large EMC test laboratory in Shanghai, a company for communication equipment in Shenzhen, and the EMC research laboratory at Jiatong University in Beijing. The test lab in Shanghai is comparable to major EMC test facilities in Western Europe, and the design engineers in Shenzhen demonstrated the same level of expertise and professionalism as their colleagues in the Western World. The EMC research group at Jiatong University consists of several professors and a number of Master and PhD students. They have strong links to industry and government enterprises, and research topics have generally some practical relevance.

WG10 participants having dinner.

ENGINEERS AUSTRALIA
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CORPORATE MEMBERSHIP

The EMC Society offers Membership to organisations who may wish to nominate up to three people for membership. This provides an important source of funding to the Society and we would like to take this opportunity to recognise Corporate Members.

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INSTITUTIONAL LISTINGS

An Institutional Listing recognises contributions to support the publication of the **ENGINEERS AUSTRALIA** EMC SOCIETY Newsletter. Minimum rates are $250.00 for a listing in one issue. Larger contributions will be most welcome. No agency fee is granted for soliciting such contributions. Inquiries, or contributions made payable to the EMC Society, plus instructions on how you wish your Institutional Listing to appear, should be sent to the Editor, EMC Society Newsletter, **ENGINEERS AUSTRALIA**, 11 National Circuit, Barton, A.C.T. 2600; or, sent to newsletter@emcsa.org.au.

THE BACK PAGE ...

... Just because it didn't happen doesn't mean it's not true!

AIR BAGS

Millions of cars have been recalled by the National Highway Traffic Safety Administration (NHTSA) and similar government safety agencies around the world, because of what is known as 'inadvertent air bag deployment'. This includes cars sold by virtually every leading automotive manufacturer.

In addition to rough roads, light jolts, stones bouncing off the road surface and light impacts at speeds air bag deployment is unexpected, the reasons for inadvertent air bag deployment include electrical shorts, dirty electrical connections, normal Supplementary Restraint System (SRS) wear and tear, static electricity and an incoming or outgoing cell phone call.

The following incident was reported by a driver in the USA, where cellphones use the PCS system and operate at 1.9GHz: "I was holding the phone at arm's length so I could see the display to dial, in my left hand, so that it was almost touching the centre of the steering wheel when the air bag went off like a bomb. My hand was violently bent over so far that my fingers nearly touched the inside of my forearm. My head was wrenched backwards and to the left like somebody was trying to twist it off my neck. The pain of the air bag hitting my hand was excruciating; it felt like my hand was on fire and went on for what seemed like forever."

The above driver did some investigation, and concludes that: "The thinking is that, in certain circumstances, the electric current coupled into the vehicle wiring from the cell phone antenna when it is close to an air bag igniter can be enough to cause deployment of the air bag. The antenna of my cell phone was, at most, an inch-and-a-half from the centre of the steering wheel when the air bag went off. A US organization involved in EMC testing said that the field at such a small distance from a mobile phone is likely to be in the region of 70V/m."

It is impossible to say with absolute certainty that the cell phone set off the air bag. There are too many unknowns: the exact strength of the 1.9GHz current required to trigger the air bag; the exact distance of the cell phone antenna from the igniter; and the exact strength of RF field emitted from the cell phone's antenna and its coupling factors into the vehicle's wiring. (Editor's note: But it seems very unlikely that the airbag should operate spuriously at the exact time that the cellphone was close to its igniter.)

The Automotive EMC Directive requires whole cars sold in Europe to be tested for immunity at a minimum of 30V/m up to 1GHz, in Europe. Since the above cellphone operated at 1.9GHz it is outside the range of this testing and the susceptibility of the car's systems at this frequency is unknown. Also the testing is done with continuous wave (CW) and amplitude modulation (AM), not with the pulsed modulated (PM) signals typical of a mobile phone.

There are no legal immunity requirements for the USA – but all the reputable motorcar manufacturers apply immunity tests anyway to help reduce their risks of liability lawsuits. The EMC immunity specification employed by the manufacturer of the vehicle involved in the above requires electronic 'components' (subassemblies) to pass tests at 200V/m from 1-400MHz in a stripline or TEM cell, and 80V/m from 0-1000MHz in an anechoic chamber. Plus the whole vehicle is tested with radiated external fields at 200V/m from 6-30MHz, 140V/m from 30MHz-1.3GHz, and 70V/m from 1.3-3GHz – but these are the external field strengths: the fields inside the vehicle during these tests are not controlled so are unknown (the same comment applies to Automotive EMC Directive immunity testing).

The cell phone concerned operated at 1.9GHz, hence it was outside of the frequency range for the 'component' testing range – and the whole vehicle testing might not have created 1.9GHz fields at the steering wheel with field strengths comparable with those created by the close proximity of a cell phone. So neither this particular manufacturer's tests, nor tests under the Automotive EMC Directive, could be sure to reveal the susceptibility of the airbag igniter to very close proximity of a cell phone transmitting at 1.9GHz. Note that about half of the cell phones in Europe operate at 1.8GHz, using the GSM system, so this brief analysis also applies to them. *(Adapted from the Automotive EMC Network www.autoemc.net by email in April 2004.)*

BROWNOUT

The widely publicized breakdowns and subsequent blackouts in the public power networks of the Northern United States and several European countries are extreme examples of phenomena that occur on a smaller scale many time every day. Studies have shown that Dips, or "brown-outs", and Interrupts, or "dropouts", in the public power supply are tending to increase in frequency in our overstretched power networks, causing further degradation in the quality of the electric power supply.

The results of power interruption can cause equipment reset and data loss, resulting in such consequences as breakdown of production or even danger to life. The situation is not going to improve in the short term. As more functions are packed into increasingly smaller volumes, power consumption inevitably increases. Further, the increased use of microprocessors means that equipment incorporating them is potentially more susceptible to power line fluctuations. *(Taken from "Dips/Interrupts Testing Gets an Update", by Martin Lutz and Nicholas Wright, Conformity, November 2004, page 12.)*

YAW SENSOR

After incidents where cell phone calls apparently interfered with a sensor in some sedans, the NHTSA recalled them (No. 98V080): "Due to a manufacturing defect of the yaw rate sensor for the vehicle stability control (VSC), the VSC can operate improperly if the sensor is affected by certain electromagnetic waves, such as from a cellular phone.

Should this occur, the brake can operate unexpectedly, affecting steering and speed control, increasing the risk of a vehicle crash." *(The Automotive EMC Network www.autoemc.net April 2004.)*

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The world is a dangerous place, not because of those who do evil, but because of those who look on and do nothing. -Albert Einstein

The information on this page is not verified fact; it is intended to provoke interest in, and an understanding of, Electromagnetic Compatibility.