NPL
National Physical Laboratory

Electromagnetic *News*

A National Measurement Newsletter

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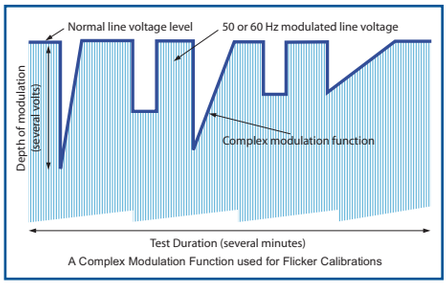
Improved Flicker Testing for Electrical Goods

European directives require that domestic electrical products be tested for their impact on the quality of the mains voltage supply.



A Complex Modulation Function used for Flicker Calibrations

One of the parameters examined is flicker, a quantitative means of assessing the degree to which an electrical appliance causes the electric lighting to flicker. Flicker arises from the fluctuating current drawn by the appliance causing a volt drop across the main impedance. These small changes in voltage cause variation in lighting levels, which although not often obvious to the observer, are nevertheless perceived, causing irritation.

The testing of electrical appliances is carried out using a Flickermeter. This instrument gives a pass/fail decision on the appliance based on a complex model of the human perception of flicker. In order to ensure that the European regulatory system is credible, the Flickermeter used for testing must be traceably calibrated.

Traditionally NPL calibrated flickermeters using a simple squarewave modulation signal to change the amplitude of a simulated mains voltage level. Such signals represent simple switching events which may occur in a product which the Flickermeter would be used to test. However in practice, the nature of the modulated voltage is essentially arbitrary and the Flickermeter must give the required results for whatever signal is produced by the electrical product under test.

In order to make calibrations more representative of practical Flicker measurements, NPL has extended its Flickermeter calibration facility to include calibrations with more complex modulation signals, which provide a more thorough examination of a Flickermeter than basic square and sine wave modulations.

The Figure shows an example of a complex flicker test waveform as designed by the IEC Joint Working Group on Power Quality. The waveform shows the line voltage being modulated by a series of abrupt changes and linear ramps. Details and further examples of the complex modulation functions that are now in use can be found at: http://www.npl.co.uk/electromagnetic/dclf/waveform/datafiles/flicker_waveform_library.pdf

In order to provide traceability for complex flicker, NPL has recently completed a Reference Flickermeter, which complies with the specifications given in IEC61000-4-15; this is used to provide a comparison measurement with a Flickermeter under test when a complex waveform is applied. This Reference Flickermeter is now used in routine calibrations of Analysers and the use of complex modulation functions is being introduced to the associated Measurements Service.

The market for electrical products in the UK exceeds £20bn. Incorrect failures of tested appliances will delay entry into these lucrative markets. Conversely, the value of the electricity network is estimated to be £35bn, incorrect passes of poor appliances undermine the quality and stability of this network. Improved flicker calibrations using waveforms representative of those used in practice will ensure that the Flickermeters used to regulate products give the best possible judgement when passing or failing an appliance.

If you wish to become involved in the new programme or wish to comment on any aspect of the services that NPL offers please visit http://www.npl.co.uk/electromagnetic/ or contact us at electromagnetics@npl.co.uk

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Filling measurement resource gaps for competitive advantage

A key part of NPL's remit is to support UK industry and make available its expertise and measurement facilities. There are a variety of ways of doing this – through paid consultancy, joint collaborative projects and secondments, and through supporting the programme directly through in-kind funding such as loans of equipment or materials.

Here are two examples of where NPL's expertise has assisted companies to fill the resource gaps in their development process, and a third example where NPL's Electrical Programme is supporting the future requirements of UK industry - and helping to prevent climate change.

The LA19-13-02 full S-parameter VNA on offer from LA Techniques

LA Techniques

LA Techniques Ltd design, develop, manufacture and sell Vector Network Analysers (VNA) that can be used for measuring the electrical performance of components and circuits at Radio Frequencies (RF), typically from 3 MHz to 3 GHz. To enable end users to have more accurate and cost effective measurement solutions, LA Techniques, in conjunction with NPL, have developed specialised calibration schemes for use with these VNAs. These schemes optimise the performance of calibration kits when used with the LA Techniques range of VNAs. LA Techniques now offer a complete measurements solution comprising both VNA and characterised calibration kits.

LA Techniques are now successfully manufacturing and selling two different models of VNA using NPL's expertise in the supplied calibration kits. This includes using accurate measurement-based models of the calibration standards incorporated into the VNA firmware. This has enabled LA Techniques to retain and enhance its market position in this highly competitive area of technology that includes several large multi-national companies.

"Collaboration with NPL has proved immensely helpful in developing a set of quality yet affordable calibration kits"

Nils Nazoa, LA Techniques

Touchsafe

Antennas for wireless computer networks and mobile telephony are increasingly found in public areas such as airports, railway stations, and shopping centres. It is often difficult to assess whether it is safe for someone to touch these antennas, or whether the ICNIRP guidelines limiting the specific absorption rate (SAR) of radio frequency energy would be exceeded. This is a important issue in light of the European Physical Agents Directive, which places a legal responsibility on employers to ensure workers are not over-exposed to electromagnetic fields. This must be adopted in National Law by 2008.

"This development will establish a simple technique for the environmental monitoring of human exposure from nearby RF radiation sources"

IndexSAR's Mike Manning

This project developed a new concept for a portable meter for measuring SAR into a metrologically sound product that will help British Industry meet the requirements of the Physical Agents Directive. The Touchsafe hand-held meter consists of an isotropic electric field sensor embedded in a broadband tissue equivalent material. It can accurately predict the maximum 1 and 10 gram averaged SAR values without

Original concept: Touchsafe

Final Instrument: Touchsafe meter developed in collaboration with IndexSAR for assessing EM radiation exposure levels close to transmitters.

the need to scan the probe around within the volume of liquid. New broadband tissue equivalent liquids were utilised to allow operation from 800 MHz to 3 GHz, which covers mobile telecommunications and Wireless local area network frequencies. The prototype was extensively tested and compatibility with existing product testing standards was demonstrated.

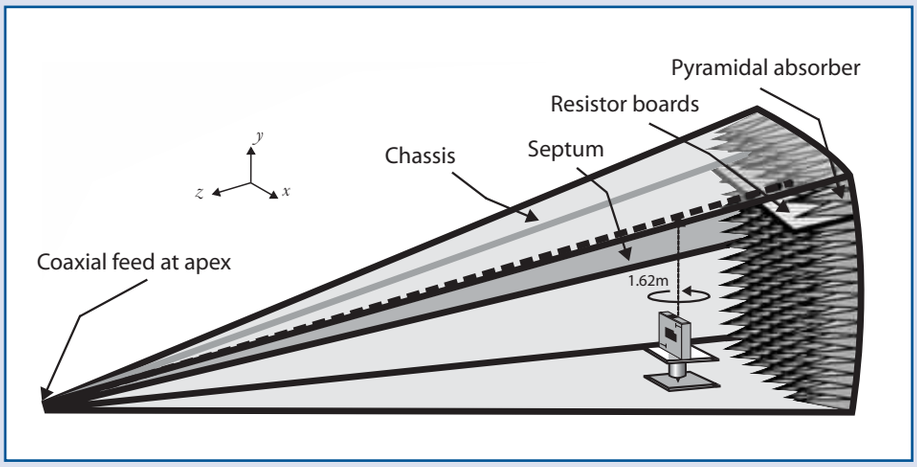
New measurement capability for non-sinusoidal power

Local councils are in the process of implementing the Merton Rule – which states that for any development within a region, 10% (or more) of the energy must come from renewable sources that will last for 40 years. It is expected that a significant percentage of power will come from local renewable power sources. These local systems have to be efficient and effective. But how do you measure the power, and the generation efficiency of the units? Unlike traditional methods of power generation the waveforms generated by renewable sources of energy can have higher harmonic content. This means that, in practice, it is difficult to measure the power efficiency. In the last electrical programme, NPL developed a new capability to solve this problem. Uncertainties of better than 100µVA/VA have been achieved over a range of voltages up to 300V and currents up to 10A. In addition a Power Quality Waveform Library has been published. The outputs from this project will support the renewables industry by providing reliable measurements of energy efficiency. It fulfils the requirements for IEC standards on power quality related to distributed generation. Given reliable measurements of the efficiency of renewable generation equipment, local councils will be able to make informed judgements about the best systems to use, and ultimately reduce all our energy requirements.

For more information about past or the current programme, please visit www.npl.co.uk/electromagnetic or email electromagnetic@npl.co.uk To specifically view the Power Quality Waveform library, please visit http://www.npl.co.uk/electromagnetic/dclf/waveform/waveform_library.html

Raising the Standards

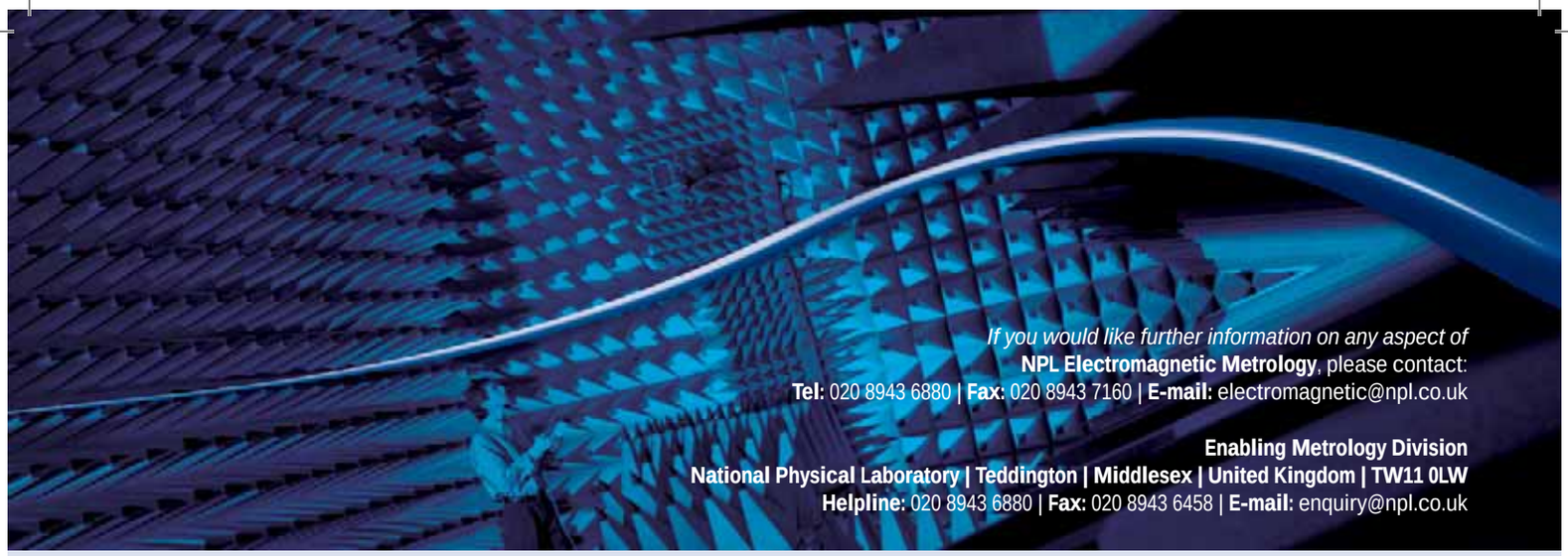
If you are a UK company, there are many ways that you can get help and support from NPL. Our Measurement Services or our helpline - offering up to two hours free advice - are two ways that NPL can help, but less obvious is the standards work that NPL undertakes.



A schematic of the MEB1750 GTEM cell at NPL, with an azimuth scanner - part of the innovative work at NPL on EMC testing

Last year on your behalf, NPL staff members represented the UK on 72 electromagnetics standards committees and ensured that the UK had input into setting and improving international standards. For example NPL attends the international EMC standards committee (CISPR/A) and has made a number of contributions to the standards for emission testing: NPL has demonstrated that the procedure for EMC testing EN61000-4-20 could be improved. One of the projects in the last programme demonstrated that, when emission testing in a fully anechoic room, it is not sufficient to make a single reading at one fixed height of antenna. It has shown that errors of 10 dB can result and has recommended two or more heights. In addition EMC testing by following the standard EN61000-4-20 can miss the intended maximum emission by around 10 dB and that it is necessary to rotate the equipment under test. The project was carried out in collaboration with representatives of UK industry such as York EMC Services, UK EMC Test Laboratories Association (EMCTLA) and the UK GTEM User's Group. This type of work is essential to UK industry because it ensures that their needs are taken into account in the standards, and that the demands of standards are not excessively onerous.

But it is equally important that NPL has access to your views so that they can be represented back to the committees. One method of contact is to join the Electromagnetic Network that NPL runs as part of its programmes. The network holds meetings on the hot topics of the day and aims to promote discussion, transfer of best practice and networking opportunities for the attendees. Membership is free. In April, the Anamet group of the network held a meeting looking



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at calibration issues including the calibration of oscilloscopes and Vector Network Analysers issues. Attended by 36 delegates (5 attended virtually using Interwise software), there was representation from European NMIs and key companies such as Agilent and Fluke. Often, the meetings are held in collaboration with other organisations such as the Institute of Engineering and Technology or the British Cyrogenics Council. There are also facilities for attending meetings remotely. If you have any topics that you think could be a suitable meeting for NPL to hold, please email electromagnetics@npl.co.uk

For more information please visit www.npl.co.uk/electromagnetics.

For specific information on EMC testing, please contact Martin.Alexander@npl.co.uk or read their latest publication: "A method to minimise emission measurement uncertainty of electrically large EUTs in GTEM cells and FARs above 1 GHz", in IEEE Trans. EMC, EMC-48, pp 634-640, Nov 2006.

The 15th Microwave Measurements Course 14 - 18 May 2007

RF and microwave technology is continually expanding into new areas where measurement techniques need to be reinforced and updated.

The Institute of Engineering and Technology will be holding the 15th Microwave Measurements Training course at NPL in May. Suitable for engineers and measurement researchers the course will provide a thorough understanding of the essential theoretical and practical background of microwave measurements necessary to employ good measurement practice. This will be achieved by a comprehensive programme of lectures, tutorials, practical demonstrations and workshops. The course includes theory and practice of parameters incorporated in modern microwave instrumentation including on-wafer measurements, and how to determine their accuracy.

The course takes place over 5 days and certificates of attendance will be awarded to those delegates who attend the full programme. The topics to be covered are as follows:

Day 1 & 2: will provide an introduction to the topic of Microwave Measurements –including a presentation from UKAS on uncertainties.

Day 3: will be based around Network Analysers

Day 4: will cover Power and Modulation

Day 5: will focus on Antennas.

As well as NPL experts, the presenters and trainers will include some of the top experts in their fields: Companies providing speakers include Agilent, Fluke, Rhode and Schwarz; there will also be experts from Imperial College, and the Universities of Cambridge, York and Cardiff.

Delegates will also have the opportunity to visit some of NPL's facilities throughout the course and for networking.

For more information, please contact the IET's James Howe on jhowe@theiet.org or visit conferences.theiet.org/microwave/ for online registration.