

## **UK GTEM User Group**

### **Minutes of the meeting held at National Physical Laboratory on 20<sup>th</sup> April 2009**

#### **Present**

Roger Dixon (RD)	ex Aeroflex Ltd [Chairman]
Ian Alderman (IA)	Consultant [Secretary]
Howard Chetwin (HC)	MTL
Sean Saint	MTL
Richard Marshall (RM)	Consultant
Neil Coote (NC)	Nokia
Michael Davies	HMGCC
Ivan Yallup	Ampy Automation
Stuart Bright	Echelon
Angela Nothofer (AN)	Nottingham University
Zaid Muhi-Al-Daher (ZD)	Nottingham University
Jonathan Hamilton (JH)	Megger Ltd
Jim Duck (JD)	Megger Ltd
Steve Cobb	EC Compliance Ltd
John Erdelyi	EC Compliance Ltd
Jason Holcombe (JHo)	TUV Product Services
Philip Stott	AWE
Andrew Hicks	Beka Associates Ltd
Richard Thompson	NPL
David Knight (DK)	NPL

#### **Apologies**

Tim Hague (TH)	EMV
Farquhar Galbraith (FG)	The EMC Centre (Paisley) Ltd
Joe Wilkinson	The EMC Centre (Paisley) Ltd
Martin Wiles	ETS Lindgren
Richard Neyton	Apollo
Martin Alexander (MA)	NPL
Eddie Veater	UKAS
John Wombwell (JW)	EMC Hire

#### **1. Chairman opens meeting**

The Chairman (RD) opened the meeting and welcomed all attending. As there were several members new to the meeting RD described his previous employment history and experience.

#### **2. Apologies**

Apologies were noted.

#### **3. Mailing List**

The mailing list was circulated for changes.

#### **4. Minutes Of The Last Meeting**

The minutes of the last meeting were circulated and have been available on the UK GTEM User Group web site for the last 2 years.

## 5. Matters Arising (from last meeting in Nov 2006)

- The web link mentioned in the last minutes for Richard Marshall's paper on cable termination impedance was found not to work. RM stated that he would make the paper available on his own web site. (<http://www.design-emc.co.uk/>)
- 'EMC Work Book' the chairman brought 18 copies to the meeting for disposal. The books are now 11 years old but if any members would like a copy (free) then please contact Roger Dixon.

## 6. UK GTEM User Group – what should be the future for this group?

The chairman then introduced the topic of the GTEM User Group and posed the question regarding the future of this group.

The group's general aims and achievements have been:-

- The group has met regularly now for over 10 years
- The group has built up a considerable GTEM knowledge with the help of various contributors
- Hopefully given assistance to new users with information on how to use these cells and to share our own researches with the other group members.
- To contribute to standards making bodies and to represent users as the industry voice to standards making committees.
- There now exists a standard for using TEM Cells including the GTEM (eg., IEC 61000-4-20) and contributions have been made towards the multimedia standards CISPR32 and CISPR35.

Many of the original aims of the group have been met although there is still further work to be done by the standards committees where some input from the group may be needed.

Opinions from some of the members were..

HC stated that in his opinion the GTEM User group still had a function as a forum for all those who have responsibility for using or supervising these cells who would otherwise be isolated from knowledgeable support. He also gave an example of how well the results from MTL's GTEM had stood up when verified, when perhaps one would have expected the GTEM to have over-tested the product.

JHo Still a lot of work to be done especially to get GTEM's accepted by standards bodies. Lots of advantages especially as a pre-compliance test facility.

RM feels the standards work still needed a lot more work, the group must exist to pressure the standards making bodies to continue to develop the standards. The definitions of small and large EUT's has still to be addressed.

AN also thought the group still had a role from the standards point of view and for research.

From the general positive comments received it was concluded that the group should continue to exist.

## 7. Election of Officers

It was previously announced to the group that Roger Dixon (Chairman) and Ian Alderman (Secretary) would be standing down at this meeting and therefore new officers should now be elected.

Jonathan Hamilton expressed interest in the role of chairman and as there were no other nominations he was elected unopposed.

David Knight mentioned that perhaps NPL could possibly take on the secretarial role for the group, to be confirmed after discussions with the appropriate section, as support for hosting trade interest groups is a role that NPL do carry out for other groups.

RD mentioned the work of the Joint Task Force for IEC CISPR A TC77-JTF and Angela Nothofer confirmed that she is the co-convenor along with Professor Andy Marvin.

Farquahar Galbraith was elected by the group previously to be an observer to the JTF meetings but as he was not present at the meeting we cannot confirm his continuing interest in this.

Howard Chetwin confirmed that he is happy to continue as web master for the group.

### **8. David Knight Presentation of NPL's current GTEM project**

DK's presentation was based on his paper - "Summary of test work on EUT's with wires in GTEM cells – GTEM UG 20<sup>th</sup> April 2009"

The work presented was an investigation into typical uncertainty associated with termination impedance of wires from EUTs in GTEM cells. The test EUT was shown to the meeting and was constructed from a 20x20x11 cm aluminium die-cast box with a 5MHz comb generator inside. The generator was connected to an output port on the wall of box, to which were attached various external wires. The test work was carried out from 20MHz to 500MHz, so the EUT could be considered small wrt one wavelength.

The work demonstrated the typical variation caused by variable termination impedance, and this was confirmed by Computer Simulation Technology (CST) modelling work. Methods of bundling or coiling excess cable were assessed and their effectiveness was measured by comparison of each result with the most simple case of a straight wire, running vertically down to the ground. The ideal bundle would remove excess cable so the measured emission matched the simple case. DK went on to show a graph where a cable 'meander' (ie one of the basic cable bundling techniques) was placed at different heights from the ground plane, the data appeared to show that the optimum height was that which had a similar characteristic wire impedance to the termination value, and specifically 150 Ohms seemed to produce the best results.

Comparisons were presented between measurements taken in Nottingham University's GTEM and NPL's GTEM, and also with 10m emission data taken on the NPL OATS. The objective was to evaluate the GTEM/OATS transform which is given in 61000-4-20. The standard transform applies to small EUTs without wires, so the presentation showed how effectively it could be applied to EUTs with wires. Also of interest was the comparison between the two GTEM cells because they were significantly different in size.

DK has also engaged with RM who has expertise on cable termination and bundling techniques, and which was reported at our last meeting and his paper is mentioned at paragraph 5 above. A slight correction has been noted in one illustration of RM's paper on cable bundling.

Feedback to DK on his presentation

HC said that MTL were willing to accept the EUT for testing with a suitable test plan. JHo also will take the EUT for testing in TUV's GTEM. TUV also have OATs and FAR which they can use as well.

In discussing EUT's DK thought that classification of EUT devices may need to be a feature of 61000-4-20 to cover the cases where EUT's have multiple cables.

JHo remarked that the configurations set out in the presentation are not altogether exactly as they would consider for their product testing.

### 9. Zaid Muhi-Al-Daher - Nottingham University

Zaid introduced the project funded by the Engineering and Physical Sciences Research Council (EPSRC) that he and Nottingham University are now engaged in. Although still at an early phase of the project he described his approach to the identification and evaluation of cable layouts, and presented some results. In particular he has been looking at...

Common mode serpentine  
Differential mode serpentine  
Tight meander  
Twisted meander bundle  
Coil bundle

Each of these cable layout schemes has been used for simulation assuming 50 Ohm termination and placed 100mm from the ground plane.

These cable layouts have been described by Richard Marshall in his paper already mentioned above which has provided important research information for both NPL and Nottingham's projects.

The simulation software being used is from Computer Simulation Technology (CST) and Zaid's analysis was based on the use of 'S' parameters and in particular  $S_{11}$  and  $S_{21}$ . The aim of the analysis was to ensure that when matched -

- $S_{11}$  (dB) Input Reflection Coefficient (looking into the input) must be as low as possible to ensure max power transfer and impedance matching
- $S_{21}$  (dB) Forward Transmission Coefficient (from input to output) must be as high as possible to reduce radiation resistance and cable losses

Zaid produced some tabulated results comparing these various layouts and their associated 'S' parameter computations at certain specific frequencies. He concluded that this simulation is on going and results will need to be confirmed with real measurements in due course.

### 10. Standards activities IEC & CISPR A TC77-JTF – Angela Nothofer

- AN mentioned that there were a lot of comments made to the first edition of IEC 61000-4-20 which would take some time to work through. The issue of cables was put aside into 'Technical Issues' and hasn't been tackled yet. A draft update is available now for comment but these are due in May so people must be quick. A Work Plan for the second maintenance cycle will run alongside the EMC Conference in Austin USA (August 17<sup>th</sup>/21<sup>st</sup>) \_ agenda looking at comments and time-plan for next maintenance cycle. The JTF documents are on the web site mentioned in the last minutes [www.emc.york.ac.uk/temjtf/](http://www.emc.york.ac.uk/temjtf/). Send your comments to Richard Marshall for feeding into GEL210/12 meetings or Martin Alexander. If anyone wants to attend one of the JTF meetings then please speak to AN and this could be arranged as you can be an observer from the GTEM UG. The next meeting after Austin will be in Europe probably in November.

Questions:-

RD asked about the 'Round Robin' work the German authorities were doing some time ago, were there any published results reported? RD thought the results would be very useful to both project teams at NPL and Nottingham.

AN pointed out that the '9' point calibration has been changed to include a statistical basis to the calibration method. Which is different from the 61000-4-3 method.

With reference to 61000-4-20 the standard doesn't include the 1.8 times overhead for the calibration file to take account of the 80% amplitude modulation /amplifier compression effects.

### **11. AOB + News**

HC talked about the experience of moving his GTEM (Rayproof 750). After re-assembling they found that the SWR was too high at 1.76 where it had previously been 1.6. AN suggested using a Time Domain Reflectometer (TDR) measurements which would provide some positional information where there may be impedance discontinuities.

Steve Cobb has set up his own company EC Compliance Ltd ([www.eccompliance.co.uk](http://www.eccompliance.co.uk))

RD had spotted a new product item called a Wave Cell from a Spanish company called 'Wave Control' – a new TEM Cell?

RM Receives documents from BSI as part of his committee membership – but doesn't have time to read all of them – asked for anyone interested who would like to see them and pass back any comments to him.

JD reported on the Safety Standard IEC61010 and in particular mentioned that the Test & Measurement section had been separated out from the main standard. PCB separation distances were now included in the general requirements.

Thanks were expressed to the retiring Chairman and Secretary.

### **12. Next Meeting**

Discussion about the next meeting thought that although the NPL facilities were very good the location was not quite so good for some members. MTL now has a new building in Luton and HC thought that it could be made available for a future venue. The date of the next meeting will be advised when there are sufficient results and information to be shared by NPL and Nottingham.

RD closed the meeting and thanked NPL for their conference room facilities and hospitality.