

UK GTEM User Group

Minutes of the meeting held at Measurement Technology Ltd on 11th July 2006

Present

Roger Dixon (RD)	Sponsored by Aeroflex Ltd [Chairman]
Ian Alderman (IA)	Consultant [Secretary]
John Wombwell (JW)	EMC Hire
Howard Chetwin (HC)	MTL
Sean Saint (SS)	MTL
Farquhar Galbraith (FG)	The EMC Centre (Paisley) Ltd
Richard Marshall (RM)	Consultant
Angela Nothofer (AN)	Nottingham University
Xavier Ngu (XN)	Nottingham University

Apologies

Tim Hague (TH)	EMV
Martin Alexander (MA)	NPL
Tian Loh	NPL
Ivan Yallup	Ampy Automation
Andy Marvin	York University
Andy Perkins	Schaffner EMC
Eddie Veater	UKAS
Joe Wilkinson (JWi)	The EMC Centre (Paisley) Ltd
Stuart Bright	Echelon
Alan Hutley (AH)	Nutwood UK Ltd
Colin Howes	Experia
Tim Harrington	FCC
Richard Neyton (RN)	Apollo
Neil Coote	Nokia
Graham Blissett (GB)	AWE
Derek Barlow	DB Technology Ltd

Chairman opens meeting

The Chairman (RD) opened the meeting and welcomed all attending including Xavier Ngu from Nottingham University.

Apologies

Apologies were noted. An email from Derek Barlow indicated that his GTEM should be completed and commissioned in the near future and he hopes to attend future meetings.

Minutes Of The Last Meeting

The minutes of the last meeting (28 March 06) were circulated at the meeting, and accepted.

Matters Arising

- 'EMC Work Book' the chairman mentioned that he has a quantity of these books which are now 11 years old but if any members would like a copy (free) then please contact the chairman.
- Web Site – HC mentioned that he had contacted Alan Hutley but had himself made no further progress in this direction partly due to pressure of work. HC has experience in managing web sites and felt that it might be easier to manage this

directly rather than feed information via Alan however the web site could still provide links to the Compliance Web Site as well as other relevant sites. There would be some nominal costs if the group decided to do this and JW kindly offered to cover these.

- The chairman mentioned that GB would like to talk to someone regarding the mods to the GTEM algorithm for use above 1GHz. FG was to enquire at Paisley Uni for a contact however with the changes taking place there he was unable to find anyone to do this. The chairman circulated a summary sheet with the general algorithm structure from work carried out by Tian Loh at NPL and supplied by Martin Alexander.

5. Large EUTs and cables

The chairman also circulated related papers from NPL and Philips.

1. "A method to minimise emission measurement uncertainty of electrically large EUT's in GTEM cell and FAR's above 1GHz" (Auth:Tian Loh & Martin Alexander)
2. "The influence of cables on uncertainty of EMC radiated emission measurements above 1GHz" (Auth:Tian Loh & Martin Alexander).
3. "The effect of cable geometry on the reproducibility of EMC measurements." (Auth: Mrs Loes van Wershoven)

A discussion then ensued regarding test methods and cables in GTEM's, as we have a standard that we can't use. Several members spoke about the various ways they have used to dress cables in the GTEM. RM talked about the issue of correct termination of cables which leave the test chamber .

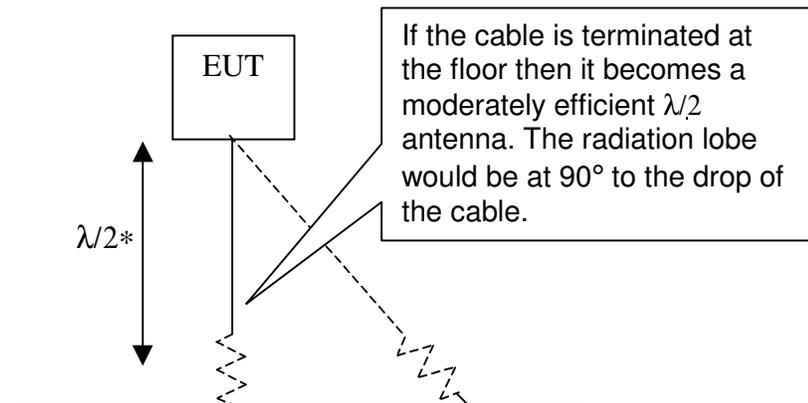


Fig 1.

By terminating the vertical cable *resistively* this reduces the efficiency of the antenna effect. Also as the frequency increases the radiation 'lobe' changes direction and points more to the floor in an 'end fire' direction and thus the measuring antenna or cell apex will not 'see' the radiation to the full extent so there seems to be a case for angling the direction of exit.

6. Xavier Ngu presentation

XN is a research student at Nottingham Uni and has been using a TLM (Transmission Line Method) mesh construction of a GTEM cell to model its performance. Both the transmission line elements and the absorber has been modeled. In the presentation XN displayed results showing the magnetic and electric field distribution at transversal cross section through the cell. This he compared with a detailed measurement of the field over the same surface and demonstrated that the TLM analysis gives results that are close

enough to provide a very useful model on which to carry out further analysis with varying size EUT objects.

XN further showed the results from a real EUT with optical fed signal placed in all 12 orientation positions. When this EUT was simulated the corresponding results gave a good correlation to the actual measurements.

A practical extension of this model has allowed XN to investigate what phase differences might exist with the EUT emissions in different orientations. The GTEM algorithm assumes that the measurements are all in-phase but XN discovered that there are real phase differences between positions 1 & 2 for example the pd is $\sim 155^\circ$!

Thinking again about EUT's and cables exiting the chamber RM suggested that it would be interesting to model the diagram discussed above (Fig 1).

XN indicated that the simulation currently is taking 3 days to run and requires a machine with 5Gb of RAM.

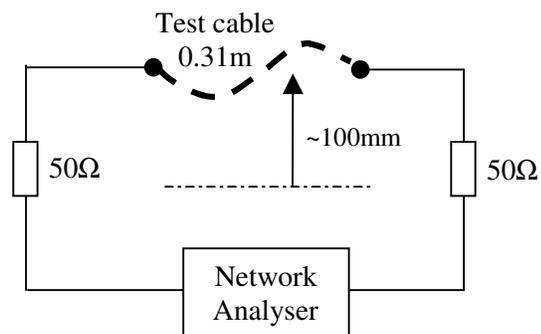
RM announced that he was looking for a partner to help with his work with cable resistive resonance damping and AN offered to work with RM on this as it would be a useful contribution to her 3 year work program proposal. JW also offered his GTEM facility to assist RM with this project.

AN then spoke further about her 3 year work program which is looking initially for examples of cable layouts from typical EUT's. RD agreed to write a statement in support of AN's work proposal indicating that it will *strengthen UK industry*. The work program proposal is to be completed by the end of August. The work item is to include emissions above and below 1GHz involving 'large EUT's' (ie EUT's with cables). Comparative measurements will be made in GTEM's, FAR's and Semi Anechoic Chambers. **To this end AN asked the GTEM User Group for information and examples about typical EUT's with cables in order to make the investigation representative of industry practice.** (angela.nothofer@nottingham.ac.uk - 0115 9515151)

PLEASE NOTE: Can members respond ideally by the end of JULY please?

7. Richard Marshall Presentation on Cable Bundling

RM has carried out an investigation into cable bundling and with the aid of a small network analyser, working up to 120MHz, has observed some interesting anomalies with the basic tightly closed loop which is normally used to gather up excessive cable in certain test set-ups.



So measuring the S_{21} forward loss characteristic with the analyser starting with a segment of cable 0.31m long gives a reasonable flat impedance curve up to 120MHz. If we now take a 1.5m cable folded in a tight loop then we can see attenuation figures up to 45dB due to parallel resonance.

RM's investigation went on to consider a whole series of bundling examples which were shown to the meeting, including open and closed meandering styles and other bundling techniques. The effects of the addition and subtraction of the loops at the ends of bundled cables was also investigated with practical solutions for successive improvements.

So..

- A meander is better than a bundle, but only if widely spaced
- A bundle may be greatly improved by having only opposed pairs of loops at each end
- An opposing bundle may be further improved by ferrite and resistive rings

From the culmination of this work RM was able to show an optimum method of bundling cable using a specific way of folding a single ended loop bundle to achieve minimal loss or resonance characteristic.

RM's work will be the subject of a paper to be given at the EMC Conference in October. Richard's full paper may be downloaded from the "Publications" section of his website www.design-emc.co.uk

8. Chairman's submission to NPL/NMS/DTI

RD circulated his submission on behalf of the group for the NPL/NMS/DTI programme. The submission points out the short comings of IEC61000-4-20 with regard to large EUT's (ie., EUT's with cables). The submission was made shortly after the meeting in March and could not wait until the July meeting for ratification. However the group approved the submission without reservation.

9. Chairman's email response to NPL regarding the NPL/NMS/DTI programme

RD has registered interest in the programme of work and specifically mentioned the performance of Electric Field sensors and the drawbacks of current designs and indicated that there is scope for further development in performance, reducing cost, less invasiveness and speed of response that would allow them to be independent of the amplitude modulation. Such a sensor would be a useful aid to industry.

10. Chairman's comments on the new draft CISPR32 and CISPR35 multimedia standards

RD circulated his comments on the new multimedia draft standards which have been incorporated into the UK's response to CISPR. Essentially the drafts had ignored the use of GTEM's as a valid means of emission and immunity testing and RD's comments address this omission comprehensively and the meeting fully concurred with comments made.

10. Other information

- **Users of IEC61326-1: 2005** revision will be required to test over the following frequency ranges (Table 1 Basic levels quoted here only) as 3V/m 80MHz < f < 1GHz, 3V/m over 1.4 < f < 2GHz and 1V/m 2 < f < 2.7GHz
- **IEC61326-3-2** [EMC British Draft from 'Standards Alert'].. Draft for comment 06/30144697DC on Industrial and Functional Safety test equipment. Industrial applications with particular EM environment
- **IEC61000-4-3** now is published as a 3rd edition which extends test frequency requirements up to 6GHz – details from the standard follow..

It forms part 4-3 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107, *Electromagnetic compatibility – Guide to the drafting of electromagnetic compatibility publications*.

This third edition cancels and replaces the first edition published in 2002 and its amendment 1 (2002), and constitutes a technical revision. The test frequency range may be extended up to 6 GHz to take account of new services. The calibration of the field as well as the checking of power amplifier linearity of the immunity chain are specified.

ETS Lindgren field probe now covers this extended frequency range going from 4 to 6GHz. Also it was noted that Milmega are offering power amps covering this standard.

- **EMV RadiLink** Tim Hague had sent in the details of this fibre device for replacing coaxial cable in EMC applications - has low loss, high dynamic range and wide band 10kHz – 4GHz
- **Barry Lytollis** (MTL Engineer) has joined the UK committee commenting on EN61326 he has a particular interest in the Functional Safety developments.
- **Colin Howes** has informed the group that he and a colleague have made a management buy-out of the technical division of Doro and are now the proud owners of the GTEM and plenty of other associated equipment along with it. The new company details are as follows: Experiortech Services Ltd.
(colin.howes@experiortech.co.uk
Tel 01527 592560)

12. Paper on a biological application using a GTEM

The Chairman gave out another paper entitled "FDTD Analysis of a Gigahertz TEM Cell for Ultra-wideband Pulse Exposure Studies of Biological Specimens" as an unusual and interesting application of a GTEM cell. The study was stimulated by the concern of the increasing use of radar generally and its potential biological effects. A key factor in order to carry out the study was the importance of being able to accurately establish the correct 'EM dose' applied to the bio samples and knowledge base for the GTEM including 'analytical calculations, numerical simulations and experimental measurements' is well documented. It was established that samples that are too close to the floor of the GTEM spoil the results. This agrees with our discussions at recent User Group meetings and the findings of Ishigami.

13. AOB

EMC Conference at Newbury 17th /18th October.

14. Close

The Chairman thanked Howard Chetwin and Measurement Technology Ltd for kindly hosting the meeting once again.

Next Meeting is to be on **Wednesday 15th November 2006** possibly at MTL again.

End.