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To: T Newton (IPC staff liason for 3-11 SC) QT/2014/304/SHv2

Copy: A Senese (chair of 3-11 SC), D Sober (vice-chair of 3-11 SC), PCB/SMT WG

Noordwijk, 16-02-2015

Subject: Cleanliness of base materials - Appendix A for IPC-4101

Dear Mr Newton,

The PCB/SMT working group (WG) of the European Space Agency (ESA), consisting of space agencies, Original Equipment Manufacturers, satellite integrators and Printed Circuit Board (PCB) manufacturers, have first addressed its concerns with the present cleanliness requirements specified in IPC-4101 with the 3-11 subcommittee (SC) during a teleconference on 20 August 2012. Action 10 of that meeting specified ESA to submit a proposal for alternative requirements. This proposal for a new class of cleaner base materials has been named "Appendix A" **[RD1]** and has been presented during the APEX on 18 Feb 2013. Action 7 of that meeting specified IPC to review the Appendix A and to provide comments.

During the meeting on 18 Feb 2013, the Appendix A was rejected to be included in the revision D of IPC-4101, because several comments needed to be resolved and because implementation of other urgent revisions took priority. This position has been accepted by the PCB/SMT WG and, therefore, a "positive vote with comment" was made for the revision D. During the APEX meeting on 24 March 2014, the significant progress described hereunder has been presented. This led to a re-submission of the comment with a request for Appendix A to be implemented in amendment 1 of IPC-4101. However, the proposal has been excluded from the list of consolidated comments for review during the meeting on 29 Sep 2014.

Since submission of Appendix A on 18 Feb 2013, the leadership of the 3-11 SC has provided the comments mentioned hereunder in response of action 7. The PCB/SMT WG is convinced that all comments have been adequately addressed by the progress recently obtained, in collaboration with base material suppliers.

1) <u>Evidence needs to be obtained for the lack of cleanliness and associated problems.</u>

   Evidence of problems associated with lack of cleanliness causing latent short circuit failure and poor yield has been published during the 13th Electronics Circuits World Convention, among others. **[RD2]**

2) The significance of the test method needs to be demonstrated.

   The test method has been reviewed by base material suppliers. Some have found it acceptable, others have not yet been able to declare compliance. As a result of this review, minor updates have been implemented in a revision of Appendix A issued on 31 Oct 2014 **[RD1]**. All addressed base material suppliers have initiated FOD reduction programmes to better meet cleanliness requirements of Appendix A. This provides evidence that the requirements proposed in Appendix A are efficient at improving the cleanliness.

   In addition, the sample test method on copper clad laminate is not a self-standing method with the aim to screen out good and bad material. It is one of several other risk mitigations that provide better process control and better accountability, with the objective to improve the cleanliness overall. Due to the probabilistic nature of contamination, 100% efficiency of the destructive sample test method is not possible and not required.

   Finally, the test method of Appendix A is identical to the test method of the main body of IPC-4101, having many years of heritage. Appendix A only increases sample size and removes ambiguity regarding the consequences of a failed inspection. In case the test method of Appendix A is deemed invalid due to lack of significance, then so is the test method in the main body of IPC-4101.

3) The additional requirements can be specified on the purchase order for the base material.

   Indeed, Appendix A is already successfully used as a procurement specification in collaboration with base material suppliers. One qualified PCB manufacturer performed the 2% sample inspection on laminate for several years already and another qualified PCB manufacturer has already implemented the Appendix A as a procurement specification in collaboration with their base material supplier. Making the Appendix A available as an option in IPC-4101 is necessary to serve the high-rel electronics industry, e.g. for space projects.

4) Support needs to be obtained from base material suppliers.

   One key base material supplier, whose materials are used by qualified PCB manufacturers, has committed to implement improvements with the aim to be compliant to the Appendix A by 2015. Two further base material suppliers, one of which also supplies already qualified materials, have declared their compliance to Appendix A and are in support of having it implemented in IPC-4101. These base material suppliers will comply with specific customer requirements for a new class of cleaner base material to be used for high reliability space applications. **[RD3, RD4]**

In conclusion, the PCB/SMT WG is convinced that it has submitted to the 3-11 SC a mature proposal for implementation in IPC-4101. The concern on cleanliness is critical for European space industry and considered to be relevant for all electronics industry. The proposed Appendix A has been formally submitted for the second time, since the concern was first addressed more than 2 years ago.

The PCB/SMT WG kindly requests to the leadership of the 3-11 SC to implement the Appendix A, to establish a time line for this and to include the proposal, in the form of the present letter, to the list of consolidated comments for the upcoming amendment of IPC-4101.

With best regards,

Stan Heltzel

References:

RD1 QT/2013/378/SHv4 Proposal for new class of cleaner base materials, Appendix A to IPC-4101 – https://escies.org/download/webDocumentFile?id=62689
RD2 https://escies.org/download/webDocumentFile?id=61987
RD3 http://www.eipc.org/isola-announces-compliance-european-space-agency-base-material-standard/
RD4 http://www.ventec-europe.com/news_more.asp?news_id=50&current_id=1