National Aeronautics and
Space Administration
Goddard Space Flight Center
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Reply to Attn of: 306

Bruce Euzent/Altera
Committee Chairman, JC14.3

Valeska Schroeder/Hewlett Packard
Tin-Whisker Test Method Task Group

Subject: NASA Goddard Space Flight Center Comments Regarding JEDEC Ballot JC-14-04-226

Ref: JEDEC Ballot "Test Method for Evaluating Tin Whisker Growth on Plated Surfaces"

The Office of System Safety and Mission Assurance and the Chief Parts Engineer at the NASA Goddard Space Flight Center respectfully offer the following comments regarding JEDEC ballot JC-14-04-226 "Test Method for Evaluating Tin Whisker Growth on Plated Surfaces." We appreciate this opportunity to comment on this subject of great importance to the electronics industry in the United States and abroad. Clearly, international, legal and market forces are driving towards lead (Pb) free electronics assembly with pure tin plating as the associated finish of choice. One of the hurdles for Pb-free conversion is the risk of tin whisker formation that has been persistently observed on pure tin finishes for the past 6 decades and continues to this day.

The tin whisker research performed by the National Electronics Manufacturing Initiative (NEMI) to date has been conducted in a highly professional manner and has contributed to the body of knowledge on this phenomenon. We applaud the effort and encourage NEMI and others to continue their research to pursue a comprehensive understanding of the fundamental factors that cause whisker growth.

We have reviewed the proposed test method and the supporting information made available by NEMI. From our review we have concluded that there is insufficient support for the proposal either as an effective way of identifying whisker prone or whisker resistant finishes or as suitable test methods to gather relevant data. Further, we believe from NEMI publications that they share many of our reservations. We oppose adoption of this test method.

The following provides more specifics:

1. Despite more than 6 decades of tin whisker research, the fundamental mechanism(s) that govern their formation and growth are ***NOT*** understood. During this same time period, attempts to control or predict tin whisker formation by means of controlling the environmental exposure have persistently produced variable results. Ironically, these are not solely NASA's beliefs, but also the beliefs of the NEMI sponsors of the subject test document.

Quoting from a June 2004 NEMI publication[1]:

"It appears there are some unknown factors that influence whisker growth more than the aging conditions in the [NEMI] testing. One conclusion is that whisker growth phenomenon is a multi-factorial event and the theory/model describing it must take into consideration numerous parameters. Another conclusion was that development of an accelerated test may not be possible until the underlying theory of whisker formation is fully understood."

"From the first two sets of [NEMI] experiments, it became obvious that whisker phenomena are a multi-factorial problem that was not going to be solved by rote testing. The theory behind whisker formation must be understood if pure Sn plated terminals are going to be reliably controlled in a manufacturing environment."

2. We understand that the proposed method disclaims being an "accelerated" test method and is not intended for "qualification." However, we are seriously concerned that once issued as a JEDEC "Standard", the industry will overlook and/or ignore these disclaimers. In fact, we are already seeing this occur as the industry is starting to use these and similar tests as de-facto qualification protocols in the absence of anything else. Again, quoting NEMI[2],

   "Unfortunately the date for changeover to Pb-free electronics is rapidly approaching, and industry must make decisions on terminal finishes whether tin whiskers are fully understood or not."

   This statement makes clear the risk that industry (both suppliers and users alike) may use the proposed test environments to assess "whisker risk" for a wide range of end-user applications. This is despite the fact that none of these methods have ever been correlated to actual whisker growth for any particular field environment. We can relate to industry's desire to have a common test protocol in order to generate relatable results. However, we must caution that data collected that has no known relationship to real world behavior could provide a false sense of security and may ultimately result in cutting off support for further fundamental research in this critical area.

   Considering the limitations with the current state of knowledge, we would support the development of a standard that focuses exclusively on the purpose of providing a standard definition and taxonomy for tin whiskers. Suggested content would include whisker shapes (e.g., straight, kinked, constant cross-section), appearance (e.g., filaments, nodules, longitudinal or horizontal striations), dimensions (e.g., effective lengths and diameters) and densities of growth. Furthermore, we support the idea that such a document could provide useful guidelines for performing scanning electron microscopy (SEM) to ascertain such features. We feel that the proposed standard provides a good start for these purposes although issues such as the statistical significance of the sampling protocols remain to be determined.

   Once again, we wish to acknowledge the diligent efforts of all the scientists and engineers who have carried out their whisker research in a fully professional manner. Unfortunately, the tin whisker phenomenon continues to resist all efforts to produce a comprehensive

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[1] R. Gedney, et al, "NEMI Tin Whisker Projects", 2nd International Conference on Pb-Free, June 2004, Netherlands, ftp://ftp.nemi.org/webdownload/newsroom/Presentations/Amsterdam04_tin_whiskers.pdf

[2] R. Gedney, et al, "NEMI Tin Whisker Projects", 2nd International Conference on Pb-Free, June 2004, Netherlands, ftp://ftp.nemi.org/webdownload/newsroom/Presentations/Amsterdam04_tin_whiskers.pdf

understanding of the mechanism(s) that govern their growth. For the reasons cited above we feel that adoption of this standard which has very limited possibility of being useful for detecting "safe" tin platings, might ultimately do more harm than good. We encourage the continuation of fundamental research into this phenomenon and in fact we are concerned that premature adoption of unproven standards could shut off continued attempts to determine root cause.

We appreciate the opportunity to comment on the subject JEDEC ballot. Please direct any comments or questions to:

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