Attachment No. 2

Minutes of the CE-2.2 Subcommittee Connector and Socket Specifications
31 March – 1 April 2008
Louisville, KY

Facilitator Carl Fritz welcomed everyone, and said that the meeting would be conducted following the published agenda.

1. Approval of the 24 – 25 September 2007 Minutes

The minutes of the 24 – 25 September 2008 meeting in San Antonio, TX were approved. Moved by Kevin Rickard and seconded by Ralph Antonelli. The motion was unanimously moved and approved.

It is noted that the CE-2.0 committee will simultaneously approve all actions taken by the subcommittee.

2. SPECIFICATIONS BY PROJECT NUMBERS

A. SP-4965, EIA-540B0AE, Detail Land Grid Array

Since this standard has not been revised since May 2000 it was moved by Kevin Rickard and seconded by Frank Ruffino send the standard to EIA for reaffirmation. The motion was unanimously approved.

The committee indicated a desire to possibly supersede this standard for new designs by EIA-364-1000 in the future by incorporating the relevant tests from 540B0AB into EIA-364-1000.

B. SP-4970, EIA-540DAAA-A, Detail, DIP

At EDEC for approval.

C. SP-4971, EIA-700A0AB, 68-pin Memory Card Connector

At EDEC for approval.

D. SP-4973: EIA-540B0AB: Low Pin Count BGA (Contech Research is sponsor)

The project leader has requested that the project be cancelled. The members unanimously accepted the request.

E. SP-5112 as follows:

- EIA-700A0AC: Detail, 88-pin DRAM Connector
- EIA-540A000-A: Sectional, Chip Carrier Sockets
- EIA-540AA00: Blank, Leadless Chip Carrier Sockets
- EIA-540AAAA: Detail, Type A Chip Carrier Sockets
- EIA-540AB00: Blank, PQFP
- EIA-540ABAA: Detail, PQFP
- EIA-540AC00: Blank, PCC
- EIA-540ACAA: Detail, PCC
- EIA-540AD00: Blank, Adaptor QFP to PGA
- EIA-540B000: Sectional, PGA
- EIA-540BA00: Blank, PGA
- EIA-540BAAB: Detail, Non-Mechanical PGA
- EIA-540BAAC: Detail, Flex Carrier PGA
- EIA-540D000-A: Sectional, In-Line Packages
- EIA-540DA00: Blank, DIP (Will be sent out for review)
- EIA-540DAAB: Detail, Flex Carrier DIP
- EIA-540EA00: Blank, Round Sockets
- EIA-540EAAA: Detail, Round Sockets
- EIA-540F000: Sectional, Multi-Package Modules

A second letter (mccwil269) was sent to Cecelia Yates (EIA Staff) EDEC ballot on 14 August 2006.

F. PN-5123, EIA-364-1003, Ball Grid Array (BGA) and Land Grid Array (LGA) Test Sequence for Electrical Connectors and Sockets (Contech Research, Tom Peel)

- The following approved ballot with comments was received from Bob Druckenmiller on 14 November 2007:

Comments/Recommended Changes

Section 3 Socket details:
Is this section necessary in a "testing procedure" document? Especially Para. 3.1 which only allows for gold plated contacts.
I recommend that the entire section be removed. If you feel the need to leave it in then at least change the wording in 3.1 to allow for other noble metal platings or any other plating.

Page 10 Test Group FP:
FP3: MFG – To save space in the table, just specified the test condition IIa and not list all of the chamber parameters. Also, for the unmated exposure you should add that the socket only is exposed in the unmated condition not the "mating device"

- The following rejected ballot was received from John Healey on 12 November 2007:

Comments:

1) The -1000 test standard is designed for ALL connectors and sockets that are used in controlled environment applications. Why should BGA and LGA sockets be covered under a separate document?
   a. If users/producers prefer different test conditions than those described in the -1000 document they can implement them. The "details to be specified" and "test documentation" should reflect any changes.
   b. If there is concern about the test conditions in the -1000 document a case should be made for changing them. FYI, a change to the cyclic T&H test procedure is already under consideration.
   c. If a test standard is needed for connectors and sockets that are used in other environments it should pertain to ALL connectors and sockets, not just BGA and LGA sockets.
2) Assuming a special case can be made for BGA and LGA sockets, two options should be considered. Include a new section in the -1000 document or continue the development of the -1003 document and change the -1000 document to exclude BGA and LGA connectors. In either case, I offer the following suggestions.
   a. Explain why BGA and LGA sockets deserve special consideration.
   b. Describe the application environment.
   c. Consider defining generic attachment hardware for LGA sockets without a heat sink to allow OEMs to compare supplier offerings.
   d. Design attributes should not be part of the document. As the title indicates, only information pertaining to test sequences should be included.
   e. LLCR measurements should be per contact, not per contact pair. The criteria should be determined by the user.

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- The following reply was sent by Max Peel to John Healey on his rejected ballot on 12 November 2007:

John,

Received your negative ballot. This is an acknowledgment of said receipt and to inform you that we do not accept your negative vote as being valid. The following are the reasons for our decision:

1) The existing document was developed (test sequences and requirements) with the input from IBM and HP and coauthored with IBM (two different IBM groups). So in a sense you are rejecting an IBM document.

2) I'm afraid we also have a philosophical difference of opinion. The proposed document is a product standard and not a "generic test" Test Standard. The TS 1000 as I understand it from the meetings I attended was to create a test standard which could be applied to a specific application and not open it up to be a catch all for every product within that classification. To do so will cause confusion and diminish TS 1000 by making it a huge document with totally different parameters. My experience has indicated that the larger a document becomes, especially, when it includes every conceivable product being manufactured, the less likely it is to be used especially if test and functional requirements differ.

3) We have no objections to change the title to include "large format" to the title of the document and add a definition within the scope to differentiate from a 50 or 100 position socket that normally require less stringent requirements, severity levels etc. that the proposed document indicates. For your information, the proposed document has been used to qualify sockets from 1000 up to 5000 high density pin outs. These types of tests would probably not apply to systems with much smaller amounts of pin outs in which case TS 1000 may be OK to use. This is a technique which was used for large format PGA's (which was a result of users being totally dissatisfied with the basic PGA document that EIA had published. Also, as a result of the slowness and unwillingness of EIA to react to the objections of the user, one user created his own document which became the de facto international standard during that time frame (that company was INTEL). Everyone was using the INTEL document which was a public domain spec.

4) The existing document currently is being used to qualify sockets which are being used in high technology work stations, super computers and high end servers and not the consumer electronic type application which TS 1000 is more geared for (even though in those applications several users also use different severity and test duration's as we have discussed in the pass.

5) The proposed document is different in the sequence of tests, severity levels and requirements. It simply does not reflect the TS 1000 sequences or requirements. A few examples are humidity, MFG, adds power cycling, a 2000 hr thermal cycle, different vibration levels, etc. It's completely a different document

6) We are currently performing two programs based on the proposed document and it's being performed at the request of the users who are aware of TS 1000 but will not use TS 1000 since it doesn't reflect their concerns. Even though they are using the current document they have also increased the duration of the thermal cycle out to 3500 cycles and in one case require continuous monitoring of LLCR during the exposure but have kept the sequences and the other requirements and parameters on the document. This document has also been use for the high speed, high density connectors as well. So it's being adopted by other areas as well except deleting the power cycling test.

7) I would support the options with a better definition of the application issues which TS 1000 would cover to put brackets around it and to prevent significant over or under testing of products.

Remember we are talking about large format units. I have long thought that there should be a better way of defining a controlled vs. uncontrolled environment and to include some definition for standard technology Vs. new technology as well since they can have an impact on test duration's and severity levels that should be employed.

8) Relative to you comment 1b, vibration should also be reviewed since everyone (user) who is aware of the document have either changed to severity level and or duration and about 80% have added shock test to be performed prior to vibration.
The same is true with MFG duration's

9) Relative to 1c, I know what you are saying but you could be opening a Pandora's box. For example, There are circular connectors which are around (non military type) which have different requirements and tests required than those which exist in TS 1000 and are used in office areas. There are plugs and jacks also which happen to have some unique requirements, and the list goes on. And there is nothing in the document that covers these issues. So to try to include this in TS 1000 I can see an explosion in the document which will not be good as it will start the before mentioned confusion.

10) Relative to 2d, The design information was put in at the insistence of IBM.

11) Relative to 2e The statement in your rejection is fine if we are dealing with standard type connectors. The problem was that it could not be done in this case. The mating devices which were dummy devices of the same materials and mass of the production units, were all daisy chained so the input had to be contact #1 and output on contact #2. If it would not be done in this manner, no readings could have been obtained. So we were stuck with that approach and did not create a problem since the two interface measurement did not affect the absolute resistance be monitored to a large degree. It did add time to any FA but did not affect the results. In any event when a failure occurred we were able to determine if an interface problem existed, or device problem existed or pcb problem existed we were able to zero in on it.

12) Relative to 2c: This issue was discussed at length with the users. There statement was very concise, candid and direct to the point. Users use a wide variety of heat sink and attachment techniques. What may be used by one user, may not be meaningful to another. The sockets must survive the conditions of a given user and they all agreed they did not care how it behaved with someone else's. It has to perform in their situation. They had some sympathy with the manufacturer but it still had to perform and the general statement was that none of them were interested in an academic test program that did not address their specific need. This by the way first occurred with PGA's which preceded the LGA and BGA's. WE also did a lot of work for a heat sink manufacturer who sent in 10 different heat sinks and had different results. So this was a user requirement.

I believed I've address all of your issues. Personally, I would be concerned more about what TS 1000 was created to do and not trying to make it cover a large arena of application. From the last set of proposals of adding the "what if" statements to the MFG sequence is a case in point it's starting to go that way. I would concern myself with the basic document to be sure it meets the needs out there and make it user friendly or it will become a wasted effort that no one will use.

There is one document that we have used quite a bit from a user that describes his Qual testing. The generic version composed of a flow diagram which shows the sequences and a series of sort definitive statements indicating test procedure to be used, severity levels and test duration's etc. It has 6 test groups and a series of short statements describing sample size, variable measurements needed,etc. Application specific areas can delete any test change any severity level, etc. The title is changed and any special notes added that are different from the base document and then issued.

This document is concise and there is no room for misinterpretation. Within one hour I know exactly what to do, what the sample size is, etc. It's a great document to work with. There is a separate document for power as well which has totally different tests involved.

Sorry to wander around but I had some reservations when this document first was devised. I was not excited about the format or the humidity and vibration test but agreed to it so it could get an airing in the marketplace. Know is the time to look at it.

Regards,

- The following is John Healey's reply to Max Peel's reply to John Healey's rejection:

Max,

I, and others on the CE-2.0 committee, believe that TS 1000 specifies the test methodology for ALL connectors and sockets used in controlled environment applications. It's scope clearly indicates that intent. That is not to say that a user cannot make changes to the test parameters. For example, if a user believes 2000 thermal cycles are appropriate for the application, instead of the default 500 thermal cycles listed in the standard, the change can be made. It should be documented in the test report. That said, I am not opposed to a standard that specifies a test methodology for BGA and LGA sockets. But, there must be justification for a stand-alone document. I'm not clear on why it's needed. The proposed scope and purpose give no indication. Unless there is something unique about BGA and LGA sockets (versus all other connectors and sockets) TS 1000 should apply if they are being used in a controlled environment. If there is a concern about the TS 1000 test methodology let's have a discussion and correct the problems. In any case, if a stand-alone document is needed it should clearly distinguish itself from TS 1000. In fact, it might be advisable to reference TS 1003 in TS 1000 and vice-versa.

In keeping with this position, I have responded to your reasons for not accepting my negative ballot. See my comments in **blue** below.

John,

Received your negative ballot. This is an acknowledgment of said receipt and to inform you that we do not accept your negative vote as being valid. The following are the reasons for our decision:

1) The existing document was developed (test sequences and requirements) with the input from IBM and HP and coauthored with IBM (two different IBM groups). So in a sense you are rejecting an IBM document.

Please forgive my lack of understanding. I am not familiar with the work of the former CE-3.0 committee. Nor was I involved in any IBM effort to develop such a document. I surmise the participating IBMers have long since left the company. But, if there is an existing document why is this proposal necessary? If it involves changes to an existing document then I do not believe I am rejecting an IBM approved document.

2) I'm afraid we also have a philosophical difference of opinion. The proposed document is a product standard and not a "generic test" Test Standard. The TS 1000 as I understand it from the meetings I attended was to create a test standard which could be applied to a specific application and not open it up to be a catch all for every product within that classification. To do so will cause confusion and diminish TS 1000 by making it a huge document with totally different parameters. My experience has indicated that the larger a document becomes, especially, when it includes every conceivable product being manufactured, the less likely it is to be used especially if test and functional requirements differ.

If this document is a product standard then it should not be part of our TS documents. Regarding TS 1000, it is a test standard for ANY connector or socket used in controlled environment applications. As the scope states, "This standard establishes the test procedures and test sequences to be followed when evaluating the performance of electrical connectors and sockets used in controlled environments. Furthermore, it applies to contacts operating under low level circuit conditions. The assumption is made that the contacts are metal. Polymer contacts, or other contact types, may require a different test methodology." If it is decided that a separate TS document is needed for BGA and LGA sockets I would think that its scope would clearly define the application environment and indicate why TS 1000 is not applicable. As I mentioned, if TS 1003 is released a change to TS 1000 to exclude BGA and LGA sockets should be made.

3) We have no objections to change the title to include "large format" to the title of the document and add a definition within the scope to differentiate from a 50 or 100 position socket that normally require less stringent requirements, severity levels etc. that the proposed document indicates. For your information, the proposed document has been used to qualify sockets from 1000 up to 5000 high density pin outs. These types of tests would probably not apply to systems with much smaller amounts of pin outs in which case TS 1000 may be OK to use. This is a technique which was used for large format PGA's (which was a result of users being totally dissatisfied with the basic PGA document that EIA had published. Also, as a result of the slowness and unwillingness of EIA to react to the objections of the user, one user created his own document which became the de facto international standard during that time frame (that company was INTEL). Everyone was using the INTEL document which was a public domain spec.

See the last 2 sentences under item #2. It seems that we not only need definition of the application environment and clarification of why TS 1000 is not applicable, but we also need claraification of why TS 1003 only applies to "large format" BGA and LGA sockets. Also, a definition of "large format" is required.

4) The existing document currently is being used to qualify sockets which are being used in high technology work stations, super computers and high end servers and not the consumer electronic type application which TS 1000 is more geared for (even though in those applications several users also use different severity and test duration's as we have discussed in the pass.

Repeating, TS 1000 is NOT geared for consumer electronics. Again, please explain in detail why you and others believe this to be the case. I would like to do whatever is appropriate to correct that misunderstanding.

5) The proposed document is different in the sequence of tests, severity levels and requirements. It simply does not reflect the TS 1000 sequences or requirements. A few examples are humidity, MFG, adds power cycling, a 2000 hr thermal cycle, different vibration levels, etc. It's completely a different document.

Justification for each of the test sequences would help. I do not consider differences in severity levels to be problematic. The user is not restricted to the severity levels outlined in TS 1000. Any deviations should be listed in "details to be specified" and "test documentation." As I mentioned, requirements/criteria should determined by the user.

Regarding your examples of differences between test procedures in TS 1000 and TS 1003, we will be considering changes to the TS 1000 cyclic T&H test procedure. Both documents reference EIA-364-65 class IIA. That being the case, I do not accept that any change in duration of the test is cause to dismiss TS 1000. If there is a need to include power cycling in TS 1000, along with when to implement it, the change can be made. Finally, any change to the temperature extremes or the number of thermal cycles in TS 1000 is easily handled by noting them in the "details to be specified" and "test documentation" sections.

6) We are currently performing two programs based on the proposed document and it's being performed at the request of the users who are aware of TS 1000 but will not use TS 1000 since it doesn't reflect their concerns. Even though they are using the current document they have also increased the duration of the thermal cycle out to 3500 cycles and in one case require continuous monitoring of LLCR during the exposure but have kept the sequences and the other requirements and parameters on the document. This document has also been use for the high speed, high density connectors as well. So it's being adopted by other areas as well except deleting the power cycling test.

It would be helpful to understand why TS 1000 does not cover their concerns. That being said, I'm sure there will always be cases where users will want to run their legacy test sequences.

7) I would support the options with a better definition of the application issues which TS 1000 would cover to put brackets around it and to prevent significant over or under testing of products. Remember we are talking about large format units. I have long thought that there should be a better way of defining a controlled vs. uncontrolled environment and to include some definition for standard technology Vs. new technology as well since they can have an impact on test duration's and severity levels that should be employed.

So, is TS 1003 supposed to apply to uncontrolled environments? If so, I understand the need for a new standard. I would recommend clarifying the scope and purpose. I, and others, may have other recommendations as well. A new letter ballot should be considered.

8) Relative to you comment 1b, vibration should also be reviewed since everyone (user) who is aware of the document have either changed to severity level and or duration and about 80% have added shock test to be performed prior to vibration.

The same is true with MFG duration's.

Again, these changes should not preclude use of TS 1000. But, I would consider amending TS 1000 to make it more "user-friendly."

9) Relative to 1c, I know what you are saying but you could be opening a Pandora's box. For example, There are circular connectors which are around (non military type) which have different requirements and tests required than those which exist in TS 1000 and are used in office areas. There are plugs and jacks also which happen to have some unique requirements, and the list goes on. And there is nothing in the document that covers these issues. So to try to include this in TS 1000 I can see an explosion in the document which will not be good as it will start the before mentioned confusion.

If there are legacy test methods for certain connector types I'm not suggesting that they be abandoned in favor of TS 1000.

10) Relative to 2d, The design information was put in at the insistence of IBM.

Again, I was not involved in any previous IBM work on this proposal. But, design information does not belong in a test standard.

11) Relative to 2e The statement in your rejection is fine if we are dealing with standard type connectors. The problem was that it could not be done in this case. The mating devices which were dummy devices of the same materials and mass of the production units, were all daisy chained so the input had to be contact #1 and output on contact #2. If it would not be done in this manner, no readings could have been obtained. So we were stuck with that approach and did not create a problem since the two interface measurement did not affect the absolute resistance be monitored to a large degree. It did add time to any FA but did not affect the results. In any event when a failure occurred we were able to determine if an interface problem existed, or device problem existed or pcb problem existed we were able to zero in on it.

Is this a one-time situation? Is it not possible to design a mating device so individual contacts can be monitored? Also, you did not mention the criteria. As I said, it should not be part of the standard. The user should determine what is required.

12) Relative to 2c: This issue was discussed at length with the users. There statement was very concise, candid and direct to the point. Users use a wide variety of heat sink and attachment techniques. What may be used by one user, may not be meaningful to another. The sockets must survive the conditions of a given user and they all agreed they did not care how it behaved with someone else's. It has to perform in their situation. They had some sympathy with the manufacturer but it still had to perform and the general statement was that none of them were interested in an academic test program that did not address their specific need. This by the way first occurred with PGA's which preceded the LGA and BGA's. WE also did a lot of work for a heat sink manufacturer who sent in 10 different heat sinks and had different results. So this was a user requirement.

I very much understand that users employ various heat sinks and attachment techniques. I do not agree, however, that testing with generic attachment hardware for LGA sockets without a heat sink would only provide "academic" information. The test results would allow OEMs to directly compare supplier offerings. They could then take the "best-of-breed" and move forward with testing using their own hardware.

I believed I've address all of your issues. Personally, I would be concerned more about what TS 1000 was created to do and not trying to make it cover a large arena of application. From the last set of proposals of adding the "what if" statements to the MFG sequence is a case in point it's starting to go that way. I would concern myself with the basic document to be sure it meets the needs out there and make it user friendly or it will become a wasted effort that no one will use.

Members of CE-2.0 committee have indicated that TS 1000 is being used. Furthermore, it is making it's way into product standards (e.g., PCI Express). Any proposed changes to the document that would increase itse usefulness would certainly be welcomed.

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There is one document that we have used quite a bit from a user that describes his Qual testing. The generic version composed of a flow diagram which shows the sequences and a series of sort definitive statements indicating test procedure to be used, severity levels and test duration's etc. It has 6 test groups and a series of short statements describing sample size, variable measurements needed,etc. Application specific areas can delete any test change any severity level, etc. The title is changed and any special notes added that are different from the base document and then issued.

This document is concise and there is no room for misinterpretation. Within one hour I know exactly what to do, what the sample size is, etc. It's a great document to work with. There is a separate document for power as well which has totally different tests involved.

I would appreciate getting a copy of the document.

Sorry to wander around but I had some reservations when this document first was devised. I was not excited about the format or the humidity and vibration test but agreed to it so it could get an airing in the marketplace. Know is the time to look at it.

I did not get this impression from you when we were developing the document. I do agree that "tweeks" can be made to cyclic T&H and vibration. In fact, as you may recall, I stated that I did not care whether vibration was included in TS 1000 or not since OEMs address that concern during system testing, rather than relying on unique test fixtures.

Regards,

The project leader has requested that the project be cancelled. The members unanimously accepted the request.

3. SPECIFICATIONS AWAITING PROJECT NUMBERS

None.

4. NEW BUSINESS

Prepared by:

Carl Fritz, Facilitator, CE-2.2