

AUTOSIR TESTING & NEW STANDARDS

In response to a number of comments from various customers, the following information is offered for general assistance pending the publication of revised standards.

Graham Naisbitt is Managing Director of GEN3 Systems Limited (formerly Concoat Systems) and a Member of IEC TC91 WG3. He is:

- Leader of SIR Testing Standard IEC 61189-5 5E01 and 5E02
- Member of IPC-TM-650 2.6.3.7
- Member of IPC-9201A SIR Test Handbook

SIR Testing has been used traditionally to characterise individual process materials such as solder resists and solder fluxes. However, and as a result of extensive research work carried out in Europe by the British National Physical Laboratory, it has been shown to be a valuable tool in the characterisation of a complete assembly process.

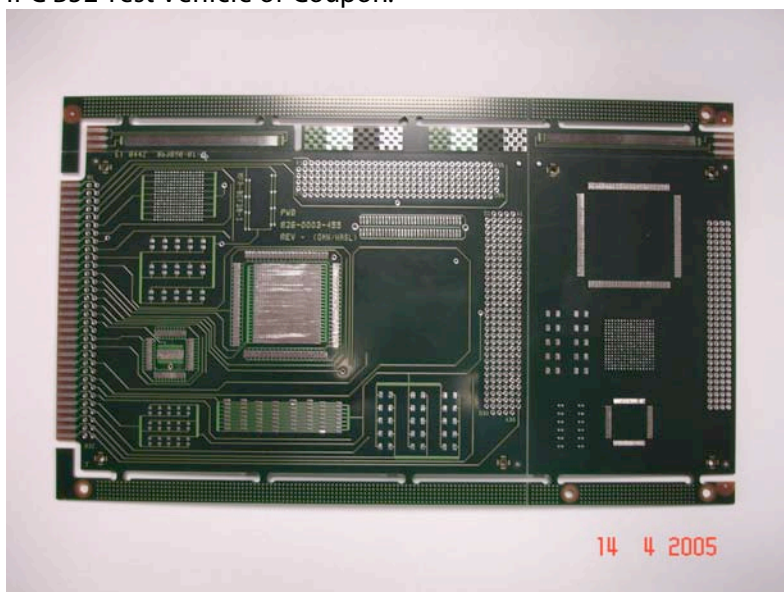
New standards are soon to be released:

- IEC 61189-5
- IPC-TM-650 2.6.3.7
- IPC 9201A – SIR Test Handbook

In addition, HP recently introduced a new test requirement EL-EN861-00. (See Bellcore Pattern)

The IEC (International Electrotechnical Commission) Standard and the American IPC employ test coupons of a common design that permit the over-mounting of components to obtain more realistic reliability data of the process. The IEC Coupon is TB57 and the IPC Coupon is B52.

IPC B52 Test Vehicle or Coupon:



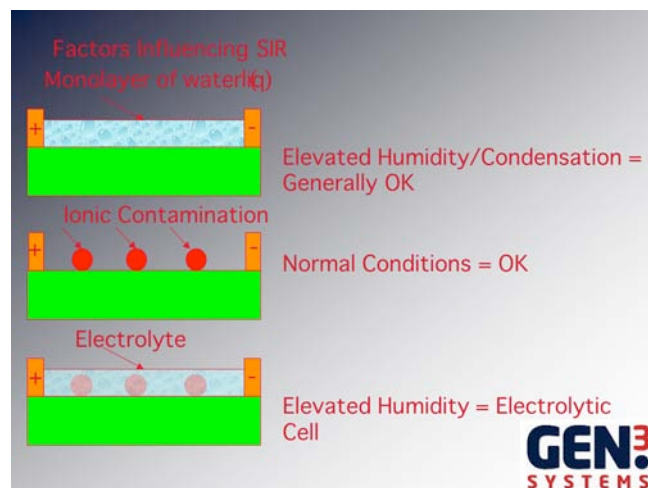
The following are some user Questions (Q) regarding SIR Testing. The Answers (A) come from both Auto-SIR customers/users and GEN3 Systems:

Q – What is the measurement interval of the Auto-SIR?

A – To take an SIR measurement:

- 1) The pattern is under electrical bias
- 2) Switch off the electrical bias
- 3) Switch on the measurement voltage
- 4) Allow time to stabilise the signal and then take the measurement

The Auto-SIR is able to take measurements at 2 second intervals unless the reading is unstable. Of course, an unstable reading is an indicator of electro-chemical activity and that is what we are attempting to monitor. In this way, the Auto-SIR can take 64 measurements in 2 minutes or 128 measurements in approximately 4 minutes.



The existing (old) standards such as Bellcore (GR78 CORE) require 1 measurement every 24 hours! The new test Standards however, require measurements to be taken at 20 minute intervals. The Auto-SIR has “Test Templates” for all existing and new test Standards.

Q – I want to have “Continuous” monitoring is this available?

A – No! There is no such thing. As described above, SIR involves the switching from bias to measurement. “Continuous” would contradict the laws of physics! It is unfortunate that some in the industry misuse this word, “Frequent” Monitoring is the correct English term.

Q – What should I do if I suffer power failure during the test and can I simply have a “resume test” function?

A1 – Here is a statement from a user: In the past, if I have been present when the power failure occurs, and it is down for more than 5 minutes or so, I will remove the power from all test samples and open the chamber door. I do not have a UPS on the chamber as it would be very expensive to get the necessary power feed. When the power returns, I check to see what the last set of data was. I ramp up the chamber to test conditions, wait an hour or so, and start measuring [again].

When the samples return to what they were before the test, with say $\frac{1}{4}\log\Omega$, then the test clock continues. Then I make note of it in the final report. During the post-test visuals, I look closely for water spots or other signs of condensation.

Assuming I don't catch it (middle of the night)? One way to do a dew point condensation test is to open run a chamber up to high humidity levels and shut it off, keeping it sealed. As the chamber cools, it will automatically pass through dew point. If the test samples are still energized and are not coated, they will be compromised.

In those situations, it is better to start with a new set of coupons and re-run the test. I have always found it less costly to re-run the test, rather than trying to interpret questionable data to a client. On the other hand, I have had power failures of this kind well into a large test, where a second set is not available or cost efficient. In those cases, I have done a thorough inspection of the coupons with top and bottom lighting looking for dendritic growth along lines of condensation markings. If none are found, then I proceed as above. If not, the test must be aborted.

A2 – It will be easier to re-run the test. The samples have a much lower thermal mass than the environmental chamber, so the samples almost certainly went through the dew-point before the chamber walls.

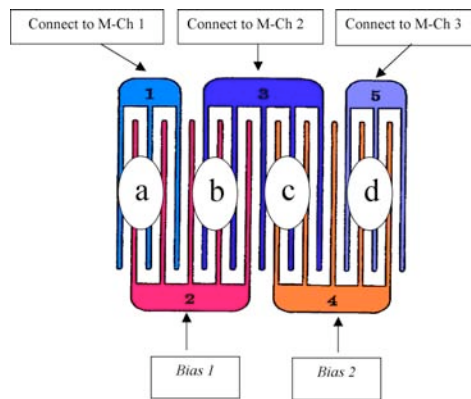
If the customer wants to restart (due to time restraints, or whatever), they should assume the risk of obtaining questionable results. It would be your responsibility to convey those risks.

We are lucky enough at our location to have very redundant municipal power. Therefore, we have only experienced "momentary" [outages] from the grid healing itself. We employ a UPS on our [Auto-SIR], but a UPS for a chamber is very expensive especially when you keep in mind that most testing must be done over not less than 72 hours. We had an UPS on a chamber which would keep it running for ~5 minutes. Also, if you use wet/dry bulb, when the fan stops running, the readout is useless.

Conclusion – Restart but do not "resume" the testing.

Q – Bellcore Pattern, what are the drawbacks?

A – The Bellcore pattern was introduced many years ago when readings would be taken manually and before instruments were available. All of the science research work has shown that new patterns are far more useful.



The Bellcore or 'W' pattern has **two** bias application connections associated with **three** measurement connections. As a result there are **four** readings taken from one coupon, each representing the areas labelled a,b,c and d on the diagram. Of course wiring these correctly is essential.

The test procedure is then:

- a. Bias applied at 2, measurement taken from 1
- b. Bias applied at 2, measurement taken from 3.
- c. Bias applied at 4, measurement taken from 3.
- d. Bias applied at 4, measurement taken from 5.

The Bellcore coupon was obviously designed for a manual monitoring operation, but the special Auto-SIR™ Bellcore software and the dual bias facility on the hardware unit, allows automatic **frequent** monitoring of an IPC B25, or other 'W' style pattern. The result is 160 test *sites* monitored from a 128 test *point* Auto-SIR™ unit.

Another drawback with this pattern is that it requires 4 measurements to 1 pattern whereas all new patterns require only 1 measurement per pattern.

All new Standards use a simple type of pattern that is an inter-digitated comb having a spacing that provides 25v/mm voltage gradient. The ends of the comb must be rounded not square:

