Balancing between cost and tester acceptance in case of new product introduction for PCB assembly

Á. Jankó and L. Lugosi

Engineering Services Centre, Elcoteq SE, Pécs, Hungary
arpad.janko@elcoteq.com

Summary: Companies which are offering Electronic Manufacturing Services are continuously balancing among fast product introduction of customer products, high quality production and profitable operation. Our paper describes link among producability of PCB boards, process control, test system & equipments reliability and profitabile manufacturing Process control is key in PCB assembly for high quality and profitable operation, however the time pressure limits the development of product test system which is the core of control of board assembly. In order to achieve good control, appropriate methods and equipments are essential assets. To be ahead of competition method and process were developed which can be used in production environment for tester system acceptance and regular check of condition of tester system. Beside of a product test coverage the production test system reliability and long term reliability is calculated with the help of statistical methods. The acceptance method can be used both for own product test system development and also for consigned equipments.

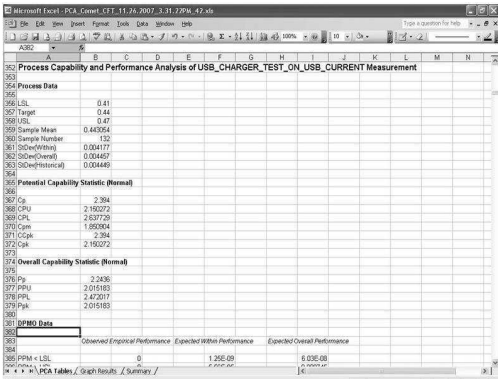
Keywords: PCB, Quality, GR&R, SPC, MSA

Motivation

This work was motivated by the need to determine quantitative quality charateristics, such as variance parameters, process capability and performance indices, originated from Measurement System Analysis (MSA) techniques called as Gage Repeatability and Reproducibility Study (GR&R) as well as Statistical Process Control (SPC) [1] for the practicing test engineers in industrial mass production environment. The applied calculation procedures are obtained from the well known and standard Six Sigma (6σ) [2] methodology in our developed program [3]. This statistical service software conforming to the Third Edition of AIAG MSA Reference Manual [4] and it can be used for the critical test measurement data estimation tasks furhermore the quantitative access of test mesurement systems.

Results

The program supports up to 128 test stations (operators), 64 products (parts) and 32 replicates (trials) for GR&R study as well as 4096 samples for SPC calculations, respectively. It processes measured data up to 1500 numeric limit test steps per sequence and stores these in well defned and structured XML files. The numerical and graphical results of the analysis for all selected steps are displayed in separated and high quality Excel tables and color charts. The graphs (control charts and histograms) give useful and quick information about the characteristic of measurement process.



Process Capability and Performance Analysis of USB_CHARGER_TEST_ON_USB_CURRENT Measurement

Process Data

LSL	0.41
Target	0.44
USL	0.47
Sample Mean	0.443054
Sample Number	132
StDev(Within)	0.004177
StDev(Overall)	0.004457
StDev(Historical)	0.004449

Potential Capability Statistic (Normal)

Cp	2.394
CPU	2.150272
CPL	2.637729
Cpm	1.850904
Ccpk	2.394
Cpk	2.150272

Overall Capability Statistic (Normal)

Pp	2.2436
PPU	2.015183
PPL	2.472017
Ppk	2.015183

DPMO Data

	Observed Empirical Performance	Expected Within Performance	Expected Overall Performance
PPM < LSL	0	1.25E-09	6.03E-08

PCA Tables / Graph Results / Summary /

Fig. 1: Excel table SPC report for a given test step. On this worksheet beside the process data the Cpk, Cp, Ppk, Pp and DPMO values are displayed.

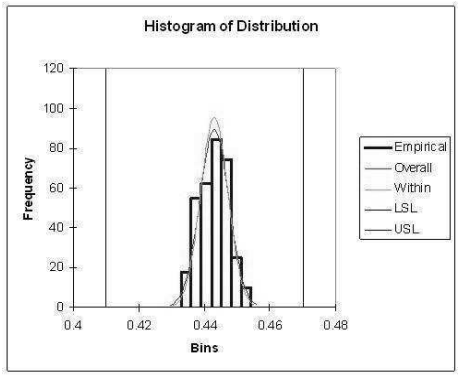


Fig. 2: Excel graphical SPC report. The histogram of the empirical relative frequency density just as the overall and within Gaussian distribution curves.

The reults of the GR&R and SPC investigations gives help to adjust the specification limits of different test steps. This is the main goal in case of a new product introduction activity, since it can lead to a stable-, controlled process and equable quality that ensures the possibility of decreasing the cost of the quality systems itself together with cost of production. On the other hand, our statistical tool -which was developed from the engineering point of view instead of a theoretical software package- are applied to validation and qualification of many test stations, are belonging to such product lines of the Elcoteq multinational company, that products are made to highly respected customers (e.g. Nokia, Ericsson, Philips, Thomson, Research In Motion - RIM). Due to the applied state-of-art numerical algorithms [5], the modern application development technologies and the tracking of the sophisticated Six Sigma methodology [2], this work should be an example of a successful innovation via applied informatics resulting cost saving and increasing quality.

References

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