



LABORATORY MANAGEMENT SYSTEM

DOC #	721186
REVISION #	B
SUPERSEDE	A
RELEASE DATE	2009-03-16
DOC TYPE	WORK INSTR

EMC LAB, TRENDS AND STATISTICS

1. PURPOSE

- 1.1. The main objective of this document is to improve the quality of the EMC testing process based on trend estimation following statistical data analysis.

2. SCOPE

- 2.1. This document provides instructions on how to record information pertaining to EMC testing trends and generate graphical and numerical data reports by using statistics against EMC test results, EMC test methods, or EMC test equipment.

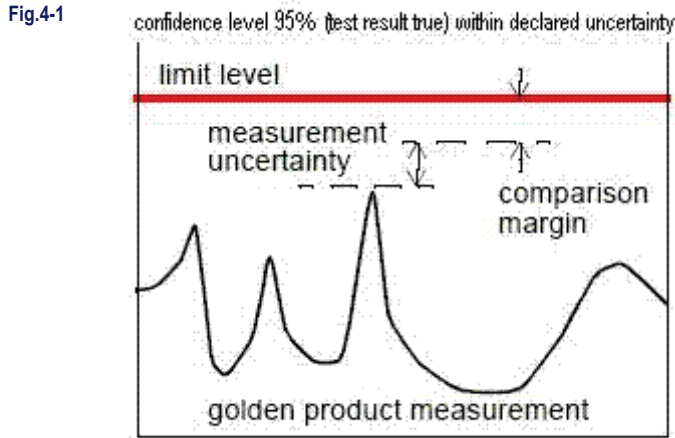
3. RESPONSABILITY

- 3.1. All EMC lab personnel

4. METHOD

- 4.1. Tracking and trending is performed for each test method under the EMC lab A2LA accreditation scope. One major reason for trending is to monitor and evaluate the confidence level of the measurements.
- 4.2. Typical factors that can influence the repeatability of the test results are:
 - Equipment accuracy
 - Test setup configuration (cables position, antenna orientation, distances to the artifacts)
 - Operator dependant (experience in configuration of the test equipment and thresholding for immunity)

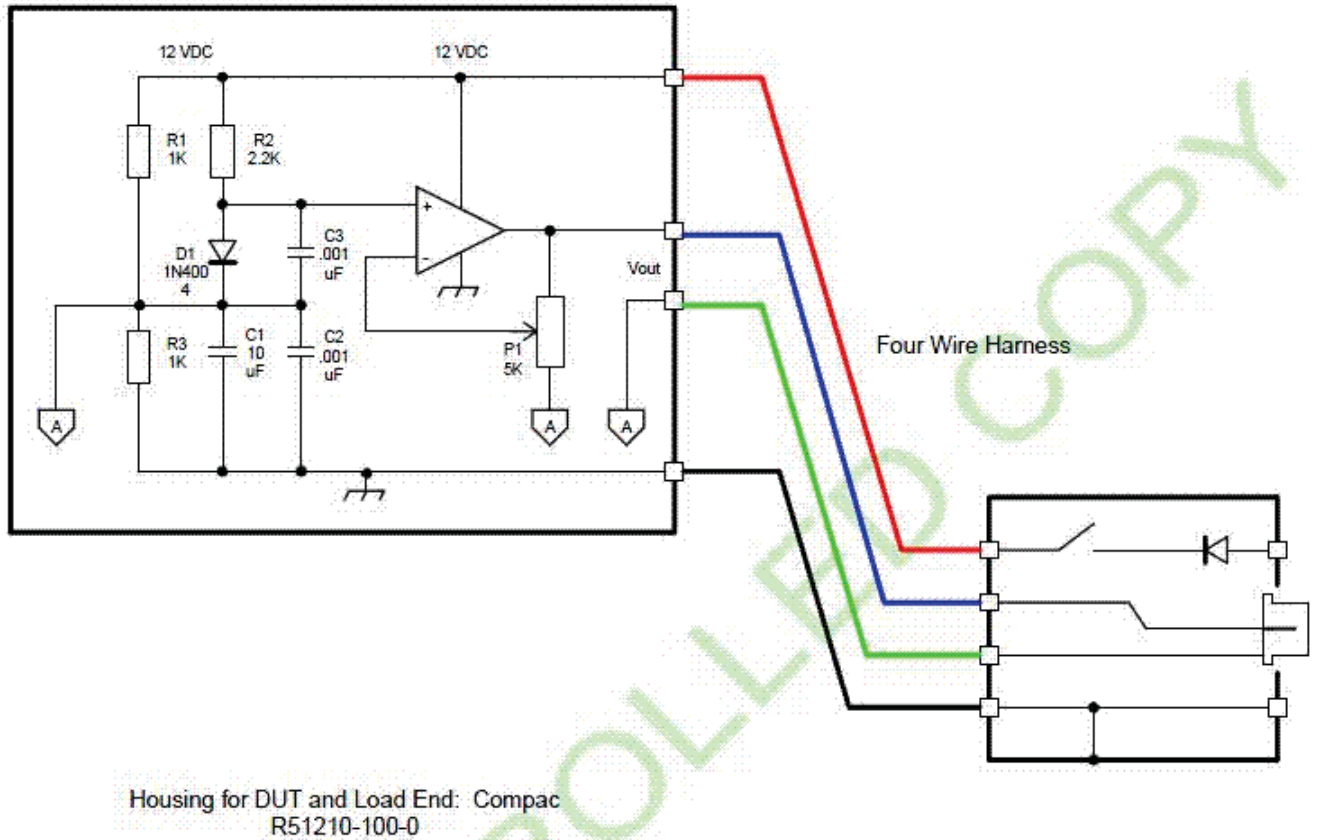
The variation of the results for those measurable points within a trend is evaluated by testing simple artifacts with a well known behavior. The Comb Generator used for "emissions testing" (see LMS011 EMC LAB PROFICIENCY TESTING PROGRAM PROCEDURE) will be used for emissions trends. Custom made artifacts will be used for immunity trends.



5. Trends Artifact

5.1. The circuit below placed in a shielded-box will be used to trend the equipment level of confidence at BCI. A similar circuit placed in a plastic-box, modified to cover the upper frequency spectrum, and connected via shielded harness will be used for ALSE Immunity trends.

Fig.5-1





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- 7.1. Enter 0 as Issue# if no nonconformance is detected in the current test-id (Fig 7-1 at the bottom of the Trends tab). In addition to confidence measurements level, trends can be defined for each test performed in order to provide statistics on DUT's performance during DV/PV phases or design revision changes. These inputs can be expressed as numerical or logical values (1.0000 for TRUE, 0.0000 for FALSE).

Fig.7-1

CONFIGURE TEST REPORT PAGE HEADER Start by selecting a filter: 1. Group # [] 2. Job # [] 3. Project [] 4. Method []

Enter report header (first row in the report) A2LA Def.Rep G6 ISO/IEC 17025 section 4.13.2.3 - SAMPLE REPC 5. Optionally filter by date Planned S-Date 04/26/2006 Planned E-Date 04/26/2006

Enter report title (second row in the report) Key Fob (PCB's and Keypads) 2007 JK/KA

Enter report title (right-side second row in the report) MC: 127926, ASSMNT ID: 11653, CAR NO: G3

CONFIGURE TEST ID FORMAT Test Record ID Prefix: TST- ID Len: 6

FILTER BY: ((tblLabTest.TestName Like "*BCI*"))

Trends	Test Name	Value
Trends01	Recoverable Bus Error	1.0000
Trends02	Inadvertent Output Activation	1.0000
Trends03	Bus Lockup	0.0000
Trends04	Fails Response Status/Group	1.0000
Trends05		
Trends06		
Trends07		
Trends08		
Trends09		
Trends10		
Trends11		
Trends12		
Trends13		
Trends14		
Trends15		

Logged by: Christian Rosu Date: 4/26/2006 Issue#: 0

Record: 4 of 56 (Filtered)

8. Trends Data Output (Drill-Down Visualization)

- 8.1. This section in EMC LAB TRENDS MAKER application queries the EMC LAB REPORTS database and creates various graphic reports based on previously stored trends data.
- 8.2. Trends data can be processed using methods shown in table 8-1.
- 8.3. The process used to interpret aggregations of data is called Data Mining and it is described in 721187 (EMC LAB,

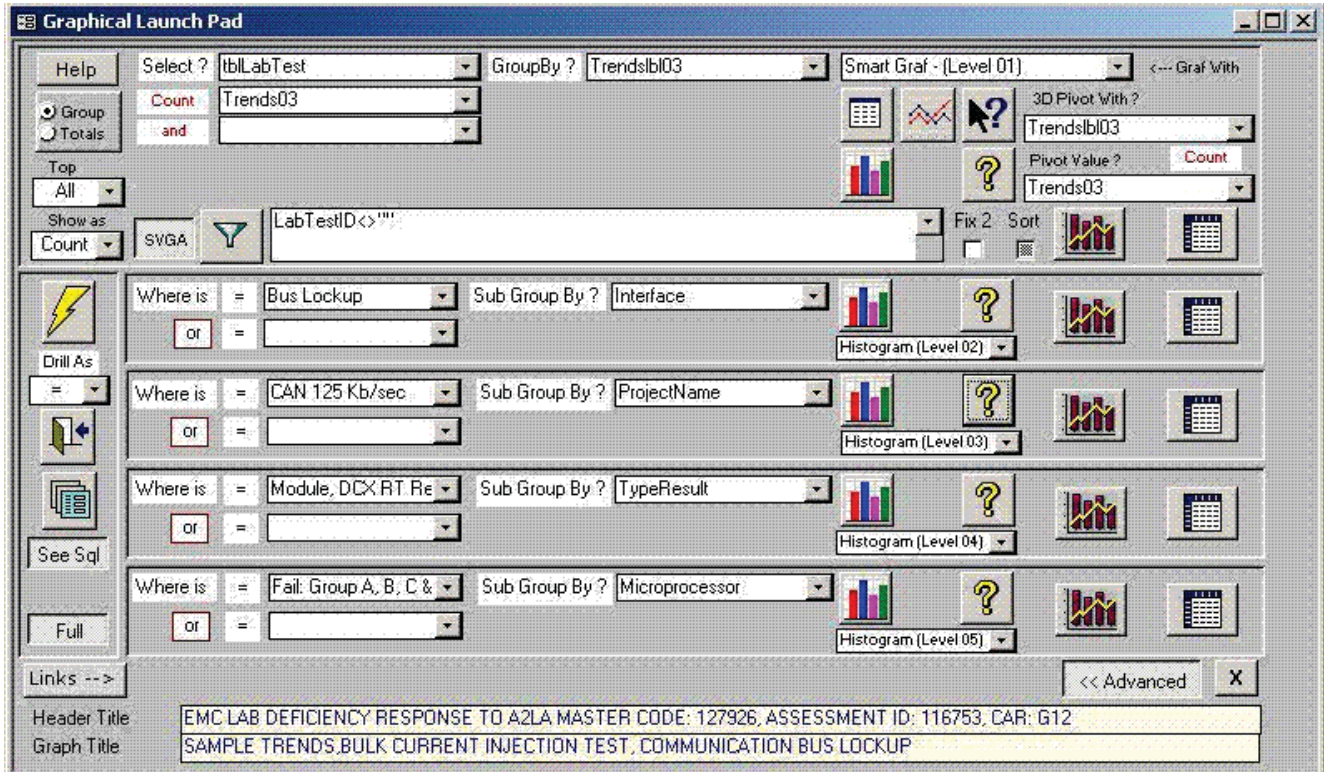


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QUALITY CONTROL DATA).

Fig.8-1



Tbl.8-1

0.	Add all values in each data group	SUM
1.	Average all values in each group	AVG
2.	Count number of rows in each group	COUNT
3.	Minimum values in each group	MIN
4.	Maximum values in each group	MAX
5.	Standard Deviation of values in group	STDEV
6.	Variance of values in group	VAR
7.	First record to be entered in the group	FIRST
8.	Last record to be entered in the group	LAST
9.	Weighted Average	WAVG



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9. Trends Data Analysis

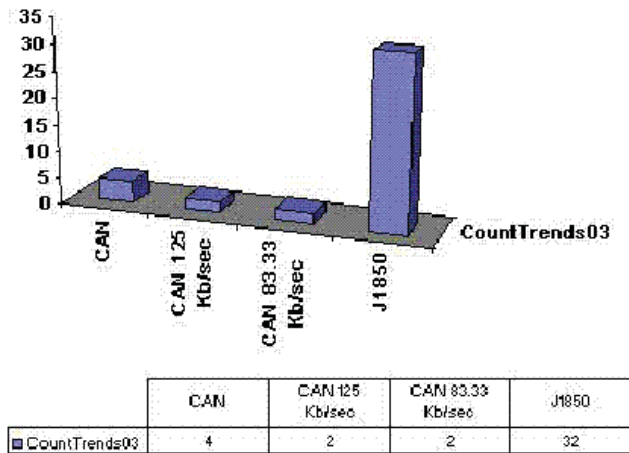
9.1. The sample trend shown below analyses the "communication bus lockup" based on type of hardware interface (various flavors of CAN bus and J1850 bus) an the type of MCU.

The CAN bus exhibits significant less "lockup issues" than the older J1850 communication bus. The experiment was conducted on multiple motion controllers samples (e.g. power liftgate modules).

Fig.9-1

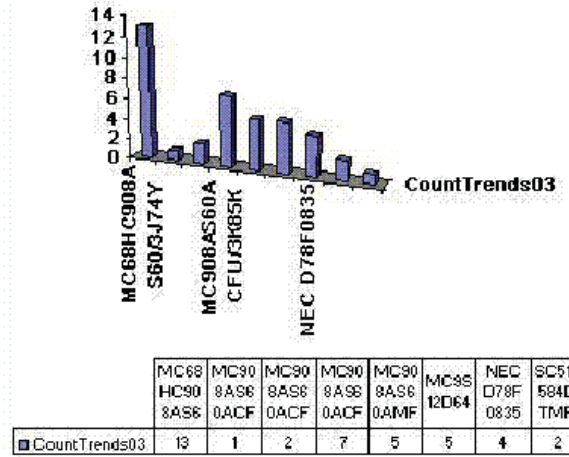
SAMPLE TRENDS,BULCK CURRENT INJECTION TEST, COMMUNICATION BUS LOCKUP

Count(Trends03)shown by Interface Where TrendsIbl03=Bus Lockup



SAMPLE TRENDS,BULCK CURRENT INJECTION TEST, COMMUNICATION BUS LOCKUP

Count(Trends03)shown by Microprocessor Where TrendsIbl03=Bus Lockup



10. Issue Tracker

- 10.1. If the analysis of the trends indicates nonconformance in some areas then an issue number must be released in order to evaluate and address the opportunity for corrective action request. This application is available over company's intranet and it is password protected. The issue# generated in this application is made available for selection within the "test reports" trends section (see Fig 7-1 in this document).
- 10.2. Issue Tracker is used to log various EMC lab issues including those detected during testing process monitoring, diagnosis, and control. **Preventive Action** (approval and surveillance) as well as **Corrective Action** (remedy history, root cause, solution, implementation, review, and follow-up) are also documented via Issue Tracker.



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Fig.10-1

LOG BOOK
 PREVENTIVE ACTION 1. APPROVAL 2. SURVEILLANCE
 CORRECTIVE ACTION 1. REMEDIAL 2. ROOT CAUSE 3. SOLUTION 4. IMPLEMENTATION 5. REVIEW 6. FOLLOW-UP

ISSUE TRACKER

ISSUE

MASTER LIST

USERS

LEVELS

DEPARTMENT

JOB/ROLE

HELP

ISSUE STATUS

CAR HISTORY

REMEDY HISTORY

PREVENT HISTORY

TO-FOLLOW-UP

TO-REVIEW

EFFECTIVENESS

DOC-MAP

Change Password

Logout

EMCLAB ISSUE TRACKER (ISO-17025)

TABLE: ISSUE

Search

Description contains

Search (*) Reset Show All Advanced Search

Exact phrase All words Any word

Page 3 of 5 Records Per Page 20

Records 41 to 60 of 82

[Add New](#) [Inline Add](#) [Delete Selected Records](#) [Update Selected Records](#) [Grid Edit](#)

Title (*)	Type	Investigator	Status	Open Date										
A2LA-11653 508/Specific	Accreditation	Rick Goodwin	Closed	2/14/2006										
A2LA-11653 509/Specific	Accreditation	Rick Goodwin	Closed	2/14/2006										
A2LA-11653 510/Specific	Accreditation	Christian Rosu	Closed	2/14/2006										
A2LA-11653 511/Specific	Accreditation	Rick Goodwin	Closed	2/14/2006										
A2LA-11653 512/Specific	Accreditation	Christian Rosu	Closed	2/14/2006										
XK-PLGM validation	Validation	Christian Rosu	Closed	2/14/2006										
Potter & Brumfield Relay	Equipment	Claudia Rosu	Closed	2/17/2006										
Second Shift Activity	Monitoring Method	Christian Rosu	Closed	4/20/2006										
VSIM wigwag issue	Validation	Christian Rosu	Closed	4/25/2006										
Scheduled IA	Improvement	Christian Rosu	Closed	5/16/2006										
RS PLG latch drops prematurely	Validation	Christian Rosu	Closed	6/7/2006										
A2LA TRENDS SUBMISSION (BCI)	Accreditation	Rick Goodwin	Closed	7/17/2006										
A2LA PT 2006 CE SUBMISSION	Accreditation	Christian Rosu	Closed	8/8/2006										
A2LA PT 2006 ESD SUBMISSION	Accreditation	Christian Rosu	Closed	8/8/2006										
Scheduled IA	Accreditation	Tom Geller												
Scheduled IA	Accreditation	Tom Geller												
2007 A2LA Surveillance	Accreditation	Christian Rosu												
A2LA PT 2007 CE SUBMISSION	Accreditation	Christian Rosu												
A2LA PT 2007 CTDI SUBMISSION	Accreditation	Claudia Rosu												
A2LA PT 2007 CTE SUBMISSION	Accreditation	Christian Rosu												

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TABLE: CAR (5 Records)

Title	Type	Area	Date
CAR No.: 110806-5	Non-conformance	Process	11/8/2006
CAR No.: 110806-3	Non-conformance	Process	11/8/2006
CAR No.: 110806-2	Non-conformance	Process	11/8/2006
CAR No.: 110806-1	Non-conformance	Process	11/8/2006
CAR No.: 110806-4	Non-conformance	Process	11/8/2006

Appendix A - TRENDS PER TEST METHOD UNDER A2LA ACCREDITATION SCOPE

Test Method	Trends procedure	Trends limits	Submit to A2LA
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1.	Electrostatic Discharge (ESD) AEMCLRP Rev. 4, Appendix D (Chrysler, Ford, GM) ISO 10605, ES-XW7T-1A278-AC GMW3097 Section 3.6, DC 10614	Use Haefely Test AG 2520311/00. Waveform verification, ESD generator, and method per ISO-10605.	<i>Per ISO-10605 Annex-A. Analyze results over 20 measurements, 2 weeks apart.</i>	ESD gun voltage, verification voltage, waveform, and trends graphs.
2.	Conducted Emissions (CISPR 25) AEMCLRP Rev. 4, Appendix F (Chrysler, Ford, GM) GMW3097 Section 3.3.2, ES-XW7T-1A278-AC DC-10614, CISPR 25	Use ETS Lindgren REFRAD Comb Generator Model# 4630B, INV#2034 and the same test profile as for DC-10614 proficiency testing for both CE Voltage and CE Current methods. Select 2 highest noise frequencies in each of the 7 bands and log them as distinct test-id trends.	<i>Reading variation shall be less than ± 3 dB in all of the frequency ranges obtained over 20 measurements, 2 weeks apart.</i>	Trends raw data and variation graphs for both CEV and CEI.
3.	Bulk Current Injection (BCI) AEMCLRP Rev. 4, Appendix I (Chrysler, Ford, GM) ISO 11452-4, GMW 3097, Section 3.4.1 ES-XW7T-1A278-AC, RI112, DC10614	Use R51210-100-0 artifact and the GMW3097 AEMCLRP test method with the following exceptions: a) Test at 150 mm from artifact. Set the voltage output of the artifact to 2.5 V. b) Artifact deviation is evaluated as its output being changed +/- 0.1V from 2.5V. After threshold, select 15 lowest dBuA deviation points among all frequencies and log them as distinct test-id trends.	<i>Deviations profiles shall be within 6 dB of separation over 90% of the frequencies tested.</i>	Trends raw data and variation graphs.
4.	Radiated Emissions AEMCLRP Rev. 4 Appendix G (Chrysler, Ford, GM) ES-EW7T-1A278-AC, RE 310, GMW 3097 Section 3.3.1, CISPR-25, DC 10614	Use ETS Lindgren REFRAD Comb Generator Model# 4630B, INV#2034 and the same test profile as for proficiency testing with the following exceptions: a) Use 100 KHz frequency step for Monopole antenna range and 1MHz repetition rate Use 500 KHz for Biconical antenna range and 5MHz repetition rate b) Use 500 KHz frequency step size for Log periodic antenna range and 5MHz repetition rate c) Use only Peak Detector and vertical antenna polarization Select 5 highest noise frequencies in each antenna range and log them as distinct test-id trends.	<i>Reading variation shall be less than ± 3 dB in 80% of the frequency ranges obtained over 20 measurements, 2 weeks apart.</i>	Trends raw data and variation graphs.
5.	Transverse Electromagnetic Cell (TEM) 1 MHz to 200 MHz, up to 150 V/m AEMCLRP Rev. 4, Appendix J, (Chrysler) ISO 11452-3, DC 10614	Use the AEMCLRP test method to demonstrate that the field monitoring probe provides correlation with calculated field strength (+/-15% in V/m). Select and log as distinct trend test-ids the following frequencies (MHz): 1.0, 5.0, 10.0, 20.0, 30.0, 50.1, 75.9, 141.3, 166.0, and 179.9.	<i>The trends data shall be within 15% of calculated mean values over selected test frequencies tested over 20 measurements, 2 weeks apart.</i>	Trends raw data and variation graphs.
6.	Absorber-Lined Shielded Enclosure (ALSE) AEMCLRP Rev. 4, Appendix K (Chrysler) ISO 11452-2, DC 10614	Use Chrysler AEMCLRP proficiency test method verification scan to evaluate the forward power in dBm between 200 MHz to 1GHz, 1 GHz to 2 GHz, and 2 GHz to 3.2 GHz. Select and log as distinct trend test-ids the following frequencies: MHz (201.8, 402.7, 602.8, 803.5, 988.6) GHz (1.006, 1.349, 1.613, 1.82, 1.995, 2.007, 2.331, 2.63, 2.692, 3.2)	<i>Measurements variation shall be less than ± 3 dB in 80% of the frequency ranges obtained over 20 measurements two weeks apart.</i>	Trends raw data and variation graphs.
7.	Conducted Transient Emissions ISO 7637-1; ISO 7637-2; ISO 7637-2.3 DC10614; ES-EW7T-1A278-AC	Use a well known DUT (preferable a motor) as artifact.	<i>Measurements variation shall be less 10% of the expected voltage level over 20 measurements two weeks apart.</i>	Trends raw data and variation graphs.



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8.	Magnetic Field Emissions DC10614	Internal performance data (Tile software raw data and graphics). Use Helmholtz Coil to generate magnetic field using sine wave at the following frequencies: (Hz) 15, 30, 60, 168, 532, 1500, 4228, 11915, 15000, 23773, and 30000. Log as trends the readings in dBpT from the loop antenna for the above frequencies.	<i>Measurements variation shall be less 10% over 20 measurements two weeks apart.</i>	Trends raw data and variation graphs.
9.	Coupled Transient Immunity ISO 7637-3; DC10614; GMW3097; ES-EW7T-1A278-AC;	Internal performance data using EMTEST equipment/software to capture on digital oscilloscope test pulse waveforms prior to test.	<i>Measurements variation shall be less 10% over 20 measurements two weeks apart.</i>	Trends raw data and variation graphs.
10.	Conducted Transient Disturbances Immunity ISO 7637-2; ISO 7637-2.3; DC10614; GMW3097;	Internal performance data using EMTEST equipment/software to capture on digital storage oscilloscope test the waveform energy content and shape prior to each test.		Trends raw data and variation graphs.

REFERENCES

LMS DOCUMENT	REV	DATE	TITLE
200093	E		LABORATORY MANAGEMENT SYSTEM MANUAL
721179	B		EMC LAB TEST REPORTS DATABASE
LMS011	B		EMC LAB PROFICIENCY TESTING PROGRAM PROCEDURE
721187	B		EMC LAB, QUALITY CONTROL DATA

REVISION CHANGES

Apr 27, 2006	A	Initial Release		
Mar 16, 2009	B	Template change		

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