National Accreditation Board for Testing and Calibration Laboratories (NABL)

Specific Criteria for Electronics Testing Laboratories
## AMENDMENT SHEET

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1. Introduction

Laboratory accreditation activities are administered under the direction of the National Accreditation Board for Testing and Calibration Laboratories (NABL), involving Assessment Team and Accreditation Committee as recommending bodies. NABL is a signatory to Asia Pacific Laboratory Accreditation Cooperation (APLAC) and International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangements (MRA). These are based on mutual evaluation and acceptance of other MRA partner Laboratory accreditation systems. Such international arrangements allow acceptance of test/ calibration results between MRA partner countries.

The laboratories are required to comply with all the requirements listed in the international standard ISO/IEC 17025:2005 (General Requirements for the competence of Testing and Calibration Laboratories). This Specific Criteria document must be used in conjunction with ISO/IEC 17025:2005. It provides an interpretation of the latter document and describes specific requirements for those clauses of ISO/IEC 17025:2005 which are general in nature. Further, the Laboratory shall follow the national, regional and local laws and regulations as applicable.
2. Scope of Document

This criteria document provides extra information and interpretation on classes of test, personnel, accommodation and environment, equipments and other aspects of Laboratory management practices which are considered to be minimum standards for Electronics testing laboratories being accredited against NABL Laboratory Accreditation Program.

For the purpose of covering the activities pertaining to grant of accreditation, a group wise list of Electronics products and test facilities for which NABL offers accreditation is given as below, under the heading of Product groups and Test Facilities in Electronics Discipline. The way of identifying these activities for the purpose of accreditation is perhaps a convenient means of expressing an accredited Laboratory capability.

This Specific Criteria document suggests only the broad range of tests in the above mentioned categories of testing in electronics discipline for measurement of various parameters. Details pertaining to nomenclature, uncertainty, resolution, range etc. of the equipment required for carrying out the tests would be duly furnished in the application by the organisation at the time of seeking accreditation.

Dimensions / size, ranges and limits shall be indicated e.g. while indicating the environmental facilities, volume and temperature, humidity ranges shall be indicated. In EMC testing the range of level (Min. & Max) and frequency band for emission test and in immunity test, the wave form details like rise time, duration, repetition and level shall be indicated.

A typical testing scope of accreditation is shown in Annexure I.
3. **Product Groups and Test Facilities in Electronics Discipline**

The Electronics testing discipline is described in terms of Product Groups and test facilities. Where the existing group does not appear to cover the needs of a Laboratory NABL secretariat welcomes proposals for additional classes or tests to be included in this discipline. The scope of accreditation may be reviewed and extended on request, provided that the Laboratory complies with conditions for accreditation for the Product Groups and test facilities.

I. **Audio Equipment**

- Buzzers & ringers
- Loud speakers / Head phones
- Microphones
- Amplifiers
- Others

II. **IT Equipment**

- CPU / Disk drives / optical drives / Solid state drive / memory module (DIMM) / Main board
- GPU/USB devices/Wi-Fi Hub/PCI extension cards
- Keyboards
- Monitors / VDUs/Modem
- Network devices
- Personal computers / Laptop / Note Book / tablets
- Printers / scanner / Copier
- Servers
- Others

III. **Domestic Electronic Appliances & Accessories**

- AM / FM radio receiver
- Cassette players / recorders & its components
- DVD players/Blu Ray Players
- CD players / recorders & its components
- Electronic fan regulators
- Picture tubes
- LCD/LED Display/TV & its components
- TV antenna(dish)
- DTH(set-top box)
- Microwave ovens
- Static Energy meters (1 Ф and 3 Ф)
- Others
IV. Power Supplies & Stabilizers

Inverters(charge controller unit)
Regulated Power supplies(AC/DC)
UPS(online/line interactive)
Charge controller
Voltage stabilizers(step/servo motor operated)
SMPS power supplies
Others

V. Electronic Components & Equipment Sub Assemblies

Transistor Amplifiers
Attenuators/AD-DA converters
Electronic Ballast
Capacitors
Inductive Coils
Connectors
Deflection yokes
Diode
Electronic Counters
Filters
Fuses
Integrated circuits
Laminates
Oscilloscope/Function generator/ signal generator
Passive components
Plugs(excluding power supply)
Potentiometer
Printed circuit boards
Solid State Relays
Resistors
Semi-conductor devices
Switches
Transformers(excluding power supply)
Transistors
Mobile Phone - CDMA
Mobile Phone – GSM
Tab / Note pad
Transceivers
Mux-demux
Others
VI. Medical Electrical Equipment

ACT Machine
Audiometer
Auto Refractometer
BIPAP Ventilator
Blood Fluid Warmer
Blood Storage Cabinet
Boyle’s Apparatus
BP Apparatus
Brain Stimulators
Breath Hydragen(H2)monitor
Capnography
Cardiopulmonary bypass machine (CPB)
CO2 Monitor
Coagulation Analyzer
Cold light source
Cryostat
CTG Machine
Daytona
Defibrillator
Dental X Ray
Diagnostic Muscular Simulator
Diode Laser. Doppler
ECG Monitor
Echo Cardiograph
ECT machine
Electro Myography
EEG Machine
EOG Machine
Electronic Traction
Electro Cardio Graph Recorder
Endoflator
Endoscopy
ETO Sterilizer
Foetal Monitor
Field Analyzer
Glucometer
HF Surgical Diathermy
Harmonic Scalpel
Heart-Lung machine
Interferential therapy
Incubator( stationary and Portable)
Blood Filtration Appliance
Cryo Surgical Appliances (Heating Part)
Dialysis Apparatus
Electro and Phonograph( Intra Cardiac)
High Pressure Injection Equipment
Hypothermia Appliances
Incubator with CO2
Infusion Pumps
Intelligent Tourniquet
Invasive Arterial Blood Pressure (IBP)
IVF Work Station
Keratometer
Laser Surgery Equipments
Lithotripsy (Impulse Apparatus)
Magnetic Particle Imaging system (MPI)
Magnetic Resonance Imaging system (MRI)
Medical Laser Systems
Mammography
Multiparameter Monitor
Muscles Stimulator (For Diagnostic and Therapy)
Nebulizer
Nerve Stimulators
Noninvasive Blood Pressure
Nuclear Magnetic Resonance Tomographs
Oxygen Concentration Monitor
Pacemaker (External)
Pachometer
Patient Monitor
Pertdish Warmer
Phototherapy Unit
Pneumatic Drill
Pulse Oximeter
Radiant Heat Warmer
Renal Dialysis machine
Retinal Camera
Shortwave Diathermy
Perfusion Pump
Photo and Laser Coagulator
Pressure Chambers for Hyper Baric Therapy
Respirators (Not Manual)
Sigmoidoscopy
Slit Lamp with Ophthalmoscope
Spirometry Devices
Steadiometer
Surgical Diathermy
Syringe Pump
Test Tube Warmer
Therapeutic Ultrasound Device
Tonometer
Transcutaneous Electrical Nerve Stimulator
Tread Mill
Trivector Dry Bath
Ultrasonic Diathermy
Vascular Infusion System
Ventilator (Adult & Infant)
Wax Bath
Others
Equipment Used in Clinical Laboratory

Auto Clave
Hot Air oven
Cell counter
Centrifuge
Cyclomixer
Densitometer
Electronic Analytical Balance
Electrophoresis system
ELISA reader
ESR Analyser
Hot Air Sterilizer
Hot plate
Incubators
Microscope
Na, K Analyzer
Photometers (Colorimeter)
Refrigerator
Rotory shaker
Semi autoanalysers
Sterilizer
Urine analyser
VDRL shaker
Water Bath

VII. EMC Test Facility

Conducted Emission Test
Radiated Emission Test
Radiated Radio Frequency Disturbances Power Test
Voltage Fluctuation & Flicker Test
RF Radiated Susceptibility Test
Electrostatic Discharge Immunity Test
Electrical Fast Transient (EFT)
Burst Immunity Test
High Energy / Telecom Surge Immunity Test
Conducted RF Susceptibility Test
Power Frequency Magnetic Field Immunity Test
Pulse Magnetic Field Immunity Test
Damped Oscillatory wave Immunity Tests
Voltage dips, short interruption & voltage variations Immunity Test
Impulse Voltage withstand Test
Radiated Magnetic Field Emission Test
Others
VIII. Environmental Test Facility

Cold Test
Dry Heat Test
Temperature Cycling Test
Thermal Shock Test
Damp Heat (Steady State) Test
Damp Heat (Cyclic) Test
Salt Mist Test
Composite Temperature & Humidity Test
Vibration Test
Mechanical Shock Test
Bump Test
Tropical Exposure Test
Sealing Test (Gross \ Fine Leak)
Acceleration Test
Driving Rain Test
Low Air Pressure Test / Altitude Test
Robustness of Terminations Test
Drop & Topple Test
Protection against penetration of dust & water
Seismic Test
Impact Test
Mould Growth (Fungus) Test
Solar Radiation Test
Sand and dust Test
Others

IX. Safety Testing Facility

Protection from hazards
Protection from electric shock and energy hazards
Provisions for earthing and bonding
Over current and earth fault protection in primary circuits
Mechanical strength
Protection against hazardous moving parts
Resistance to fire, Touch current and protective conductor current
Electric strength test
Heating under normal operating conditions
Constructional requirements with regard to the protection against electric shock
Electric shock hazard under normal operating conditions
Insulation resistance test,
Measurement of temperature rises
Clearances and creepage distances
Abnormal operating and fault conditions
Ultraviolet light conditioning test
Hazardous radiations
Ionizing radiation
Laser radiation
Mandrel test
Protection of telecommunication network service persons, and users of other equipment connected to the network, from hazards in the equipment
Protection of equipment users from over voltages on telecommunication networks
Protection of the telecommunication wiring system from overheating
Others

X. Miscellaneous Products

Anti-static accessories, wrist strap
Communication equipment
Electro-magnetic components & equipment
Electro-mechanical components & equipment
Fire alarm systems
Franking machines
Lighting equipment, LED display Board Controller
Measuring instruments
Opto-electronic components & equipment
Photo-voltaic equipment
Piezo electric devices
Telephones/EPABX & Fax machines
Transducers
AC and DC Drives
Harness and cables
Others

The management requirements shall be addressed in accordance with ISO/IEC 17025:2005 Section 4.

5.1 General
The requirements shall be addressed in accordance with ISO/IEC 17025:2005 cl. 5.1.

5.2 Personnel
The appraisal of staff is the important part of Laboratory assessment as they shall ensure competence of all who operate the specific equipment, perform tests, evaluate results and sign the test reports. Personnel performing specific task (testing personnel) shall be qualified on the basis of appropriate education, training and experience. The Laboratory shall have policy and procedures to identify and provide the relevant training to the Personnel and also evaluate the effectiveness of the training. They shall also have knowledge about the safety rules and instructions (for Electrical / Mechanical / Physical), use of first aid kits, firefighting equipment and other safety aspects.

Testing Personnel: Graduate in Science with Physics / Electronics or diploma in Electrical / Electronics Engineering with at least one year experience or the trade certificate (ITI) with three years experience in the relevant field of testing. Personnel should have knowledge of test procedures and safety precautions to be taken during testing.

Authorized Signatory: Authorized signatory should fulfill either of the following requirements.

<table>
<thead>
<tr>
<th>Minimum Qualifications</th>
<th>Minimum Years of Experience</th>
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<tr>
<td>Degree (Engg.) / Post Graduate in Science</td>
<td>Same field of testing</td>
<td>Similar field of testing</td>
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<tr>
<td>Diploma (Engg.) / Graduate in Science</td>
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<tr>
<td>ITI / Equivalent</td>
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<td>Same field of testing</td>
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Note -
(a) Similar field may be considered when that particular subject / field of testing is covered in at least one year of the course;
(b) In each case, merely requisite qualifications and experience is not sufficient to become the Authorized signatory; the technical competence will be verified by NABL assessment team before recommending as authorized signatory;
(c) For EMI/EMC, qualification in ‘Similar field’ and ITI / equivalent shall not be considered.
Special Requirements EMC or Safety Testing

**Testing Personnel:** Graduate in Science with Physics / Electronics or diploma in Electrical / Electronics Engineering with at least one year experience in the EMI/EMC or safety testing. Personnel should have knowledge of test procedures and safety precautions to be taken during testing.

**Authorised Signatory:** Personnel shall have sound knowledge of the principles of Electro-magnetic interference & compatibility including regulations for EMI/EMC testing and risk & hazards involved for safety testing and evaluation of the test results including uncertainty of test results and interpretation of standard & international norms.

5.3 **Accommodation and Environmental Condition**

Laboratory facilities for testing including lighting, environmental conditions and energy source shall be as required by the relevant specification to ensure correct performance of tests. The Laboratory shall monitor, control and record environmental conditions to ensure continued conformance with the requirements. The technical requirements for accommodation and environmental conditions that can affect the results of tests shall be documented and tests shall be stopped when the environmental conditions adversely affect the required accuracy of measurement. Layout of the Laboratory shall be well defined to perform the desired tests. There shall be sufficient space around test equipment to minimize the risk of damage or danger and to provide for convenient and accurate operation and measurement. The electrical wiring, water & gas / air connection (for chambers) shall be fail safe and to be concealed wherever possible.

Various other environmental conditions to be maintained in the Laboratory depending upon the type of product being tested or type of test being conducted.

The flooring shall have antistatic covering and test personnel shall ensure that all static protection measures are taken while testing static sensitive devices. Wherever applicable (as in case of EMC testing / HV testing antistatic is not required).

The Laboratory shall be properly sealed to minimize the effects of external noise, wherever applicable.

Testing shall be undertaken in a shielded cage/enclosure to minimize the interference, wherever applicable.
Wherever the accuracy of measurements is adversely affected, the testing area shall be free from influence of vibration (due to vehicular movements, heavy machinery, bump & Vibration test(open type), proximity to lifts, plant rooms, workshops, walkways, busy roads, railway tracks) and other sources of noise and vibration should be avoided.

Satisfactory grounding is a critical element to measurement integrity and personnel safety in the testing laboratories. Dedicated earthing shall be provided to the test Laboratory as per relevant specification, IS:3043. The earth resistance of the Laboratory shall be less than 2Ω. The earth pit shall be maintained, monitored and necessary records of earth resistance shall be maintained. Measurement & recording shall be done at least twice in a year.

The Laboratory shall monitor, control and maintain records of the Laboratory power source to ensure continued conformance with the requirements. Considerations to be taken into account include changes in characteristics of the power as supplied by the electric utility (or other source), changes in load conditions on the power source substation due to power consumption of neighboring areas and affects of other testing being conducted in the Laboratory. The power to the testing Laboratory and test bench should be on a phase independent of the other electrical circuits as far as transients for which necessary starters / line filters, stabilizers and isolation transformers, MCB, RCCB shall be provided. The power supply shall be provided with a regulated standby power supply of adequate capacity wherever required by the test method or standard. When not otherwise specified in the testing standard, the power source used for testing shall meet the following requirements:

Voltage stability: ± 6 % maximum

Frequency stability: ± 3 % maximum

Total Harmonic Distortion in EMC testing & laboratory: < 3%

The Laboratory shall be maintained at an ambient temperature( of DUT & Measuring equipment ) of 25 degree centigrade with tolerances to be decided as per the requirements and sensitivity of measurements being made by the Laboratory. The relative humidity shall be between 45 and 75 percent Rh. Both temperature and humidity shall be effectively monitored and recorded periodically. Where necessary, atmospheric pressure shall also be monitored and air curtains shall be provided.
If the parameters to be measured depend on temperature and/or pressure and the law of dependence is known, the values shall be measured in the conditions specified below and, if necessary, be corrected by calculation to the standard reference atmospheric conditions.

Temperature: 15 °C to 35 °C (25 ±10)  
Relative humidity: Upto 75 % In case of ESD it is < 60%

The light fittings should be chosen to ensure adequate illumination at the work bench without glare and radiated/conducted disturbance. The illumination should be minimum 300 lux.

**Other Requirements:** There shall be all evidence of the implementation of all necessary safety measures including first aid kits within the reach of all staff members and safety instructions shall be displayed prominently. Fire fighting equipment and fire exits shall be provided adequately. The flooring shall have antistatic covering and test personnel shall ensure that all static protection measures are taken while testing static sensitive devices. Wherever applicable (as in case of EMC testing / HV testing antistatic is not required).

**Site Testing**

The site test Laboratory shall monitor, and record environmental and Power Supply conditions to ensure continued conformance with the requirements as specified in the relevant test standard. Where the environment may affect the instrumentation, the test specimen or the measurement and test data, the data shall be qualified as per the requirements of relevant standard. (Refer NABL 130).

In case of on-site EMC testing, the procedure for packing of measuring equipment, in particular the antenna shall be defined and verification to be done. Grounding continuity is to be ensured. Ambient RF noise < 6dB below the limit line.

Where tests are undertaken in a hostile or unstable environment or in an environment that may affect the test results, there shall be procedures for monitoring these conditions and the effect of the environment on the performance of the test. This monitoring shall be documented.

There shall be provisions for restricting access to the site test Laboratory & use of any electronic gadget which may adversely affect the measurements.
Additional Requirements for EMC Testing Laboratories

Requirement for Open Area Test Site (OATS)
An environment is required that assures valid, repeatable measurement results of disturbance field strength from equipment.
Disturbance field strength measurement are normally perform at OATS, are area characteristic of cleared level terrain as per CISPR 16-1-4 annexure B.

The site validation procedure for OATS as per CISPR 16-1-4 Annexure E and Annexure F containing acceptance criteria.

The OATS shall conform to the relevant specification of CISPR 16-1-4 and CISPR 16-1-5 for its physical and electrical properties and for its validation.

Normalized Site Attenuation for Alternate Test Site
For an alternate test site, a single NSA is insufficient to pick up possible reflection from the constructive and/or RF absorber material comprising the walls and ceiling of the facility. The alternate test site is considered suitable for performing radiated emission testing if all NSA measure meets the requirement of 5.33 of CISPR 16-1-4.

Site Attenuation
A measurement site shall be considered acceptable for radiated electromagnetic field measurement if the measured horizontal and vertical NSA measured are within + 4dB of the NSA of ideal site.

Test site (Semi Anechoic chamber) for measurement of radio disturbance field starting from the range 1GHz to 18 GHz.
The test site shall relay on reflection-free condition. It may be necessary to use absorbing material and/or to raise the height of the EUT to achieve free space condition.

A test site shall be considered acceptable for radiated electromagnetic field measured in 1GHz-18GHz if it satisfying the criteria prescribed in 8.3.2, 8.3.3 site validation procedure given in CISPR 16-1-4.
Measurement in absorber-lined shielded chamber

Measuring in absorber-lined shielded chamber with ground plane (Semi Anechoic chamber-SAC)

Requirement for calibration test site, used to perform antenna calibration as well as the test antenna characteristic, Site verification procedure and site compliance criteria CISPR 16-1-5.

A test site suitable for performing antenna calibration is intended to provide a suitable environment to calibrate an antenna for its free-space antenna factor. The characteristic are a per sub clause 4.3-4.6 of CISPR 16-1-5.

5.4 Test Methods and Method Validation

The Laboratory shall use appropriate methods and procedures for all tests within its scope. These include sampling, handling, transport, storage and preparation of items to be tested, and, where appropriate, an estimation of the measurement uncertainty as well as statistical techniques for analysis of test data. The Laboratory shall have instructions on the use and operation of all relevant equipment, and on the handling and preparation of items for testing, where the absence of such instructions could jeopardize the results of tests. Deviation from test methods shall occur only if the deviation has been documented, technically justified, authorised, and accepted by the customer.

Laboratory, whenever using non-standard methods or a standard method beyond its stated limits of operation is required to validate such test methods. Validation of a method establishes, by systematic Laboratory studies, that the performance characteristics of the method meet the specifications related to the intended use of the results.

Estimation of Uncertainty of Measurement

Electronics testing laboratories certifying conformance with specification limits for safety and electromagnetic compatibility tests must define and document a policy on calculation of measurement uncertainties. The policy must include consideration of all contributions to uncertainty (type A and type B) (In many cases repetition of tests are not practical due to time, cost, deterioration) and must define the method the Laboratory will use to combine these effects and the confidence interval within which the test result can be expressed.
Where relevant, measurement uncertainties must be reported in test reports. When test results lie within the uncertainty band about a specification limit, the Laboratory must define its policy on reporting conformance and must report the uncertainty.

Please refer NABL 141, CISPR 16 for further reference.

5.5 Equipment

General
The Laboratory shall be furnished with all items of measurement and test equipment required for the correct performance of the tests.

As part of its quality system, a Laboratory is required to operate a programme for the maintenance and calibration of equipment used in the Laboratory. Calibrations or performance checks will be necessary where the setting can significantly affect the test.

Appropriate accessories should be used with test equipment wherever impedance matching, contact losses, lead length affect the quality of test results.

EMC Testing Equipment
For EMC testing measuring apparatus shall comply to CISPR 16-1-1, which specifies the characteristics and performance for the measurement of radio disturbance voltages, currents and fields in the frequency range 9 kHz to 18 GHz.

The measurement instrument, including antennas, shall conform to the relevant requirement in CISPR 16-1-1 and CISPR 16-1-4

Antennas of the type that are used for radiated emission measurements, having been calibrated, shall be used to measure the field strength. When the antenna is connected to the measuring receiver the measuring system shall comply with the bandwidth requirement of CISPR 16-1-1 appropriate to the frequency band concerned.
5.6 Measurement Traceability
Testing Laboratory is required to establish and maintain traceability of test results through an appropriate and established program of calibration. Traceability requirements shall comply with the requirements of NABL-142.

The test equipment shall be calibrated periodically. Based on the data generated in scientific way by successive calibrations the periodicity may be decided with the help of ISO 10012. In the absence of the availability of the accredited calibration facility for particular parameter, the data for that particular parameter may be compared among at least three accredited laboratories so as to generate the scientific data which shall conform to requirement of the relevant standard.

EMC Antenna Calibration
Methods specified in ANSI C63.5 or CISPR 16-1-5 shall be followed for EMC antenna calibration, or the traceability to a National laboratory and whether antennas are calibrated individually. A test site suitable for performing antenna calibration is intended to provide a suitable environment to calibrate an antenna for its free space antenna factor. The characteristics are as per sub clause 4.3-4.6 of CISPR 16-1-5.

5.7 Sampling
The test reports are issued for the product tested and hence sampling is not generally applicable. The test report does not represent the result of entire lot but only of the samples tested. In case sampling is requested by the customer, standard method for sampling is to be followed.

5.8 Handling of Test Items
The laboratory shall have procedures for the transportation, receipt, handling, protection, storage, retention and/or disposal of test items including all provisions necessary to protect the integrity of the test item and interests of the laboratory and the customers.

5.9 Assuring the Quality of Test and Results
The tests performed shall be monitored by using quality control procedures appropriate to the type and frequency of the testing undertaken. The range of quality control activities available to laboratories include the use of:

- Control charts
- Replicate testing
Alternative methods
Correlation of results
Retesting of retained items
PT/ILC (only for quantitative test)

Depending on the particular test, one or more of these examples may be appropriate. Quality control procedures must be documented. A record must be retained to show that appropriate quality control measures have been taken, that quality control results are acceptable or, if not, that remedial action has been taken. In case where data loggers are not used to monitor the simulated environmental conditions, lab should maintain the records of periodic checks with respect to temperature profiling including ramp rate checks are to be included in quality control measures. Where appropriate, quality control data must be recorded in such a way that trends in analysis can be readily evaluated. It is desirable to participate in proficiency testing for quantitative tests for better quality assurance of test results.

Applicant Laboratory shall successfully participate in one PT program prior to gaining accreditation. Accredited Laboratory shall have 4-year plan for Proficiency Testing participation which shall cover all the accredited groups as practicable. In case when formal PT Programs are not available or appropriate, alternatively the applicant / accredited laboratories may participate in suitable inter-Laboratory comparisons with adequate number of accredited laboratories, as per NABL 162.

5.10 Reporting the Results

General
The results of each test, or series of tests carried out by the Laboratory shall be reported accurately, clearly, unambiguously and objectively, and in accordance with any specific instructions in the test methods.

Test Reports
Each test report shall include the photograph of test setup along with graphs/plots shall be attached wherever applicable.

The EMC Laboratory shall issues test reports giving clearly, unambiguously and objectively final results in the form of a table and/or graphs, setup photographs and list of EMC components with reference to specific standard applicable for the test.
All test reports will include the following for the interpretation of the test results:
Where relevant, a statement of compliance/non-compliance with requirements and / or specifications shall be given. Where applicable, a statement on the estimated uncertainty of measurement shall be given. Information on uncertainty is needed in test reports when it is relevant to the validity or application of the test results or when the uncertainty affects compliance to a specification limit. (When the test certificate is used for meeting the regulatory requirements the test result shall be reported along with uncertainty)
## Sample Scope

### Audio Equipment

<table>
<thead>
<tr>
<th>Product(s) / Material of test</th>
<th>Specific tests performed</th>
<th>Test Method / Standard against which tests are performed</th>
<th>Range of testing/ Limits of detection</th>
<th>Uncertainty of Measurement (±)</th>
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<tr>
<td><strong>TV Receiver Audio Video Equipments</strong></td>
<td>Visual Examination</td>
<td>IS: 10662-92 Reaffirmed 2003</td>
<td>Qualitative</td>
<td>NA</td>
</tr>
<tr>
<td>VSWR</td>
<td>&lt; 2 for 5 MHz Band</td>
<td>Up to 2700V 30Hz to 70 Hz</td>
<td>0.1 at 5 MHz</td>
<td></td>
</tr>
<tr>
<td>Power Supply requirement -Voltage -Frequency</td>
<td></td>
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<tr>
<td>Power Consumption</td>
<td>25 mW to 200 kW&lt;sub&gt;PK&lt;/sub&gt;</td>
<td></td>
<td>0.2% at 200 kW</td>
<td></td>
</tr>
<tr>
<td><strong>Vision: Picture Quality</strong></td>
<td>-Aspect Ratio</td>
<td>4:3</td>
<td>1% at 736 mm</td>
<td></td>
</tr>
<tr>
<td>-Definition and Focus</td>
<td>200 to 600 lines</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sensitivity</strong></td>
<td>-Gain limited Sensitivity</td>
<td>- 127 dB&lt;sub&gt;mw&lt;/sub&gt; to 13 dB&lt;sub&gt;mw&lt;/sub&gt;</td>
<td>1% at 13 dB</td>
<td></td>
</tr>
<tr>
<td>-Color Sensitivity</td>
<td>- 127 dB&lt;sub&gt;mw&lt;/sub&gt; to 13dB&lt;sub&gt;mw&lt;/sub&gt;</td>
<td>1% at 13 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synchronizing Sensitivity</td>
<td>- 127 dB&lt;sub&gt;mw&lt;/sub&gt; to 13dB&lt;sub&gt;mw&lt;/sub&gt;</td>
<td>1% at 13 dB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Electronic Components

<table>
<thead>
<tr>
<th>Product(s) / Material of test</th>
<th>Specific tests performed</th>
<th>Test Method Standard against which tests are performed</th>
<th>Range of testing/ Limits of detection</th>
<th>Uncertainty of Measurement (±)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacitors</strong></td>
<td>Capacitance</td>
<td>IS 4317 (1983)</td>
<td>0.01 pF to 1999 mF</td>
<td>0.4% at 1999 mF</td>
</tr>
<tr>
<td></td>
<td>Tangent of Loss Angle</td>
<td>IS 9256 (1979)</td>
<td>0.0001 to 9.999</td>
<td>0.5% at 0.8</td>
</tr>
<tr>
<td></td>
<td>Impedance</td>
<td>IS 9638 (1980)</td>
<td>0.001mΩ to 19.999MΩ</td>
<td>0.5% at 19.99 MΩ</td>
</tr>
<tr>
<td></td>
<td>Inductance</td>
<td>IS 7305 (1984)</td>
<td>0.001 nH to 1999.9 H</td>
<td>2% at 1999.9 H</td>
</tr>
<tr>
<td></td>
<td>Insulation Resistance</td>
<td>IEC 60384 (2008)</td>
<td>At 500 VDC</td>
<td>2% at 2x10(^{16}) Ω</td>
</tr>
<tr>
<td></td>
<td>Outer Foil Termination</td>
<td>JSS 50200 (2003)</td>
<td>I.R.:2x10(^{16}) Ω (max)</td>
<td>1% at 2x10(^{-5}) A</td>
</tr>
<tr>
<td><strong>Resistors</strong></td>
<td>Resistance</td>
<td>IS 5786(1978)</td>
<td>Upto 100 M Ω</td>
<td>0.8% at 100 MΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEC 60115 (2001-05)</td>
<td>Resolution : 100μΩ</td>
<td>2% at 2x10(^{16}) Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JSS 50400 (1996)</td>
<td>I.R. : 2x10(^{16}) Ω max</td>
<td>NA</td>
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<tr>
<td></td>
<td>Insulation Resistance</td>
<td></td>
<td>Test Voltage : 100V, 250 V, 500 V, 1000 DC</td>
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<tr>
<td></td>
<td>Voltage Proof</td>
<td></td>
<td>Qualitative (Upto 15.5 kV ac &amp; 40kV DC at)</td>
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<tr>
<td></td>
<td>Temperature Characteristics of Resistor</td>
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<td>I(_L) : 5 mA max AC/DC)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>100 Ω to 100MΩ at -40°C to 125°C</td>
<td>0.5% at 100 MΩ</td>
</tr>
</tbody>
</table>
| Noise | Overload Life | For R: 10 Ω to 250MΩ  
Noise voltage: 0.6 µV in a decade to 1000 µV in a decade  
Noise: 48 dB (Max.)  
3 kV max.  
V: up to 1000 V DC  
Time: 1 sec to 999 min (on/off) | 0.5% at 1000 µV  
0.5% at 1000 V  
2% at 10 min |
## IT Equipment

<table>
<thead>
<tr>
<th>Product(s) / Material of test</th>
<th>Specific tests performed</th>
<th>Test Method / Standard against which tests are performed</th>
<th>Range of testing/ Limits of detection</th>
<th>Uncertainty of Measurement (±)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information Technology Equipment</strong> (Computer Systems, Monitors, Printers, Scanners, Keyboards, Telephones &amp; Automatic Data Processing Machine)</td>
<td>Input</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001 First Edition (clause 1.6.2)</td>
<td>1 mA to 20 A Upto 2000 W</td>
<td>0.5% at 20 A 0.5% at 2000 W</td>
</tr>
<tr>
<td></td>
<td>Heating</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001 First Edition (clause 4.5.1)</td>
<td>Qualitative Up to 400°C</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Abnormal operations</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001 First Edition (clause 5.3.1)</td>
<td>Qualitative Up to 400°C</td>
<td>NA</td>
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<tr>
<td></td>
<td>Humidity conditioning</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001 First Edition (clause 2.9.1)</td>
<td>Qualitative 20°C to 100°C 93% RH to 95% RH</td>
<td>NA</td>
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<tr>
<td></td>
<td>Dielectric strength</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001 First Edition (clause 5.2)</td>
<td>Qualitative 10 V to 10 kV AC/DC 10 to 900 Sec</td>
<td>NA</td>
</tr>
<tr>
<td>Test Category</td>
<td>Standard Details</td>
<td>Specification</td>
<td>Result</td>
<td></td>
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<tr>
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<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>Touch current</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001 First Edition (clause 5.1)</td>
<td>0.005 mA to 4 mA</td>
<td>0.5% at 4 mA</td>
<td></td>
</tr>
<tr>
<td>Accessible connector overload test</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001 First Edition (clause 5.3.7)</td>
<td>0°C to 400°C 0.1 V to 60 V 20A max 800 VA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Earthing test</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001 First Edition (clause 2.6.3.4)</td>
<td>0.001 Ω to 0.3 Ω</td>
<td>1% at 0.3 Ω</td>
<td></td>
</tr>
<tr>
<td>Limited power source measurement test</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001 First Edition (clause 2.5)</td>
<td>0.1 V to 60 V 20 A max 800 VA</td>
<td>0.3% at 60 V 0.5% at 20 A 0.8% at 800 VA</td>
<td></td>
</tr>
<tr>
<td>Component failure test</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001 First Edition (clause 5.3.1)</td>
<td>Qualitative Up to 400 °C</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Steady force test</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001 First Edition (Clause 4.2.1)</td>
<td>Qualitative 10 g to 80 Kg 0.1 to 60 Sec</td>
<td>NA</td>
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<tr>
<td>Test Type</td>
<td>Standard Details</td>
<td>Result Description</td>
<td>Notes</td>
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<tr>
<td>Impact test</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001</td>
<td>Qualitative (1.0 J to 6.8 J)</td>
<td>NA</td>
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<td></td>
<td>First Edition (Clause 4.2.5)</td>
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<tr>
<td>Stability test</td>
<td>UL 60950-1 First Edition 2006-07-07/ CSA C22.2 No.60950-1-03/ IEC 60950-1:2001</td>
<td>Qualitative 1º to 15º</td>
<td>NA</td>
<td></td>
</tr>
<tr>
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<td>First Edition (Clause 4.1)</td>
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</table>
## Medical Diagnostic & Therapeutic Equipment

<table>
<thead>
<tr>
<th>Product(s) / Material of test</th>
<th>Specific tests performed</th>
<th>Test Method / Standard against which tests are performed</th>
<th>Range of testing/ Limits of detection</th>
<th>Uncertainty of Measurement (±)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety of Medical Electrical Equipment</td>
<td>Power Input</td>
<td>IS 13450 : 2008 Sec 1 IEC-60601-1, ed. 3.0 : 2005</td>
<td>Power: 25 mW to 400 kW&lt;sub&gt;Pk&lt;/sub&gt; Voltage: 0.5 to 2000 V&lt;sub&gt;Pk&lt;/sub&gt; Current: 0.05 to 200 A&lt;sub&gt;Pk&lt;/sub&gt;</td>
<td>1% at 400 kW&lt;sub&gt;Pk&lt;/sub&gt;</td>
</tr>
<tr>
<td>Protection Against Electric Shock &amp; Energy Hazards</td>
<td>Qualitative</td>
<td>Upto 200 N Up to 20 mA Up to 25 A, 12 V DC Voltage: 200 mV to 1000 V AC Voltage: 200 mV to 750 V Up to 5 kV AC, Up to 20 mA AC</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Protection Against Mechanical Hazards</td>
<td>Qualitative</td>
<td>Up to 200 mm Up to 200 N 0.5 Nm</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Product(s) / Material of test</td>
<td>Specific tests performed</td>
<td>Test Method / Standard against which tests are performed</td>
<td>Range of testing/ Limits of detection</td>
<td>Uncertainty of Measurement (±)</td>
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<tr>
<td>Electronic Products</td>
<td>Cold (Low Temperature)</td>
<td>IS 9000 (Part II/Sec 1 to 4); 1977 IEC 60068-2-1:2007 JSS 55555:2000 QM 333/Issue-2:2010</td>
<td>LxWxH mm Qualitative Ambient to (-)75 ºC</td>
<td>NA</td>
</tr>
<tr>
<td>Dry Heat (High Temperature)</td>
<td></td>
<td>IS 9000: (Part III/ Sec 1 to 5) 1977 IEC 60068-2-14:2009 JSS 55555:2000 QM 333/Issue-2:2010</td>
<td>LxWxH mm Qualitative Ambient to 180 ºC 180 ºC - 250 ºC</td>
<td>NA</td>
</tr>
<tr>
<td>Change of Temperature</td>
<td></td>
<td>IS 9000: (Part 14) 1986 IEC 60068-2-14:2009 JSS 55555:2000 QM 333/Issue-2:2010</td>
<td>LxWxH mm Qualitative (-)75 ºC to 180 ºC 180 ºC - 250 ºC</td>
<td>NA</td>
</tr>
<tr>
<td>Damp Heat Cyclic</td>
<td></td>
<td>IEC 60068-2-30:2005 IS 9000:1986 (Part V) QM 333/Issue-2:2010</td>
<td>Qualitative LxWxH mm 25 ºC to 85 ºC 40 %RH to 95 %RH</td>
<td>NA</td>
</tr>
<tr>
<td>Test Type</td>
<td>Standards/Specifications</td>
<td>Requirements</td>
<td>Notes</td>
<td></td>
</tr>
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<td>------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
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<tr>
<td>Dust Test</td>
<td>IS 9000:1981 (Part XII) JSS 55555:2000 QM 333/Issue-2:2010</td>
<td>Qualitative 1m x 1m x 1m Dust collect (25 ± 5) g Ambient to 40 °C</td>
<td>NA</td>
<td></td>
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<tr>
<td>Composite Temperature</td>
<td>IEC60068-2-38:2009 IS 9000:1978 (Part VI) JSS 55555:2000 QM 333/Issue-2:2010</td>
<td>Qualitative LxWxH mm (-)10 °C to 65 °C 70 %RH to 95 %RH</td>
<td>NA</td>
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<tr>
<td>Humidity</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Vibration</td>
<td>IEC 60068-2-6:2007 IS 9000:Part VIII)1981 JSS 55555:2000 QM 333/Issue-2:2010</td>
<td>Qualitative 5 Hz to 3.0 kHz sweep ± 0.035 mm to 50 mm in Y axis at 10 m/sec² to 700 m/sec² Force : upto 100kgf</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Standard &amp; Guideline</td>
<td>Description</td>
<td>Notes</td>
<td></td>
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<tr>
<td>Drop &amp; Topple</td>
<td>IS 9000:1979 Part VII Sec 3 &amp; 4 QM 333/Issue-2:2010</td>
<td>Qualitative 1 N to 1000 N Drop height 25, 50, 100, 250, 500 mm</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>
## Safety Testing

<table>
<thead>
<tr>
<th>Product(s) / Material of test</th>
<th>Specific tests performed</th>
<th>Test Method / Standard against which tests are performed</th>
<th>Range of testing/ Limits of detection</th>
<th>Uncertainty of Measurement (±)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating</td>
<td></td>
<td>Upto 400 °C  Depends upon type of Thermocouple used (5 °C to 300 °C)  Upto 20 kΩ</td>
<td>1% at 75 °C  1% at 0.3 kΩ</td>
<td></td>
</tr>
<tr>
<td>Constructional Requirements - Creepage Distances and Clearance</td>
<td></td>
<td>Upto 200 mm</td>
<td>1% at 200 mm</td>
<td></td>
</tr>
<tr>
<td>Protection against Electric Shock</td>
<td></td>
<td>Up to 200 N  Up to 20 mA  Up to 25 mA,12 V  DCV: 200 mV to 1000V  ACV: 200 mV to 750V  Up to 5kVAC  Up to 200 mm</td>
<td>NA</td>
<td></td>
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<tr>
<td>Insulation Requirements - Surge test - Insulation Resistance - Dielectric Strength</td>
<td></td>
<td>Up to 25 kV  1000 MΩ  Up to 5kVAC</td>
<td>NA  2% at 1000 MΩ  NA</td>
<td></td>
</tr>
<tr>
<td>Mechanical Strength</td>
<td></td>
<td>Qualitative  Up to 200 N  Up to 5 Nm</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>External Flexible Cable</td>
<td></td>
<td>Up to 200 mm  Qualitative (Up to 25Nm)</td>
<td>1% at 200 mm  NA</td>
<td></td>
</tr>
<tr>
<td>Mechanical Strength of Picture Tubes</td>
<td>Qualitative 230 g 1.5mm to 100 mm</td>
<td>NA</td>
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<tr>
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<tr>
<td>Stability</td>
<td>Qualitative (Up to 200 N)</td>
<td>NA</td>
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<tr>
<td>Product(s) / Material of test</td>
<td>Specific tests performed</td>
<td>Test Method / Standard against which tests are performed</td>
<td>Range of testing/ Limits of detection</td>
<td>Uncertainty of Measurement (±)</td>
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<tr>
<td>Electrical / Electronic Product</td>
<td>Conducted Emission Test</td>
<td>CISPR 11,2004-06, CISPR 22,2006-03, CISPR 25,2002-08</td>
<td>9kHz to 30 MHz Up to 90 dBμV</td>
<td>3.4 dB (2dB with respect to level) at 10 MHz</td>
</tr>
<tr>
<td>Radiated Emission Test</td>
<td>CISPR 11, 2004-06, CISPR 25,2002-08, CISPR 22,2006-03</td>
<td>30MHz to 18GHz Up to 90 dBμV</td>
<td>3.08 dB (2dB with respect to level) at 500 MHz</td>
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</tr>
<tr>
<td>Radiated Radio Frequency Disturbances Power Test.</td>
<td>BS EN 55014-1,2006</td>
<td>30 MHz to 300 MHz Up to 70 dBpW</td>
<td>2dB at 100MHz</td>
<td></td>
</tr>
<tr>
<td>Harmonic Current Emission Test</td>
<td>IEC 61000-3-2,2005, BS EN 61000-3-2,2006, IEC 60601-1-2,2006</td>
<td>Upto 40th Harmonics</td>
<td>NA</td>
<td></td>
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<tr>
<td>Voltage Fluctuation &amp; Flicker Test</td>
<td>IEC 61000-3-3,2005, BS EN 61000-3-3,2006</td>
<td>16.6A/ Phase</td>
<td>NA</td>
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<tr>
<td>RF Radiated Susceptibility Test</td>
<td>BS EN 61000-4-3,2007-11, IEC 61000-4-3,2006, CISPR 24,2002</td>
<td>For 3 m Distance: 10kHz to 30 MHz 10V/m 24MHz to 1GHz 30V/m 1GHz to 6 GHz 75V/m For 1m Distance: 200MHz to 1GHz 100V/m 1GHz to 2GHz 75V/m</td>
<td>NA</td>
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<tr>
<td>Test Description</td>
<td>Standards</td>
<td>Maximum Value</td>
<td>Notes</td>
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<tr>
<td>Electrostatic Discharge Immunity Test</td>
<td>BS EN 61000-4-2,2001 IEC 61000-4-2,2001 BS EN 55014-2,1997</td>
<td>Up to 25kV</td>
<td>NA</td>
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<tr>
<td>Electrical Fast Transient (EFT) / Burst Immunity Test</td>
<td>BS EN 61000-4-4,2004 IEC 61000-4-4,2004</td>
<td>Up to 4.4kV</td>
<td>NA</td>
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</tr>
<tr>
<td>High Energy / Telecom Surge Immunity Test</td>
<td>BS EN 61000-4-5,2006 IEC 61000-4-5,2005</td>
<td>Up to 7.4kV</td>
<td>NA</td>
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</tr>
<tr>
<td>Conducted RF Susceptibility Test</td>
<td>BS EN 61000-4-6,2007 IEC 61000-4-6,2004 CISPR 24,2002</td>
<td>150kHz to 400MHz</td>
<td>NA</td>
<td></td>
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<tr>
<td>Power Frequency Magnetic Field Immunity Test</td>
<td>BS EN 61000-4-8,2001 IEC 61000-4-8,2001 BS EN 55014-2,1997</td>
<td>Up to 1000 A/m</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Ring Wave / Damped Oscillatory wave Immunity Tests</td>
<td>BS EN 61000-4-12,2006 IEC 61000-4-12,2001</td>
<td>Ring Wave: 7.4kV</td>
<td>NA</td>
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<tr>
<td></td>
<td></td>
<td>Damped: Up to 3.3kV</td>
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<tr>
<td>Pulse Magnetic field Immunity test</td>
<td>BS EN 61000-4-9,1994 IEC 61000-4-9,2001</td>
<td>1000 A/m</td>
<td>NA</td>
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</table>
## REFERENCES

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<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>3.</td>
<td>CISPR - 16</td>
<td>Specification for radio disturbance and immunity measuring apparatus and methods</td>
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<tr>
<td>4.</td>
<td>NABL 130</td>
<td>Specific Criteria for Site Testing and Site Calibration Laboratories</td>
</tr>
<tr>
<td>5.</td>
<td>NABL 142</td>
<td>Policy on Calibration and Traceability of Measurements</td>
</tr>
<tr>
<td>6.</td>
<td>NABL 162</td>
<td>Proficiency Testing Programme for Testing and Calibration Laboratories</td>
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<tr>
<td>7.</td>
<td>NABL 163</td>
<td>Policies &amp; procedures for Inter-Laboratory Comparisons and/ or Proficiency Testing</td>
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<tr>
<td>8.</td>
<td>NABL 174</td>
<td>Sample Calculation for Uncertainty of Measurement in Electrical Testing</td>
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<td>9.</td>
<td>IS 12360:1988</td>
<td>Voltage Bands for Electrical Installations including preferred voltages and frequency</td>
</tr>
</tbody>
</table>