

Prepared (also subject responsible if other)		No.		
ENC/EN/L Beryl HE		1701-FCH 102 02 Uen		
Approved	Checked	Date	Rev	Reference
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## Test methodes for monitoring ESD protection

### Abstract

This document specifies the requirement for regular functional testing of ESD-approved products and also describes the test environment. The document constitutes a summary of existing test methods for ESD-approved products. It can be adapted to form a local document if you only wish to define the control methods used locally.

### Application

These instructions, or their equivalent, are to be applied at all units within the Ericsson group and those of external suppliers of services and products where ESDS (Electro Static Discharge Sensitive) devices are handled. Time intervals between functional inspections are specified in document 1003-FCH 102 02.

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# 1 General

## 1.1 General information

Devices used for protection against ESD are exposed to wear and contamination. To ensure cleaning and maintenance measures are sufficiently rigorous for maintaining their protective function, regular routine inspections must be conducted in accordance with this document.

## 1.2 Documentation

To prove that the ESD protection is monitored and functions properly, the results of test must be documented. And the storage time according to local definition, recommend at least one year.

## 1.3 Measurement environment

The inspection is performed in the user environment concerned.

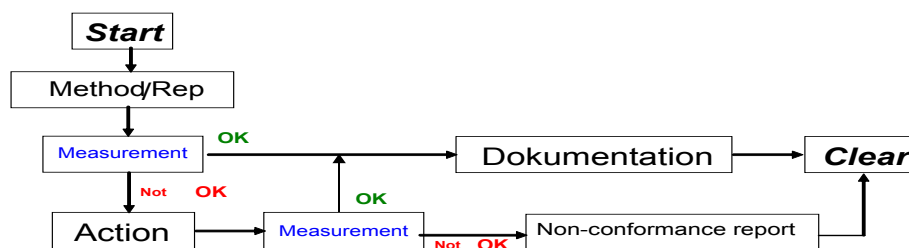
## 1.4 Detergents

The detergents prescribed/recommended by the supplier are to be used.

## 1.5 Deviations

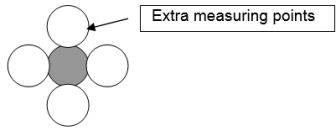
If a test reveals deviations, a deviation, report shall be prepared.

## 1.6 Work flow



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## 2 Test Method

Tested Items	Requirements	Test Method	
<b>Test of Table Coverings /Shelf</b>	<p>The discharge resistance of installed (loose-lying or glued) coverings/shelf should be <b>0.75 – 100 MΩ</b></p> <p>Measured from the surface of the covering to the equipment or EPA earth.</p>	<ul style="list-style-type: none"> <li>The covering should be brushed off with a soft brush before measuring.</li> <li>The discharge resistance should be measured in at least 3 points per m<sup>2</sup> of covering, evenly distributed over the surface.</li> </ul>	<p><b>Testing with insulation meter</b> Connect the instrument's grounding terminal to EPA ground and measuring socket to the measuring electrode, 2.27 Kg, which is placed on the surface to be measured.</p> <p>Measure with the insulation tester. Measuring voltage 100 volts.</p>
<b>Test of Wrist Strap Sockets</b>	<p>The resistance should be <b>&lt; 2 MΩ</b>.</p> <p>All wrist strap sockets must be grounded.</p>	Measure the resistance for all wrist strap sockets to ground.	<p><b>Testing with ohmmeter (multimeter)</b> Connect the instrument's grounding terminal to EPA ground and measuring socket to the measuring electrode, 2.27 Kg, which is placed on the surface to be measured.</p>
<b>Testing Floors</b>	<ul style="list-style-type: none"> <li>The discharge resistance must be <b>≤ 100 MΩ</b></li> </ul> <p>When measured from the surface of the floor to the facility ground or EPA ground. The EPA area should be divided up into surfaces to be documented.</p> <p><b>Accepted level</b> The following criteria must be met for a test surface to be approved:</p> <ul style="list-style-type: none"> <li>Discharge resistance must be <b>≤ 100 MΩ</b> for a minimum of 95% of all measuring points. <i>The extra measuring points must not be included.</i></li> <li>The discharge resistance for all extra measuring points must be <b>≤ 100 MΩ</b>.</li> </ul>	<ul style="list-style-type: none"> <li><b>General:</b> The floor covering should be brushed off at the measuring points with a soft brush before measuring. A reading should be taken 15 seconds after applying voltage.</li> <li><b>Selection and number of measuring points</b> One measuring point per 10 m<sup>2</sup>, but a minimum of five (5) points per test surface must be measured.</li> </ul> <p>The measuring points must be distributed evenly over the surface. If possible, measurements should be taken straight across as well as the furthest point possible away from any grounding wire.</p> <p><b>NB.</b> The number of measuring points per test surface shall be increased to 40 if the measured value within a test surface exceeds the maximum limit. These measuring points should be evenly distributed over the whole "measuring surface". Moreover, 4 extra measuring points should be added around each original measuring point where the measured value has exceeded the maximum limit.</p>	<p><b>Testing with floor measuring stick</b> Connect the instrument's grounding cable to EPA ground. Press on the instrument so that it touches bottom against the surface to be measured. The green light-emitting diode "OK" lights up when the control result is approved.</p> <p><b>Testing with insulation tester</b> Connect the instrument's grounding terminal to EPA ground and measuring socket to the measuring electrode, 2,27 Kg, which is placed on the surface to be measured. Measure with the insulation tester. Measuring voltage 100 volts.</p> 

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<b>Testing Chairs</b>	<ul style="list-style-type: none"> <li>Discharge resistance must be <math>\leq 100 \text{ M}\Omega</math></li> <li>Measured from the seat of the chair, backrest and armrest, if applicable, to the floor.</li> </ul>	<ul style="list-style-type: none"> <li>The chair should be placed on an insulating base with one of the wheels on a metal sheet. The discharge resistance should then be measured from the sheet to a measuring electrode that is pressed against the chair seat.</li> <li>The measurement is then repeated with the sheet under each one of the wheels. Then the discharge resistance should be measured from the backrest (both sides) and the armrests, if fitted, to the sheet with one wheel remaining on it.</li> </ul> <p>Apart from the electrode, the chair must be unloaded during measuring.</p> <p>A reading should be taken 15 seconds after applying voltage.</p>	<p><b>Testing with insulation tester</b> Connect the instrument's grounding terminal to the metal sheet and measuring socket to the measuring electrode, which is placed on the surface to be measured.</p> <p>Measure with the insulation tester. Measuring voltage 100 volts.</p>
<b>Testing Shoes / Shoe Straps</b>	<ul style="list-style-type: none"> <li>Discharge to ground shall be <math>\leq 100 \text{ M}\Omega</math> per shoe.</li> <li>System resistance with shoe/floor combination must be <b>lower than <math>35 \text{ M}\Omega</math></b> and where potentials higher than 100 volts must not be built up in the body in a "walking test".</li> </ul>	<ul style="list-style-type: none"> <li>The shoes are checked by measuring the discharge resistance of the shoes plus user. Method in accordance with <b>IEC 61340-4-5</b> First edition, 2004</li> </ul>	<p><b>Testing with shoe resistance tester</b> For the measurement to be taken, the user stands with one shoe on each of two insulated metal plates between which the discharge resistance is measured.</p> <p>If the green light-emitting diode "OK" lights up or the red light-emitting diode "LOW" lights up, the control result has been approved.</p>
<b>Testing Wriststraps</b>	<ul style="list-style-type: none"> <li>Complete strap: <math>&lt; 10^7 \Omega</math></li> <li>Strap only: <math>&lt; 10^5 \Omega</math></li> <li>Cable: <math>&lt; 10^6 \Omega</math></li> <li>The discharge resistance must be <b><math>750 \text{ k}\Omega \sim 35 \text{ M}\Omega</math></b></li> </ul> <p>Measured from the cable's ground connection to the hand.</p>	<ul style="list-style-type: none"> <li>The wrist strap is checked by measuring the discharge resistance of the fitted wrist strap plus user.</li> </ul>	<p><b>Testing with wrist strap tester</b> The following limits apply when measuring with this equipment: <math>0.75\text{-}35 \text{ M}\Omega</math>. Put on the strap and connect the cable to the instrument's grounding terminal. Press down on the instrument's metal plate with your hand.</p> <p>The green light-emitting diode "OK" lights up when the control result is approved.</p>
<b>Testing Cushions on the Ground</b>	<p>The discharge resistance of ESD cushion should be <b><math>&lt; 1000 \text{ M}\Omega</math></b> measured from the surface to EPA earth.</p>	<ul style="list-style-type: none"> <li>The discharge resistance should be measured in at least 3 points per cushion, evenly distributed over the surface.</li> </ul>	<p><b>Tested with resistance tester</b> The test meter is connected to EPA ground and the probe is placed on the cushion surface, then push the "push to test" button about 2-3s. The displayed value is the resistance.</p> <p>If the resistance is less than 1000 Mohm, the result is approved.</p>

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<b>Testing Tray on the Production Line</b>	The discharge resistance of ESD trays included production line systems should be <b>0.75 – 1000 MΩ</b> measured from the surface to EPA earth	<ul style="list-style-type: none"> <li>The discharge resistance should be measured in at least 3 points per tray, evenly distributed over the surface.</li> </ul>	<p><b>Tested by resistance tester</b> The test meter is connected to EPA ground and the probe is placed on the ESD tray surface, then push the "push to test" button about 2~3s. The displayed value is the resistance.</p> <p>If the resistance is 0.75 - 1000 Mohm, the result is approved</p>
<b>Testing Soldering Irons</b>	The resistance between tip and ground must be <b>&lt; 2 Ω</b> for qualification; <b>&lt; 10 Ω</b> for compliance test.	After a period of use, an oxide coating can form between the soldering iron element and tip which increases resistance between the tip and earth. However, this is of no great significance from the ESD standpoint.	<p><b>Measuring with ohmmeter (multimeter)</b> The resistance of a soldering iron can be checked with an ohmmeter with a measuring voltage of at least 10 volts DC.</p> <p>Connect one of the ohmmeter's probes to the soldering iron tip and the other to EPA ground or grounding terminal on the soldering equipment.</p>
<b>Testing Transport Trolleys</b>	The discharge resistance must be <b>750 kΩ ~ 1000 MΩ</b> from each loading surface to the floor.	<ul style="list-style-type: none"> <li>The covering should be brushed off with a soft brush before measuring. The discharge resistance should be measured in at least 3 points per m<sup>2</sup> of covering, evenly distributed over the loading surface.</li> <li>The transport trolley should be placed on an insulating base with one of the wheels on a metal sheet. The discharge resistance should then be measured from the sheet to a measuring electrode that is pressed against the loading surface.</li> <li>The measurement is then repeated with the metal sheet under each one of the wheels to all loading surfaces. A reading should be taken 15 seconds after applying voltage.</li> </ul>	<p><b>Testing with insulation tester</b> Connect the instrument's grounding terminal to the metal sheet and measuring socket to the measuring electrode, which is placed on the loading surface to be measured.</p> <p>Measure with the insulation tester. Measuring voltage 100 volts.</p>
<b>Testing Hand Tools</b>	The discharge resistance must be a <b>≤ 1 GΩ</b> from the hand tool's grip surfaces to the hand tool's metal components.	There is no measuring method for approved hand tools.	<p><b>Tip</b> If no ESD-approved tool is available, the tool can be discharged by touching the metal components with a finger before contact with ESDS.</p>
<b>Testing Ionizers</b>	Ionizing equipment should be capable of neutralizing a charged metal plate in <b>≤ 20 seconds</b> .  The time for discharge between 1000 volts and 100 volts is measured. Neutralization should result from both positive and negative charging.	Ionizing equipment as ESD protection can be used as a complement to existing protection in the EPA.  Test method according to <b>IEC 61340-4-7</b> .	<p><b>Testing with Charge analyzer</b> Follow the manufacturer's instructions on handling the instrument</p>

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Tested Items	Requirements	Test Method
<b>Testing ESD Clothes</b>	<p>After friction charging an article of clothing, the voltage should fall to <b>&lt; 100 volts within 2 seconds.</b></p> <p>This applies to the whole of the article of clothing. Thus, it is not sufficient for only parts of a coat, e.g. an arm, to meet the requirement.</p>	<p>To ensure the whole garment has the capacity to discharge static electricity, charging and measuring must be done on surfaces that compel charges to pass through seams on the way to ground. This is why measuring should take place on the front or back of the garment and not on the arms.</p> <p>Stroke the upper side of the hand smartly, 1-3 times, at least 30cm across the garment to friction charge it.</p> <p><b>Method 1</b> The coat/overall should be hung up by both cuffs. As the cuffs are normally the only route by which charges from the garment can be discharged to the person and then to ground, only the cuff should be tucked into the clip.</p> <p><b>Method 2</b> Measure the garment worn by a person.</p>
<b>Testing Ageing Materials</b>	<p>When applying frictional charge on an approved material, the voltage should fall to <b>&lt; 100 volts within 2 seconds.</b></p>	<ul style="list-style-type: none"> <li>First check that the material is marked with a manufacturer's label, packaging class, product identity, batch number, date of manufacture (Best before date) and ESD symbol.</li> <li>Check that the material is within the approved use-by date.</li> <li>Stroke the upper side of the hand smartly, approx. 5 times, over the surface of the material to be checked in order to friction charge the material.</li> </ul>
<b>Testing/treatment of Chargeable Material</b>	<p><b>General</b> These instructions cover all types of chargeable material that need to be present in an EPA. Examples of such materials are roller doors, recycling containers, screen walls, fixtures, handheld instruments, Plexiglas cases and computer equipment, etc. The purpose of the instructions is to guarantee the effect of treatment with a low-charging agent so that the material is not charged up to dangerous levels.</p> <p><b>Requirements</b> No material should be charged up to <b>&lt; 100 volts.</b></p> <p>** In cases where risk assessment shows the material does not constitute any form of hazard/risk for ESDS, e.g. where the distance to the charged material is adequate, the risk assessment is sufficient and treatment with a low-charging agent is not necessary. The requirement is that the electrostatic field is <b>lower than 5000V/m</b></p>	<p>Stroke the upper side of the hand smartly, several times over the surface of the material to be checked.</p> <p>Check with the field indicator that the material is not charged up. The indication in the most sensitive area should not exceed a maximum of 100 volts.</p>

**Testing with a field indicator**  
Switch on the field indicator and set it to zero.  
Check how quickly the voltage falls.

**Testing with field indicator**  
Switch on the field indicator and set it to zero.  
Check how quickly the voltage falls.

**Testing with field indicator**  
Switch on the field indicator and set it to zero.  
If the field indicator produces a result in excess of 100 volts, the material should be retreated with a suitable low-charging agent, e.g., Staticide.  
Repeat the inspection after a minimum of 12 hours to ensure the treatment has been successful.

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Testing of Packaging Materials	<p><b>General</b> Components, products and materials that are packaged and delivered to EPA must be packaged in specially-designed ESD-adapted packs.</p> <p><b>Requirements</b> Materials used within an EPA area must primarily be <b>electrostatic conductive</b> or <b>electrostatic dissipative</b>. No material should be charged up to <b>more than 100 volts</b>.</p> <p><b>Exception:</b> Where a risk assessment shows that ESD-faulty packaging materials are not at risk of damaging ESDS (e.g. where the distance between the charged material and ESDS is sufficiently great) chargeable material can be handled on an EPA surface. <b>NB!</b> this procedure must be subject to a routine.</p>	<ul style="list-style-type: none"> <li>Stroke the upper side of the hand smartly, several times over the surface of the material to be checked.</li> <li>Check with the field indicator that the material is not charged up. The indication in the most sensitive area should not exceed a maximum of 100 volts.</li> <li>The charging depends very much on the humidity level. For this reason, packages with measured values in excess of approx. 50 volts must be checked at the EPA surface's (during the year) <u>low est</u> level of humidity. With reference to 155 03-FCH 102 02 point 2.3.</li> </ul>	<p><b>Testing with field indicator</b> Switch on the field indicator and set it to zero. Conduct inspection according to instructions.</p> <p>If the field indicator gives a reading in excess of 100 volts, the material must be removed from EPA and be reported in accordance with the local routine for ESD-faulty packaging or treated in accordance with Exceptions above.</p> <p><b>Tip</b> Chargeable material can be removed to ensure there is no risk of ESD damage. See also 155 03-FCH 102 02, layout section.</p>

### 3 Measures to be taken in case of fault

Items	Measures to be taken
Table coverings/Shelf	<p>Check that the table/shelf's grounding cable is connected and in good condition. Measure again with a measuring voltage of 100 volts. Use an insulation tester.</p> <p><u>If the measured value is <math>\leq 10^9 \Omega</math> (<math>\leq 1000 M\Omega</math>) do the following</u> Clean the table covering Let the covering air-dry for at least 12 hours in a normal working environment Perform a new control measurement <b>NB</b> the table covering <b>may</b> be used during that time</p> <p><u>If the measured value is <math>&gt; 10^9 \Omega</math> (<math>&gt; 1000 M\Omega</math>) do the following</u> Clean the table covering Let the covering air-dry for at least 12 hours in a normal working environment Perform a new control measurement <b>NB</b> the table covering <b>must not</b> be used during that time. Mark this in an appropriate manner.</p> <p>If an approved value is obtained only after cleaning, this indicates that the cleaning procedure should be reviewed. If non-conformance is still evident after measures have been taken, a non-conformance report must be written.</p> <p><b>Tip</b> A failed table can be used temporarily by covering it with an antistatic bench mat.</p>
Wrist Strap Sockets	<p>If any of the wrist strap sockets is not in contact with earth ground, examine the cabling, cable shoes and jointing, and repair or replace any defective materials.</p>
Floor	<p>In the case of a non-approved measurement result, the mat should be cleaned and the measurement taken again after the mat has been air-dried for at least 20 hours in a normal working environment. If an approved value is obtained only after cleaning, this indicates that the cleaning procedure should be reviewed. Check that the floor's grounding cable is connected and in good condition. If non-conformance remains after measures have been taken, a non-conformance report must be written and a risk assessment performed.</p>

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Items	Measures to be taken
<b>Chairs</b>	<p>In the case of a non-approved measurement result, the wheels should be cleaned and the measurement taken again after they have been air-dried for at least 12 hours in a normal working environment. A non-approved measurement result may be due to the connection cable inside the chair's column having snapped. If non-conformance remains after measures have been taken, a non-conformance report must be written and the chair sent away for repair.</p> <p><b>Tip</b> If the chair is fitted with antistatic plastic wheels, a measure for improvement may be to replace these with metal wheels. Move the grounding cable to the chair chassis and check the wheels, chair seat, backrest and armrests if fitted, separately with the instrument.</p>
<b>Shoes</b>	<p>In the case of a non-approved measurement result, when checking shoes, they should be cleaned and the measurement taken again. If cleaned with water, the shoes must be air-dried for at least 12 hours in a normal working environment before a new measurement is taken. In the case of a non-approved measurement result, when checking shoe grounders, check that the shoe grounders are turned the right way round and that the strap is in contact with the skin and tucked properly into the socks or shoes.</p> <p><b>Tip</b> Use shoe grounders until you get some new shoes.</p>
<b>Wriststraps</b>	<p>If the red light-emitting diode "LOW" lights up, the wrist strap has failed and must be replaced immediately. If the red light-emitting diode "HIGH" lights up, the wrist strap has failed. Check that the wrist strap fits close to the wrist If non-conformance is still evident after measures have been taken, a non-conformance report must be written.</p> <p><b>Tip</b> To achieve better contact, we recommend that you use hand lotion (NB must not contain silicone).</p>
<b>Cushions on the Ground</b>	<p>If the measurement results are not approved, it should be cleaned and the measurement taken again. If cleaned with water, it must be air-dried for at least 12 hours in a normal working environment before a new measurement is taken. If non-conformance remains after measures have been taken, a non-conformance report must be written and the cushion shall be scrapped.</p>
<b>Tray on the Production Line</b>	<p>If the measurement results are not approved, a non-conformance report must be written. Do cross test to check it's tray or line problem. Then defect ones shall be repaired.</p>
<b>Soldering Irons</b>	<p>With a failed result, the soldering equipment should be sent off for repair.</p>
<b>Transport Trolleys</b>	<p>In the case of a non-approved measurement result, the wheels and loading surface should be cleaned and the measurement taken again after they have been air-dried for at least 12 hours in a normal working environment. If an approved value is obtained only after cleaning, this indicates that the maintenance procedure should be reviewed. If non-conformance remains after measures have been taken, a non-conformance report must be written and the transport trolley sent away for repair.</p> <p><b>Tip</b> Move the grounding cable to the trolley chassis and check the wheels and shelves separately with the instrument.</p>
<b>Ionizers</b>	<p>If the ionizing equipment fails to meet the above requirements, send it off for repair. If non-conformance is still evident after measures have been taken, a non-conformance report must be written.</p>
<b>ESD Clothes</b>	<p>If the garment fails to meet the above requirement, the following trouble-shooting points apply. Check that the article of clothing has contact with ground. Test the "defective" garment by charging up and measuring an arm instead of the front or back of the garment. If it turns out that the contact is broken via the seams and the coat only conducts from arm to cuff, the garment should be scrapped.</p>



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Items	Measures to be taken
<b>Ageing Materials</b>	If material with an approved date code fails to meet the requirement for the discharging time, a non-conformance report must be written and the material should be scrapped. As the inspection indicates a failed result, further investigation using superior measuring methods can be resorted to, e.g. through RISE or its equivalent.
<b>Chargeable Material</b>	If non-conformance remains after measures have been taken, a non-conformance report must be written and a risk assessment performed.  <b>Tip</b> Chargeable material can be removed to ensure there is no risk of ESD damage. See also 155 03-FCH 102 02, layout section.

#### 4 Revision information

Rev	Description	Date
A	New document	2002-01-02
B	Amendments, paragraphs 9.1, 13.1, 13.2, 14, 15.5, 15.9, 15.10.	2002-05-17
C	Addition to paragraph 2 and 15 plus new	2002-11-06
D	Amendments to paragraphs 5, 6 and 7 Chapter 1.7 deleted	2009-07-23
F	Changes in paragraph 2, 3, 4, 6, 8, 10,12, 13 and removal of list of test instruments	2012-01-24
G	Revue	2013-02-04
H	Review and update according to new standard; Update the format	2017-12-22