

# **The ESD Experience in Canada**

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POS Strategic Leadership Team**

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**Table of Contents**

Introduction ..... 3

What is ESD? ..... 4

What causes ESD damage in POS terminals? ..... 4

What contributes to the incidence of ESD issues? ..... 5

What information and support is being provided for ESD issues? ..... 5

What is Canada's experience with ESD issues? ..... 9

Summary ..... 10

Appendix A - EMV Co Terminal ESD Evaluation ..... 11

**Disclaimer:**

The contents of this Point of Sale Strategic Leadership team paper are the result of a collaborative process. As such, it does not represent the views of any specific organization and may, in part, be contrary to specific views.

ACT Canada, stakeholders driving payment evolution and digital identity  
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## **Forward**

This paper was first published in June 2013. The original paper makes reference to work being done by EMVCo in regards to ESD. This updated version provides information related to EMVCo's work. Other minor changes have been made related to timelines to reflect the eighteen months that have passed since the original 2013 publish date.

## **Current Status of ESD in the Canadian Market**

Due to extensive testing by many members of ACT Canada, a primary cause of the problem was determined. Although we would like to say that this resolves the issue and that ESD will not be a problem in the future, we cannot. The problem found through testing was related to a product that did not meet the specifications of ISO; so other products, both current and future, could also encounter ESD issues.

## **Next Steps**

This paper, with a request to review all pertinent ISO standards, will be sent to the appropriate ISO groups and to other impacted stakeholders.

## Introduction

Over the past 42 months there has been an increasing amount of attention drawn to terminal failures believed to be caused by Electrostatic Discharge (ESD). The problem appears to be more prevalent in Canada, and Canadian retailers and acquirers have been actively involved in identifying causes and introducing solutions to address POS failure due to ESD. EMV Co was engaged early in the identification of this problem. ESD related discussions and activities to address this issue are ongoing.

More recently, as enhanced terminals augmented with ESD protective circuits are deployed in Canada, there are early indications that ESD may now be permanently damaging credit and debit chip cards. Further investigation was undertaken to understand and confirm the root causes of card failures at the POS.

ACT Canada created a POS Strategic Leadership Team that consists of retailers, acquirers, terminal manufacturers, card manufacturers, issuers and payment brands. This group met regularly and continues to monitor the Canadian market for ESD events. It proposed that by exchanging information related to card reissuance statistics and terminal deployment, this group will be well-positioned to identify any impacts of enhanced terminal deployment on chip card performance.

This document will provide an overview of ESD in Canada, describe retailer and acquirer experiences to date, outline the actions that are being taken by Canadian payment stakeholders and provide a summary of supporting activities currently underway at EMV Co. It is ACT Canada's intention to drive industry level testing to identify root causes to and support the creation of solutions to address these issues.

## What is ESD?

**Electrostatic discharge (ESD)** is defined as the sudden flow of electricity between two objects caused by contact or an electrical short. One of the causes of ESD events is static electricity generated through tribocharging (the separation of electric charges that occurs when two materials are brought into contact and then separated). Examples of tribocharging include walking on a rug, rubbing a balloon against a sweater, and removing some types of plastic packaging.

## What causes ESD damage in POS terminals?

**ESD damage in POS terminals** is caused by electrical overstress to sensitive device components that are in the discharge path during the discharge of static electricity to ground. Many ESD events occur without a visible or audible spark. The cardholder is usually the cause of static electricity, and this energy is transferred to the card body and into the POS device during an EMV payment. A person carrying a relatively small electric charge may not feel a discharge that is sufficient to damage sensitive electronic components.

Smaller charges may affect the long term performance and reliability of an unmodified POS device, increasing susceptibility to ESD over time and ultimately causing device failure. If the charge is sufficient to impact the terminal, the terminal failures may include reset, lock up or other failure modes up to and

including losing keys. Larger ESD charges (can cause immediate failure of a POS device and the terminal will switch to SECURITY mode and the cryptographic keys must be reloaded before normal operation can resume.

## What contributes to the incidence of ESD issues?

**Certain card features:** It has been demonstrated that some payment card features support the conduction of electricity. For example, cards incorporating a metallic foil layer (Full Face Foil) or holographic magnetic stripe facilitate electrostatic load. Dual interface cards with an embedded antenna are believed to be more susceptible to ESD damage. Canada leads the globe in the deployment of dual interface cards.

**Terminal design and age:** Older terminals appear to be more susceptible to ESD damage. As chip-to-chip transactions have increased, so too has the incidence of POS damage caused by ESD. It is likely that some of the devices that have failed due to ESD have sustained thousands of smaller charges that have gradually caused a decline in device performance. Method of terminal grounding may be a contributing factor.

**Cold, dry weather:** Most of Canada experiences several months of cold, dry weather - excellent conditions for generating static electricity that an individual can unknowingly transfer into the payment terminal as the EMV chip card is inserted into the device. During dry, cold winter conditions with Relative Humidity of less than 20%, cardholders have been demonstrated to pass a charge as high as 5.5kV<sup>1</sup>. Although incidence of ESD impacts is higher in winter conditions, ESD impacts are seen in all types of weather indicating that cold, dry weather may contribute to ESD issues but it is not the only factor.

**Retail Environment:** Certain environmental factors (for example, carpeting) may contribute to the incidence of ESD.

## What information and support is being provided for ESD issues?

### **EMVCo**

At the time of the first publication (June 2013), EMVCo specifications and approval processes did not currently address ESD. To address ESD concerns raised by ACT Canada, a dedicated Task Force was created in 2010 to manage ESD as a high priority issue. The objectives of the Task Force included defining ESD tolerance levels for terminals to minimize the probability of ESD events, to establish testing processes to evaluate compliance and to accredit multiple labs to offer testing.

ESD has been a priority for EMVCo<sup>2</sup>. The EMVCo Interoperability Working Group has been assessing the cause and impact of reported ESD-related interoperability issues and is developing potential resolution plans (see below). As a result of initial assessment, EMV Co is now looking to address the ESD issues

<sup>1</sup> Smart Payment Association, **Electrostatic Discharge (ESD) in Terminals**, Spring 2012  
[www.smartpaymentassociation.com](http://www.smartpaymentassociation.com)

<sup>2</sup> EMVCO –NEXT GENERATION GLOBAL PAYMENT STANDARD, Sean Conroy, EMVCo Board of Managers, March 2012 CARTES North America

through a combination of terminal requirements and card evaluation. The recent focus has been on defining testing processes to evaluate POS terminal resilience to ESD events. EMVCo will not issue any ESD card requirements, but the card evaluation methodology will be contributed and made available through ISO. In addition ISO is independently developing card conductivity tests.

In 2012, EMVCo finalized and released a number of ESD-related documents that are available at [www.emvco.com](http://www.emvco.com), including a white paper entitled ***Recommendations for Management of Electrostatic Discharge at the Point of Sale*** that provides an overview of ESD and outlines remedial measures that can be taken to reduce or eliminate the impact of ESD events in retail environments.

EMVCo recommended actions to mitigate the impacts of ESD prior to insertion of the payment card into the POS terminal include:

- Placing a static dissipative floor mat or carpet so that the customer walks along the length of the mat prior to paying at POS. These mats and carpets require proper grounding.
- Placing an antistatic table mat on the counter so that the user touches the mat prior to inserting the card and discharges any static electricity prior to paying at POS. These table mats must be connected to a ground point such as the ground terminal on a 3-prong electrical outlet.
- Using a static dissipative or conductive floor coating to reduce the build-up of static charge in the general area around the POS terminal. For tile floors, floor wax can be used. For carpeted floors, static dissipative sprays are available.
- Cleaning the read head of the terminal with ESD cleaner using an ESD treatment card. As the card is dipped or swiped, it applies a small amount of material to the read head or to the contact points of the terminal, which helps alleviate static discharge.
- Use of a balanced ionizer near the POS can neutralize the static charge on both the user and the card. Ionizers use a high voltage power supply to generate positive and negative ions, and a blower pushes the ions out of the ionizer to neutralize the charge on the cardholder and card.
- Raising the humidity level to greater than 30% will reduce the incidence of ESD. The use of humidifiers is a practical solution for smaller retail locations with one or two terminals.

EMVCo has, as of September 2014, announced the launch of the Terminal ESD Evaluation process. The purpose of this ESD process is to evaluate the resilience of card acceptance devices to electrostatic discharges during a transaction. The terminal is evaluated by performing Chip reader and Magstripe reader ESD testing, based on scenarios that represent real world situations. Terminal ESD Evaluation documents are available on the EMVCo website. They are:

- Administrative Process v2.3
- ICS v2.3
- Request for Evaluation v2.3
- Request for registration v2.3
- Test Cases v2.3

For detailed information, please refer to the EMVCo Terminal ESD Evaluation Administrative Process v2.3 which can be found on the EMVCo website.

EMVCo has clearly stated that terminal resilience to ESD has no impact on Level 1 Approval. The target date for the official release of these terminal evaluation processes is Q4 2013. Terminals have been requested from regions experiencing ESD incidents to support this validation exercise.

Supporting information related to EMVCo's Terminal ESD Evaluation testing process can be found in Appendix A.

### **ACT Canada**

The ACT Canada POS Strategic Leadership Team has provided a forum for discussion of ESD and the impacts that have been seen in the Canadian marketplace. EMVCo has been engaged by ACT Canada and is aware of this group's activities in the area of ESD. Several members of the ACT POS Strategic Leadership Team are EMVCo Technical Associates (Ingenico, Interac, Moneris, WalMart) or members of the Smart Payments Association (G+D, Gemalto). A primary objective of the POS SLT is to understand the extent and impact of the deployment of enhanced terminals on ESD and card performance in advance of the 2015 liability shift that is in place for both the United States and China. Terminal providers, card manufacturers and our members have been conducting tests.

### **Terminal Vendors**

With the terminal being the primary point of contact between a merchant and their customer, terminal vendors are viewed as a critical component of the payment environment. Terminal vendors, with a historical and measurable presence in Canada (Ingenico, NBS Payment Solutions, Verifone), were on the forefront of the ESD issue as early manifestations of ESD resulted in less than favourable terminal behaviours. As a result, terminal vendors have worked to provide enhanced protection against ESD in their products, protecting their customers' investment.

As part of the payment ecosystem, the terminal vendors recognize the need for involvement over and above the protection of terminal assets against ESD. As such, the terminal vendors have provided, and will continue to provide, support for activities that deliver solutions for ESD-related issues. That support includes, but is not limited to:

- Providing terminals and software for in house and third party testing
- Working with EMVCo on their terminal ESD testing program
- Making ESD lab set ups available for testing
- Actively testing existing and new card designs
- Providing thought leadership regarding the nature of ESD and its impacts on electronics

### **Card Manufacturers**

Giesecke & Devrient Canada has been working with Ingenico and various card issuers on a comprehensive study to understand what is happening in the field with respect to ESD and DI card behaviour. They have contracted the services of an expert lab in the US with the mandate to analyze and characterize the ESD related chip failures recently experienced with some merchants. This work resulted in the identification of a primary cause of the ESD issue in Canada.

### **Smart Payment Association**

The Smart Payment Association (SPA) members include Austria Card, Giesecke & Devrient, Gemalto, Incard, Morpho and Oberthur Technologies. SPA addresses the challenges of the evolving payment ecosystem, offering leadership and expert guidance to help its members and their financial institution customers realize the opportunities of smart, secure and personalised payment systems & services both now and for the future. With more than 898 million smart payment cards delivered by its members in

2011, SPA represents more than 85% of the smart payment cards market.

In June 2012, SPA published a position paper entitled "**Electrostatic Discharge in Payment Terminals**". SPA is committed to working closely with the payment industry to resolve ESD issues associated with payment cards, but recognizes that the SPA cannot act in isolation. SPA states that failure due to ESD discharge can be eliminated very effectively if terminals are designed in such a way that their conductive surfaces are properly grounded. SPA supports the approach of EMVCo to align with ongoing ISO standardization activity as the best way to fix any ESD issues in EMV transactions.

The paper describes experimental tests performed by the SPA to evaluate card and terminal behaviour in the presence of electrostatic energy. The findings of these tests are summarized as follows:

- 1) Under particular conditions electrostatic charge generated by a card holder can be transmitted inside the terminal
- 2) Specific card types are more likely to propagate the charge (and therefore discharge inside) than conventional full plastic cards
- 3) Many terminals are protected against the risk of discharge. Some are not, and are more susceptible to ESD
- 4) Implementation of appropriate ESD protection for terminals is the most efficient way to control ESD problems in the field
- 5) If a terminal is protected against ESD, cards may, in extreme conditions, still disturb the communication electronics and cause the terminal to reset without causing permanent damage.

The SPA recommends the following preventative measures for payment terminals and cards to minimize the risk of ESD events:

	<b>Recommendation</b>
<b>POS Terminals</b>	Prevent the generation of electrostatic discharge
	Eliminate potential discharge paths between charged devices and ESD-sensitive components
	Use electronic components with adequate ESD protective circuitry
	The terminal should be protected against ESD events by appropriate measures e.g. grounding or shielding to prevent the ESD from reaching sensitive hardware
	Electronic components within the terminal should be fitted with adequate ESD protection circuitry
	<b>Recommendation</b>
<b>EMV Cards</b>	Cards should be ESD resistant, meaning that when handled, they do not accumulate significant levels of charge
	Smart card electronics must be ESD resistant. Chips used in smart cards are, as a minimum, protected
	The card construction should not facilitate a conductive path between the source of the electrostatic charge, typically the user, and the terminal. Metallic foil cards in particular are more prone to conduct charge than traditional white cards

**Source:** Electrostatic Discharge (ESD) in Payment Terminals, Smart Payment Association, Spring 2012

## What is Canada's experience with ESD issues?

Canada's deployment of EMV terminals and cards began in 2008 and is nearing completion. As of December 2012, over 90% of cards and 82% of POS devices are EMV-enabled. Chip to Chip transactions have grown to represent over 70% of transactions at the POS.

Canada is a global leader in contactless deployment. Many MasterCard and Visa issuers have been focused on providing dual interface capability. Interac issuers are issuing dual interface cards supporting Interac Flash in significant numbers. Contactless payment is typically only accepted for transactions under \$50 although the allowable limit has been increased recently. Contactless transactions as a percent of total transactions are growing year over year. There are still a number of Canadian retailers that do not accept contactless transactions.

ESD-related terminal issues were first confirmed in Canada in late 2009 following several months of investigation. The impacts of ESD have been substantial for a number of Canadian retailers, requiring complete replacement of the terminal inventory (sometimes more than once). Impacted merchants have implemented measures to try and reduce opportunities for the creation of static electricity ranging from replacing carpets at POS with rubber mats to modifying shopping carts.

Terminal manufacturers, acquirers, merchants and issuers have been working together to identify and address ESD-related terminal failures. As a result of these efforts, a number of terminal manufacturers have enhanced their POS terminals in the field to more effectively resist ESD. Unmodified terminals are impacted by lower ESD values (terminals will reset, or will become inoperable and shut down); enhanced terminals can withstand higher ESD values with no apparent damage. These enhanced terminals are currently being deployed by Canadian acquirers and retailers. Several of the terminals that are being deployed in Canada have been submitted to EMVCo to support the development of the EMVCo ESD terminal evaluation process.

Following the deployment of enhanced terminals, some Canadian retailers that also issue credit cards experienced a noticeable increase in card failure rates. Investigation into the causes of the failures indicated that many of the cardholders experiencing issues with their chip cards had transacted at a known enhanced POS device. The card stopped functioning at the enhanced device and the contact chip interface no longer functions (the contactless interface continues to function). For transactions that require a contact transaction, only the magnetic stripe (fallback) is supported by the card.

A small number of payment industry stakeholders including Scotiabank, Ingenico and two other issuers, TDMS (TD Merchant Services) and a card manufacturer undertook an investigation into the behaviour of cards using modified and unmodified terminals. Dual Interface cards were charged to levels ranging from 2kV to 8kV and inserted into enhanced retrofitted and unmodified POS devices. The study indicated that enhanced terminals were successfully resistant to higher levels of ESD (no obvious damage occurred). Contact only cards showed no obvious effects from the higher ESD levels at enhanced retrofitted and unmodified terminals, but chips in Dual Interface cards have been damaged. Although the contactless interface continues to function, a contact transaction cannot be completed<sup>3</sup>. This initial research indicates that there may be some negative impact to Dual Interface (DI) cards used at enhanced POS terminals. The exact failure mode is not well understood yet, however, forensic

<sup>3</sup> Proprietary research performed by Canadian payment industry stakeholders.

analysis of damaged chips indicates an ESD CDM (Charge Device Model) event. Further investigations and studies are ongoing in order to understand the exact failure mode is required.

If enhanced terminals are indeed impacting the performance of DI cards, it will be important to determine the potential impact of this issue. The penetration of enhanced terminals is still low, but it is expected that enhanced terminals will represent at least 50% of terminals deployed in Canada by 2015. As of the end of 2012, Canadian card manufacturers have confirmed that there has not been any significant increase in card replacement rates for DI cards in Canada.

## Summary

Canada has been a global leader in Contactless deployment. As a country with a cold, dry climate for part of the year, Canada provides a hospitable environment for the creation of static electricity; however there are reports of failures throughout the year, including hot, humid weather. ESD issues in Canada took some time and the participation of multiple industry players to identify and define. The Canadian experience with ESD led EMVCo to create a Task Force in 2010 to address ESD issues on a global scale. EMVCo piloted an ESD terminal evaluation process in 2013 and published the final version in 2014. The Smart Payments Association has published a position paper on ESD and has outlined preventative measures that can be taken to reduce ESD incidents at POS.

Terminal manufacturers have worked with Canadian retailers to design POS devices that are more resilient to ESD. Several large Canadian merchants have deployed enhanced POS devices. This deployment of enhanced devices will gather momentum and it is expected that over 50% of unmodified POS devices will be replaced over the next three years (2013 – 2016). Retailers who also issue payment cards have noticed an increase in dual interface card failure rates following the deployment of enhanced terminals at known merchants. Other issuers are also seeing an increase in failure rates. Key payments industry stakeholders are working together through ACT Canada to determine the impact enhanced POS devices are having on dual interface cards.

ACT Canada has identified ESD as a priority for its POS Strategic Leadership Team, and is leveraging this group as a forum for the exchange of information related to ESD issues. ACT Canada has engaged EMVCo as an occasional participant at POS SLT meetings to support the early communication of any key findings by Canadian payment industry participants.

At this time the team has concluded their investigation into ESD and will forward this report to ISO with a request to review all applicable ESD related standards. ACT Canada will continue to monitor the market for any ESD related occurrences.

## Appendix A - EMV Co Terminal ESD Evaluation

### *Certified Laboratories*

EMVCo is pleased to announce the following laboratories have been accredited to perform EMV Terminal ESD Evaluation testing.

<b>Beijing Unionpay Card technology Co., Ltd (Bank Card Test Center)</b>	9th Building No. 26 West Waihuan Road Fengtai District Beijing 100070 China	Mr. Liu Shaopeng E-mail: <a href="mailto:emv@bctest.com">emv@bctest.com</a> Phone: +86 10 62266902 Fax: +86 10 62266910
<b>CETECOM ICT Services GmbH</b>	Untertuerkheimer Str. 6-10 Saarbruecken 66117 Germany	Mr. Jens Feldmann E-mail: <a href="mailto:Jens.Feldmann@ict.cetecom.de">Jens.Feldmann@ict.cetecom.de</a> Phone: +49 681 598 8518 Fax: +49 681 598 9075
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### *Process and Forms*

Vendors can find the necessary forms to complete to receive Terminal ESD Evaluation and the specification of the ESD Test Application that must be present in the Device for ESD testing purposes.

- [Terminal ESD Evaluation Process Documentation](#)
- [Terminal ESD Evaluation Vendor Forms](#)