



**WHITE PAPER**  
**Smart Card Alliance**  
Payments Council

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# Contactless EMV Payments: Benefits for Consumers, Merchants and Issuers

Publication Date: June 2016

Publication Number: PC-16001

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# About the Smart Card Alliance

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The Smart Card Alliance is a not-for-profit, multi-industry association working to stimulate the understanding, adoption, use and widespread application of smart card technology. Through specific projects such as education programs, market research, advocacy, industry relations and open forums, the Alliance keeps its members connected to industry leaders and innovative thought. The Alliance is the single industry voice for smart cards, leading industry discussion on the impact and value of smart cards in the U.S. and Latin America. For more information, please visit <http://www.smartcardalliance.org>.

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# 1 Introduction

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A contactless payment is a payment transaction that does not require physical contact between a consumer's payment device and a point-of-sale terminal. The consumer holds a payment device (such as a contactless or dual-interface chip card<sup>1</sup> or a mobile device) in close proximity to the terminal (less than 1-2 in. away), and payment account information is transmitted wirelessly, over radio frequency (RF). The consumer's contactless payment device can assume a variety of form factors, including cards, Near Field Communication (NFC)-enabled smart phones, and wearables. Contactless transactions are cryptographically secure and generate a unique code for each transaction.

Over the past decade, contactless payments have been deployed and adopted successfully around the world. However, despite the fact that the payment networks have been championing this technology in the United States since 2005, adoption has lagged. The absence of a critical mass of contactless-enabled cards and point-of-sale (POS) terminals has impeded migration, and the anticipated business opportunity has never been realized. However, contactless technology remains in the spotlight, as the convenience and security it offers are too substantial to ignore.

Transit can play a key role in the next chapter of contactless payments in the U.S. market. Transit fare payment systems in cities around the world, including Chicago, Philadelphia, New York and London, are being replaced or upgraded to rely on technologies that adhere to global payment industry standards. These open payment systems allow transit customers to pay fares with their own contactless bank cards at transit points of entry, such as turnstiles and when boarding buses. As has been demonstrated in London, transit contactless payments drive "top of wallet" consumer behavior for issuers and usage at contactless-enabled merchants located close to transit stations.

This white paper addresses current questions about the adoption of contactless payments, including: how contactless fits into today's payment industry; what is currently different from earlier adoption attempts; and why now is the ideal time to go contactless. The white paper focuses on mass adoption of contactless EMV payments using both cards and NFC-enabled mobile devices, which leverage the EMV chip transaction infrastructure currently being implemented in the U.S. It describes the benefits of contactless payments for consumers, issuers and merchants, outlines the benefits of dual-interface card issuance for issuers and summarizes implementation considerations. The goal of the white paper is to provide a fresh look at contactless payments in the current U.S. payments environment that is embracing both EMV and NFC-enabled mobile devices.

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<sup>1</sup> Dual interface cards allow the chip to be accessed by both the contact plate on the front of the card and the antenna embedded in the card.



## 2 What Is New with Contactless Payments?

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Contactless credit and debit card payments were first introduced in the U.S. in 2005. At that time, a contactless payment transaction emulated a magnetic stripe data (MSD) transaction,<sup>2</sup> with the addition of dynamic data to an existing data element. While the technology worked, there was no clear benefit for any of the stakeholders. Although contactless transactions were fast, their advantage over swiping a magnetic stripe card, particularly at traditional retailers, was marginal. The value proposition was further diminished when the payment networks removed some requirements for cardholder verification (e.g., a signature or PIN) for magnetic stripe card transactions under certain dollar amounts, thus emulating the rules for contactless transactions and diminishing the transaction speed value proposition. Interoperability represented another hurdle—not all contactless devices worked with all contactless readers.

Payments technology based on the EMV standard is now being rolled out in the U.S. market. The U.S. move to EMV brings with it global interoperability as well as the highest standard of security. However, a typical contact EMV transaction can be slower than a magnetic stripe transaction. The perception of both cardholders and merchants is that inserting a card, optionally entering a PIN or signing for the transaction, and waiting for authorization seem to take a lot longer than just swiping a card. Contactless EMV transactions, however, are perceived to be much faster than contact transactions, while still maintaining the high EMV security standard.

As merchants migrate to EMV, in most cases their new POS equipment already comes with the ability to perform contactless transactions. The question for merchants is whether they enable this functionality. This is in stark contrast to contactless payments from a decade ago, where the contactless reader was typically a separate unit that needed to be purchased, and then integrated with the existing POS equipment. Further, as merchants enable for contactless payments, they are enabling for all forms of NFC-based contactless payments, including smart phones and wearables, as well.

Another current market dynamic that impacts contactless adoption is the U.S. transit industry move to upgrade transit points-of-entry to accept contactless payment cards or devices.<sup>3</sup> Transit commuters, who by definition use public transportation every day, can be a catalyst for adoption of and habituation to the idea of tapping to pay with contactless devices. This is supported by international experience. Data from Transport for London (TfL) indicate that contactless transactions increased from 100 million transactions in 2013 to 319 million in 2014, spurred by transit's acceptance of contactless cards.<sup>4</sup> According to the UK Cards Association, "The number of contactless payments further soared by 228% in 2015, driven by acceptance on the Transport for London network with over a million journeys a day being paid by contactless cards."<sup>5</sup>

The introduction of Apple Pay, Android Pay and Samsung Pay is also driving interest in contactless payments using NFC-enabled mobile devices. Many issuers are now investing in mobile payment solutions, yet the majority of their transactions are still card-based. As has proved true in other markets, for consumers to

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<sup>2</sup> Note that there are two terms that sound very similar. The acronym MSD stands for "magnetic stripe data" and refers to the data that was transferred in the initial versions of contactless payments; the acronym MST stands for "magnetic secure transmission," a proprietary technology where certain mobile phones use RF to communicate with a magnetic-stripe-only POS terminal.

<sup>3</sup> Examples are: Utah Transit Authority (UTA), Chicago Transit Authority (CTA) and Southeastern Pennsylvania Transit Authority (SEPTA).

<sup>4</sup> The UK Cards Association, "Consumers turn to contactless as usage surges," Feb. 6, 2015, [http://www.theukcardsassociation.org.uk/news/contactless\\_surgeJan2015.asp](http://www.theukcardsassociation.org.uk/news/contactless_surgeJan2015.asp).

<sup>5</sup> The UK Card Association, *Card Expenditure Statistics December 2015*, [http://www.theukcardsassociation.org.uk/wm\\_documents/December%202015%20Full%20Report%20update.pdf](http://www.theukcardsassociation.org.uk/wm_documents/December%202015%20Full%20Report%20update.pdf).



readily adopt new forms of contactless payment, being able to use both cards and mobile devices for contactless payments would help drive adoption. As issuers move to the next wave of EMV chip card issuance, dual-interface chip cards, capable of both contact and contactless transactions,<sup>6</sup> would help to further motivate usage.

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<sup>6</sup> Dual interface cards allow the chip to be accessed by both the contact plate on the front of the card and the antenna embedded in the card.



## 3 Lessons Learned: Australia, Canada, and the United Kingdom

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Countries that have migrated to EMV chip technology have seen strong adoption of contactless payments. This section provides an overview of results achieved in Australia, Canada and the United Kingdom.

### 3.1 Australia

Australia is a global leader in contactless adoption. With a cohesive strategy focused on improved customer satisfaction, Australia is leading the way to contactless acceptance beyond low-value transactions, and contactless payment is becoming the national preferred payment option. Consumer preference for contactless technology has resulted in an annual contactless spend of \$3 billion Australian, with over 60 percent of all debit transactions being contactless.<sup>7</sup>

#### 3.1.1 Issuance

Currently, over two-thirds of the general population of Australia own a dual-interface card; over half of the population has used a contactless card.<sup>8,9</sup> Furthermore, satisfaction for contactless card users is on the rise; 60 percent of those with contactless cards report that the card is used at least once a week, up from 43 percent in 2014.<sup>10</sup>

#### 3.1.2 Acceptance

All large chain merchants already accept contactless payments, with Coles Supermarkets reporting that over 70 percent of all transactions are contactless.<sup>11</sup> Smaller merchants are also implementing contactless payment to drive cash displacement and offer additional transaction security. Merchants such as movie theaters, fast food vendors, convenience stores, drugstores, and bars are either contactless-enabled or in the process of adopting contactless.

In the next four years, about half of all cash displacement is expected to result from contactless transactions. While low value transactions have had a significant influence on contactless adoption, higher limits have also resulted in improved customer experience, with 66 percent of customers now preferring contactless cards to contact cards and 64 percent preferring contactless cards to cash when performing transactions worth up to \$100 Australian.<sup>12</sup>

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<sup>7</sup> "Australia Making Waves in the World of Contactless Payments," Let's Talk Payments, August 9, 2014, <https://letstalkpayments.com/australia-making-waves-world-contactless-payments/>.

<sup>8</sup> BPAY Banter Payment News and Insights, "Why do Australians lead the way in contactless payments?," Feb. 25, 2016, <http://www.bpaybanter.com.au/news-views/why-do-australians-lead-the-way-in-contactless-pay/>.

<sup>9</sup> Rian Boden, "Australia leads the way for contactless ownership and usage," NFC World+, May 13, 2015, <http://www.nfcworld.com/2015/05/13/335191/australia-leads-the-way-for-contactless-ownership-and-usage/>.

<sup>10</sup> Ibid.

<sup>11</sup> "The Evolution of Cash: An Investigative Study," Australian Payments Clearing Association, July 2014, <http://www.apca.com.au/docs/policy-debate/evolution-of-cash.pdf>.

<sup>12</sup> MasterCard press release, "Survey Reveals: Cash No Longer King for Australian Shoppers," Dec. 1, 2015, <http://newsroom.mastercard.com/asia-pacific/press-releases/survey-reveals-cash-no-longer-king-for-australian-shoppers/>.



## 3.2 Canada

Like the U.S., Canada originally pushed for contactless adoption in 2005, before EMV migration. While this effort was mildly successful, the result was similar to what happened in the U.S.—too few merchants and issuers and insufficient benefits for stakeholders. When EMV migration started in 2008, it quickly became clear that increased transaction times could be mitigated by adopting contactless transactions in parallel with EMV.

### 3.2.1 Issuance

Issuers who tested magnetic stripe data (MSD) contactless cards prior to EMV migration did not realize a positive business case. However, after being confronted with slower EMV chip transaction times, consumers who had used contactless requested this functionality.

The first issuer to roll out dual-interface cards en masse was also a major grocery retailer. Being both retailer and issuer, they had control of the entire consumer–merchant experience, end-to-end. Consumers were trained to tap their cards and were vocal in their preference for this experience. As other issuers tested dual-interface cards, they experienced higher consumer satisfaction, greater card usage (top of wallet), and more card use for low-value transactions (cash displacement).

The majority of credit and debit cards in the Canadian market are now dual-interface cards. According to the Canadian Bankers Association, as of the end of 2014 more than 70 percent of credit cards and 40 percent of debit cards in Canada support contactless payments.<sup>13</sup>

### 3.2.2 Acceptance

Key merchant verticals were targeted for contactless payment – specifically those that are “frequent usage” and those with a need for fast throughput (e.g., grocery stores, quick service restaurants, pharmacies and gas stations). As of July 2015, over 80 percent of merchant POS devices in the targeted categories were NFC-enabled and about 30 percent of all POS devices were NFC-enabled.<sup>14</sup>

Because consumers have clearly expressed a preference for contactless payments, most merchants now request (or automatically receive) contactless-enabled POS devices from their acquirers. A few years into the contactless EMV migration, the limit for contactless transactions was increased from \$50 Canadian to \$100 Canadian, and a linear increase occurred in the number of contactless transactions (representing nearly 30 percent of all transactions).<sup>15</sup>

## 3.3 United Kingdom

The U.K. leads contactless payment adoption in Europe. Contactless payments are commonplace in the U.K., illustrating that a mature EMV market can successfully introduce contactless payments, leveraging consumer use in public transportation while meeting demands for an improved consumer experience at other retailers as well.

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<sup>13</sup> Canadian Bankers Association, “Payments Security White Paper,” July 2015, <http://www.cba.ca/contents/files/submissions/misc-2015-paymentssecurity-whitepaper-en.pdf>.

<sup>14</sup> Canadian credit card, debit card and debt statistics, CreditCard.com Canada, <http://canada.creditcards.com/credit-card-news/canada-credit-card-debit-card-stats-international-1276.php>.

<sup>15</sup> Jamie Sturgeon, “‘Tap and go’ credit card purchases are surging in Canada,” Global News, Oct. 29, 2015, <http://globalnews.ca/news/2306518/tap-and-go-credit-card-purchases-are-surging-in-canada/>.





### 3.3.1 Issuance

Ensuring that cardholders have dual-interface cards is one key component of the shift in payment behavior in the U.K. Over half the credit and debit cards in circulation today are contactless-capable, and the percentage of adoption is expected to continue to grow.<sup>16</sup>

### 3.3.2 Acceptance

Transport for London (TfL) played a significant role in solidifying acceptance of contactless payments; TfL alone accounts for 1 million contactless transactions per day.<sup>17</sup>

The presence of over 460,000 contactless-capable terminals<sup>18</sup> in the U.K. guarantees that the infrastructure will continue to support the move to contactless, with the expectation that mobile payments will also benefit from ubiquitous contactless acceptance. Customer satisfaction has been on the rise, with consumers highlighting transaction speed, convenience, safety, and enhanced shopping experience as key differentiators.

The results are outstanding; in 2015, electronic payment transactions are estimated to have outnumbered cash-based transactions. With initial limits of £10 (now raised to £20), contactless transactions have been instrumental in cash displacement; contactless spending has tripled, reaching £7.75 billion, more than double the amount in the previous seven years combined.<sup>19</sup>

The result is an enormous spike in use, with Visa reporting that the number of contactless transactions increased from one in every 25 in 2014 to one in every seven by the end of 2015.<sup>20</sup>

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<sup>16</sup> UK Cards Association, "Annual contactless spending trebles to £7.75 billion," December 2015, <http://www.theukcardsassociation.org.uk/news/CESDec2015.asp>.

<sup>17</sup> Hilary Osborne, "Contactless payments used for 1bn UK purchases in 2015," The Guardian, Feb. 26, 2016, <http://www.theguardian.com/money/2016/feb/26/contactless-cards-purchases-spending>.

<sup>18</sup> Visa, "Visa Europe announces record revenues as the UK goes contactless," <https://www.visa.co.uk/newsroom/visa-europe-announces-record-revenues-as-the-uk-goes-contactless-1300858?returnUrl=/newsroom/index#sthash.7o7ZNXcV.dpuf>.

<sup>19</sup> Ibid.

<sup>20</sup> Ibid.



## 4 Benefits for Consumers

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Critical to the success of any new payments technology is delivering value to the consumer to drive adoption. The original value proposition for contactless payments proved to be less valid a few years after such payments were introduced. Issuers then began replacing contactless cards with less expensive magnetic stripe cards, and merchants began disabling contactless functionality at the POS. For consumers who were never aware of the technology in the first place, this transition passed largely unnoticed. But consumers who were die-hard users of contactless were disappointed. Contactless EMV provides these consumers with a chance to recover the convenience they lost.

From the consumer's point of view, contactless transactions are fast and convenient. A quick tap on the POS terminal, combined with no signature requirement, allows consumers to complete transactions quickly. In addition, when faced with the decision of whether to use cash or tap a card or NFC-enabled mobile device, consumers enjoy the freedom of tapping.

Tapping is not only faster, it also means that the transaction is not restricted to the amount of cash on hand. Moreover, as contact EMV cards become the norm (as a result of the October 2015 liability shift), consumers may become frustrated with the amount of time it takes to complete contact chip card transactions, even with the introduction of faster contact solutions.

Transit acceptance of contactless payments also provides greater consumer convenience for both the frequent commuter and the infrequent traveler. In a transit environment that accepts open contactless payments, the consumer can tap a contactless card or NFC-enabled mobile device of choice directly at the subway, rail, or bus point of entry. The need to stop and purchase traditional agency-issued fare media from a vending machine, sales office, or other sales channel is eliminated, as is the requirement for exact change.

In addition, as mobile wallets and wearables gain traction, consumers who have NFC-enabled mobile devices will expect to be able to use them wherever they shop and also use other value-added mobile services via the contactless interface.

The value of today's contactless payments is not just applicable for consumers making low value transactions, but is also important for payment transactions in all merchant segments.



## 5 Benefits for Issuers

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The primary goal for issuers in the U.S. has been to complete the migration to EMV, and significant progress has been made in adopting this more secure global technology. Some issuers are well on their way; others who have yet to establish their EMV migration strategy may want to consider issuing dual-interface cards.

This section discusses the benefits for issuers of adopting contactless payments, issuing dual-interface cards and offering NFC-enabled mobile payments solutions.

### 5.1 Improved Consumer Experience

In a mature EMV market, consumers expect to insert a card into a POS terminal. In a less mature market, such as the U.S., the consumer experience can be awkward. Consumers are not accustomed to inserting a card into a POS terminal and leaving it there, and all too often they leave the card behind, insert it incorrectly, or remove it at the wrong time in the transaction flow.

In a contactless payment transaction, the dual-interface card or NFC-enabled mobile device never leaves the consumer's hand, making the consumer payment experience simple and quick.

In addition, as consumers get increasingly used to paying with NFC-enabled mobile devices, they'll look to be able to use their card for contactless payments as well.

### 5.2 Improved Portfolio Utilization

As consumers become increasingly accustomed to contactless payments, they will begin to prefer using their dual-interface cards or NFC-enabled mobile devices for such payments, with several advantages. Contactless capabilities target low value transactions, displacing cash. Increased use captures transactions that otherwise either would have not occurred (incremental spend) or would have been cash transactions. As a result, issuers can expect incremental revenue.

More frequent use creates a top-of-wallet card for everyday purchases. Industry studies have “found a clear correlation between contactless adoption and preference for a particular card, illustrating that a contactless payments solution may help drive top-of-wallet behavior.”<sup>21</sup> In addition, the research shows that consumers spend more using contactless cards.

The adoption of open payments by public transit agencies at transit points-of-entry (turnstiles, buses) would also benefit issuers by increasing transaction volume and driving consumer habituation. Simplifying the use of the transit system by not requiring riders to purchase a proprietary form of payment leads to more frequent use and faster entry. Transit agencies also favor open payment because it minimizes the cost of issuing tickets.

The most important benefit, however, is the resulting consumer habituation. Habituation drives adoption, leads to wider acceptance, and increases consumer demand. Frequent card use also improves issuer fraud-scoring intelligence, eliminating false alerts and resulting in more reliable fraud detection.

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<sup>21</sup> MasterCard, “New MasterCard Advisors Study on Contactless Payments Shows Almost 30% Lift in Total Spend Within First Year of Adoption,” May 3, 2012, <http://newsroom.mastercard.com/press-releases/new-mastercard-advisors-study-on-contactless-payments-shows-almost-30-lift-in-total-spend-within-first-year-of-adoption/>.



## 5.3 Enhanced Security

Contactless transactions with dual-interface cards include the same security features as EMV contact transactions. If the contactless transaction fails, an EMV contact transaction can take place, maintaining the high level of EMV security. In addition, issuer fraud detection improves due to frequency of use.

Dual-interface EMV chip cards also include built-in capabilities to perform offline data authentication (ODA), which provides additional protection against counterfeit cards. When ODA is supported by the issuer, it can offer significant benefits for some merchants, providing strong authentication when a merchant chooses to enable deferred authorization. ODA may also support merchant risk management for stand-in processing of contactless EMV transactions when online communications are limited or unavailable. ODA is particularly useful for transit and in other environments (e.g., quick service restaurants, stadiums, theaters) where throughput is essential and/or when latency exists with host connectivity. Note, however, that issuers are not required to support offline data authentication for contactless EMV cards for all payment networks, so merchants may not be able to rely on ODA to manage counterfeit risk for a delayed authorization environment.

EMVCo tokenization, introduced with Apple Pay in the latter part of 2014, provides an additional layer of security for contactless payments using NFC-enabled mobile devices. Tokenization replaces the primary account number (PAN) with an alternate number, obviating the need for the merchant environment to handle the PAN and preventing cross channel fraud even in the case of a data breach. A token service provider (TSP) maintains the token vault and is responsible for tokenization, detokenization, and token lifecycle management. The TSP performs cryptogram support and restricts the domain and channels for which the token is issued during the transactions. Even if the token is compromised, it cannot be used in other channels, such as card-not-present (CNP) transactions, with the restrictions imposed by the TSP.

## 5.4 Easy Dual-Interface Card Deployment

The deployment process for dual-interface cards is no more complicated than the deployment process for EMV contact-only cards. Both types of cards require the following:

- Personalization equipment (both are personalized over the contact interface)
- A payment application (the application is the same for both)
- Key management, which is almost identical when considering EMV contactless as opposed to the previous MSD contactless card issuance

Issuer experience with EMV chip technology makes dual-interface card deployment easier than the switch from magnetic stripe cards to chip cards.

## 5.5 Global Interoperability

The contactless cards formerly deployed in the U.S. were not interoperable globally. Contactless payments using EMV contactless cards and NFC-enabled mobile devices are. Frequent travelers therefore benefit by being able to use familiar capabilities when riding the transit system in a foreign city or tapping their card or NFC-enabled mobile device at a foreign retail location. This helps to drive higher spend and top-of-wallet benefits for issuers.

## 5.6 Dual-Interface Card Affordability

Dual-interface cards are now more affordable. Global acceptance of the technology—from Europe, China, and the rest of Asia to Australia and Canada—has resulted in a mature, well-established product that is available from most card vendors with a variety of chip and payment application options for all major payment networks.



## 5.7 Complementary Strategy to Mobile Payment App Issuance

With the introduction of Apple Pay, Android Pay, and Samsung Pay, contactless payment using NFC-enabled mobile devices has gained significant popularity in the U.S.

Contactless payments with both dual-interface EMV chip cards and NFC-enabled mobile devices use the same payment network acceptance specifications. The difference for issuers is that contactless payment with NFC-enabled mobile devices uses tokenization. Tokenization offers additional security and convenience; issuers can provide contactless payment only to targeted consumer groups. That is, issuers can initially restrict offers of mobile payment to only those consumers who are aware of contactless payment and want to use it.

As the market for contactless payment matures, however, consumer awareness and demand for contactless payment are expected to increase (based on what has occurred elsewhere in the world). Greater consumer demand will therefore drive the need to complement strategies supporting contactless payment with NFC-enabled mobile devices by issuing dual-interface cards on a larger scale, to cater to all of an issuer's cardholders, while at the same time providing an alternative payment method, when needed, for consumers who have started using mobile payment.

Dual-interface cards actually offer the following advantages for issuers offering contactless payments capability to their cardholders:

- Issuer control. Dual-interface card issuance is completely under the control of the issuer.
- Convenience. The payment selection method is simple and straightforward.
- Consistency. The card does not depend on third-party apps for functionality and offers a more consistent user experience.
- Reliability. The card does not require a mobile device power source or another mobile application.
- Consumer perception of higher security. Payment credentials are not exposed on a more vulnerable connected device.
- Maturity. Dual-interface card technology is mature.
- Familiarity. The use of cards for payment is already pervasive, while NFC-enabled mobile payments are still emerging.
- Flexibility. Multiple interfaces within the payment card ensure that a transaction can be performed regardless of the merchant setup and capabilities (contactless, contact, magnetic stripe, key entry and embossed).

Dual-interface card deployment also allows issuers to preserve their branding and approach to winning customers with appealing card design and features. In addition, a comparison of the costs of mass adoption of dual-interface cards with the costs of mobile apps and tokenization services may very well favor cards.

## 5.8 New Use Opportunities

The contactless card interface offers new opportunities for card use. For example, the card can interact with an NFC-enabled mobile device for secure mobile payment enrollment, mobile banking access, or high risk mobile transaction authentication. Additional authentication or access control applications are also possible in a corporate environment or on a university campus. In addition, offering NFC-enabled mobile payments – either through an issuer-branded mobile wallet or through another branded wallet – provides the opportunity to leverage the mobile platform and offer other value-added services to cardholders.



## 6 Benefits for Merchants

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As merchants migrate to EMV, in most cases their new point-of-sale (POS) equipment includes the capability to perform contactless transactions.<sup>22</sup> This provides merchants with the opportunity to not only migrate to EMV contact chip transactions, but also to enable contactless payments for multiple form factors (e.g., cards, NFC-enabled mobile phones and wearables).

This section identifies the benefits for merchants of enabling contactless payment acceptance.

### 6.1 Better Consumer Experience

The consumer experience with contactless payment is determined mostly by what features the merchant chooses to implement. For some merchants, customers will simply perceive that checkout is faster. Merchants who are able to tie loyalty programs in with mobile wallets can enhance the consumer experience further with personal communications, promotional opportunities, and transaction histories. In general, consumers using mobile applications such as Apple Pay and Android Pay also perceive an increase in security, particularly when biometrics are involved.

The chip card experience in the U.S. is still new to both consumers and merchant sales associates. Consumers can be confused about where and how to insert the card, and a sales associate often needs to assist. In contrast, performing a contactless transaction is intuitive and requires minimal participation by a sales associate.

### 6.2 Improved Transaction Speeds

Contactless payments are currently the fastest way to pay for EMV chip transactions, as consumers are not required to leave the card in the POS device for the duration of the transaction. This eliminates scenarios in which consumers remove the card before the transaction is completed, requiring them to reinsert the card and reprocess the transaction. In addition, it prevents situations in which the card is not fully inserted or the chip contacts are worn, resulting in multiple attempts before falling back to magnetic stripe.

The market has acknowledged that EMV contact chip transactions are relatively slow; both contactless payment and other new market initiatives (such as Amex Quick Chip, MasterCard M/Chip Fast and Visa Quick Chip) can help address this issue.

### 6.3 Additional Payment Options

When merchants enable contactless payments, they are enabling all forms of NFC-based contactless payments, including payment made with cards, smartphones, and wearables. Consumers can use their preferred payment mechanism, enabling greater consumer convenience at the POS.

### 6.4 Absence of Contactless Transaction Limits

The U.S. has no limit on contactless transaction values. The same no cardholder verification method (CVM) limits apply to both contactless and contact transactions. The absence of limits is convenient for consumers and results in the same consumer experience for both contact and contactless transactions.

### 6.5 New Cardholder Verification Methods

Consumers using an NFC-enabled mobile device to complete a contactless payment transaction can experience an additional benefit if the device supports the on-device cardholder verification method

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<sup>22</sup> Incorporating this capability into the equipment is in contrast with the situation a decade ago, when the contactless reader typically had to be purchased as a separate unit that needed to be integrated with the merchant's POS equipment.



(ODCVM), also known as the consumer device cardholder verification method (CDCVM). ODCVM uses a mobile device's PIN or user biometric to authenticate cardholder identity in an NFC-enabled mobile contactless transaction. The POS terminal needs to have a contactless kernel and application from the payment network(s) to accept the mobile credentials.

ODCVM allows transactions to exceed the no CVM limit without requiring the consumer to sign a receipt or enter a PIN on the POS device, providing a more seamless and faster checkout experience for the consumer. An additional benefit for the merchant is that the contactless transaction flow is preserved regardless of the transaction amount. This lack of friction may lead to higher spend on contactless purchases.

## 6.6 Enhanced Security

Contactless EMV payment transactions (with both dual-interface cards and NFC-enabled mobile devices) use the same cryptographic functions as contact EMV chip transactions. Therefore, they are very secure, even more than the previous generation of MSD contactless transactions.

In addition, if there are problems with the chip card during a contactless transaction, the failure recovery mechanism is to insert the chip card and proceed with a contact EMV transaction. Switching to a contact chip transaction is more secure than a magnetic stripe transaction.

Merchants who enable both contactless and contact EMV are almost always protected against fraud chargebacks. To be sure, merchants and acquirers should refer to the payment networks for guidance.

In addition, dual-interface EMV chip cards include built-in capabilities to perform offline data authentication (ODA), which provides additional protection against counterfeit cards. When ODA is supported by the issuer, it can offer significant benefits for some merchants, providing strong authentication when a merchant chooses to enable deferred authorization. ODA may also support merchant risk management for stand-in processing of contactless EMV transactions when online communications are limited or unavailable. ODA is particularly useful for transit and in other environments (e.g., quick service restaurants, stadiums, theaters) where throughput is essential and/or when latency exists with host connectivity. Note, however, that issuers are not required to support offline data authentication for contactless EMV cards for all payment networks, so merchants may not be able to rely on ODA to manage counterfeit risk for a delayed authorization environment.

As discussed in Section 5.3, EMVCo tokenization provides an additional layer of security for contactless payments using NFC-enabled mobile devices. Tokenization replaces the primary account number (PAN) with an alternate number, obviating the need for the merchant environment to handle the PAN and preventing cross channel fraud even in the case of a data breach.

## 6.7 “Cool” Factor

A recent Pew Research Center survey<sup>23</sup> documents an overall smartphone adoption rate in the U.S. of 72 percent. That number skyrockets to 92 percent for consumers in the 18- to 34-year-old age range. Adopting contactless payments presents merchants with an ideal opportunity to stay in step with the latest mobile payment developments, thus presenting an image of being ahead of the technological curve, especially with early adopters.

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<sup>23</sup> Jacob Poushter, “Smartphone Ownership and Internet Usage Continues to Climb in Emerging Economies,” Pew Research Center, Feb. 22, 2016, <http://www.pewglobal.org/2016/02/22/smartphone-ownership-and-internet-usage-continues-to-climb-in-emerging-economies/>.



## 6.8 Reduced Cash Handling

Handling cash is expensive, cumbersome, and prone to error and shrinkage. Although, in general, contactless acceptance can reduce the amount of cash handled at the POS without replacing it completely, there is one environment that will benefit greatly from a reduction in cash usage—vending. Although some vending machines are equipped with magnetic stripe readers, they predominantly require cash. Adding contactless capability to vending machines will reduce the need for consumers to carry small change in the exact amount required.

## 6.9 Higher Transaction Amounts

Industry studies have shown that consumers spend more using contactless enabled cards.<sup>24</sup> Not only is tapping faster and more convenient than paying with cash, the consumer is no longer restricted to spending only the amount of cash on hand.

## 6.10 Use of Current Infrastructure

Many merchants are currently deploying EMV contact terminals or have already completed EMV reterminalization. These merchants may be concerned with the impact of supporting contactless transactions.

Many available POS terminals include hardware that supports both contact and contactless EMV transactions, and it is likely that a merchant's hardware is already contactless-capable. The contactless software component of these terminals can be enabled with minimal impact to the merchant's current POS solution. Additional testing and certification are required, but testing and certification can be done without disturbing the current infrastructure.

## 6.11 Point of Entry Throughput

Adopting contactless payments is particularly beneficial in venues where throughput is a concern—not only transit, but also quick service restaurants, stadiums, and theaters. These same venues would also realize benefits in the form of lower ticket issuance costs if the contactless device is used as the ticket.

## 6.12 Benefits for Transit Merchants

An open payment system allows transit customers to pay fares with their own contactless payment devices (bank cards, mobile devices) at transit points of entry. Such acceptance can potentially change the way transit riders pay for fares, reducing reliance on agency-issued media such as contactless transit-only media. For transit merchants such systems can provide various benefits, such as reducing the use of more costly sales channels, reducing the need for costly infrastructure (such as vending machines), and shrinking the supply chain and reducing the resources needed to support transit-only media. It is important to note that many transit agencies are likely to retain some form of agency media, but accepting open payments can minimize this requirement.

Additionally, by leveraging the standards-based technologies used by the broader retail payments industry, transit merchants can deploy systems that are aligned with customer expectations. Such systems can also facilitate interoperability among other transit and non-transit entities without requiring direct systems integration, as customers can use the same device to pay everywhere.

Additional potential benefits for transit merchants are based on changes to the customer experience. By enabling customers to pay with something they already have, contactless acceptance can increase use of

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<sup>24</sup> MasterCard, "New MasterCard Advisors Study on Contactless Payments Shows Almost 30% Lift in Total Spend Within First Year of Adoption," op. cit.





transit by reducing barriers to using public transportation (how do I pay? where do I get a card? a ticket?). Passengers with contactless bank cards can avoid queues and the need to retain separate fare media to access public transit networks, while no longer having to search for cash or exact change when traveling. Agencies can even offer the assurance that a customer will always be charged the best fare, similar to the capabilities sometimes offered with closed-loop transit smart cards.

Note that transit open payments do present challenges. The environment is different from most other retail environments: ensuring public safety and the smooth flow of customers means that real-time issuer authorization at entry gates is generally not feasible. Granting access without an authorization response exposes transit agencies to both counterfeit fraud and financial risk. Transit merchants can (and many plan to) leverage EMV capabilities by enforcing ODA to mitigate this counterfeit risk, and transit-specific models that share financial risk can further support the business case for transit open payments.



## 7 Implementation Considerations

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This section summarizes key implementation requirements for issuers and merchants.

### 7.1 Issuer Considerations

There are several considerations issuers need to take into account in order to adopt contactless:

- Card issuance and personalization
- Mobile device provisioning (optional)
- Authorization processing
- Servicing the customer
- Educating the consumer

Card issuance involves procurement of contactless-enabled dual-interface EMV cards. Issuers should consult with their card provider. There are various mature dual-interface card products available from all major vendors for issuers to choose from. If considering a debit portfolio for dual-interface, issuers must ensure with the card vendor that the product is U.S. common debit compliant. Such products exist today for all major payment networks. This white paper is intended to help guide the issuer on the additional consideration above and beyond contact-only EMV card or mobile issuance. In addition to the chip and building the antenna into the card body, minor design changes may be required to accommodate the contactless EMV logo indicating the additional card feature.

If the issuer already issues contact EMV cards, no updates to the personalization equipment are needed to support contactless. The embossing files and card profiles must be enhanced to include additional contactless parameters.

If the issuer has not yet migrated to EMV, support for contactless could be developed at the same time as contact EMV. The incremental work needed to add contactless on top of contact is negligible given the scope of EMV. If mobile acceptance is on the roadmap, issuers will need to engage with a Token Service Provider to enable provisioning of the account data to the mobile wallet. This effort is done separately for each mobile wallet that the issuer wants to be in.

Authorization processing and risk management rules may need enhancements to accept both MSD and EMV contactless transactions. While the U.S. payments market is still in transition, there are likely merchant terminals in the market that can only process MSD. The card or mobile device will automatically downgrade to MSD. If the issuer already supports mobile wallets, then it is likely that this effort has already been done.

When servicing customers it may be necessary for advisors to differentiate transactions that originated from the contact or contactless interface.

Customers must be made aware that their new card is contactless enabled and should be provided with instructions on how to use it at the point of sale. It may also be necessary to allay customer misconceptions of card account information theft via the contactless interface.

### 7.2 Merchant Considerations

While the U.S. market has some experience with enabling contactless payment, the EMV liability shift means that many more merchants have had to upgrade their POS terminals to support EMV transactions. The



required upgrade provides the opportunity to accept a variety of contactless form factors for those merchants who have so far not opted for contactless support:

- Merchants who support only magnetic stripe transaction-capable terminals
- Merchants who support earlier forms of contactless transactions, such as contactless MSD
- Merchants who have upgraded to EMV-capable terminals but have not yet activated either the contact or contactless functionality
- Merchants who have upgraded to EMV terminals that only support contact chip cards

Merchants who only support magnetic stripe transactions will require a complete terminal upgrade. For these merchants, installing EMV integrated terminals makes business sense even if the merchant chooses initially to support contactless only. Multiple certifications are required, such as EMVCo Levels 1 and 2, acquirer level 3 integration, PCI, and payment network certifications. The same considerations apply to merchants with legacy MSD contactless terminals.

For merchants who have upgraded their terminals but either the contact or contactless functionality is not activated, full or partial terminal certification is required, depending on the current deployment (integrated as opposed to standalone contactless devices). New contactless form factors require additional data elements and CVMs such as PINs or biometric authentication. Some deployed terminals that support contactless transactions are already upgraded to the latest network-specific contactless specifications to enable the new data elements. Some terminals can be upgraded remotely, while some will have to be replaced, depending on the particular merchant service provider.

It is important to note that contactless payments with NFC-enabled mobile devices also use tokenization. While a token resembles the PAN, merchants see some impact on implementations of loyalty programs and processing of chargebacks. To alleviate some of the challenges of tokenization, EMVCo introduced a new data element, the Payment Account Reference (PAR). However, implementing PAR in the merchant environment can be time-consuming.



## 8 Conclusions

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This white paper describes how contactless payments have evolved since their introduction in 2005 and describes the benefits for consumers, merchants, and issuers. NFC-enabled mobile payments are revealed to be an important driver of contactless acceptance, and transit implementations make a good case for issuing contactless-capable cards or other devices. All players seem to agree that there are valid drivers for and benefits to encouraging contactless payments in the U.S.

Issuers and mobile wallet providers such as Apple, Samsung, and Google may already have taken the first step toward driving broader contactless acceptance. However, due to the scarcity of contactless POS terminals, issuers may still feel that there is not enough merchant acceptance to justify issuing dual-interface cards. Similarly, some merchants may feel that adding contactless just for the small lift offered by NFC-enabled mobile payments is not worth the cost and effort. Ultimately it will be consumers, spurred by speed and convenience, who will drive the demand for contactless payments.

Consumers who use mobile payments solutions such as Apple Pay, Google Pay, and Samsung Pay do so under the assumption that they will be able to use the wallet to complete transactions at any POS. These consumers (and the wallet providers) are pushing for more contactless-enabled POS terminals. And as more merchants enable contactless terminals, there will be more opportunity for consumers to use their mobile devices for contactless payments, thereby generating more consumer awareness of contactless technology. As awareness reaches consumers without NFC-enabled mobile devices, these consumers may look for ways that they, too, can speed up transactions, creating demand for additional opportunities to pay through contactless transactions. While some may choose to use a mobile device, this may not be a viable solution for others. These consumers could shift spending from a non-contactless card to another dual-interface card that is already in their wallet. Or they may contact their issuer to request a contactless card. To meet this consumer demand, issuers hopefully will step up their issuance of dual-interface cards or enable their cards to be loaded into a mobile wallet.

More contactless cards and devices in the market will increase demand for more contactless-enabled terminals. As this snowball effect takes hold, convenience will lead to habit, which leads to demand and then to adoption.

The original 2005 contactless movement was based on magnetic stripe data, was not interoperable with contactless payments implementations in other countries and delivered few benefits to stakeholders. With the U.S. payments industry now migrating to EMV chip cards and acceptance infrastructure, merchants and issuers have a prime opportunity to take advantage of the infrastructure changes and implement contactless payments for both dual-interface cards and NFC-enabled mobile devices.

Current contactless EMV technology delivers clear benefits to all stakeholders including but not limited to an affordable contactless solution, faster transaction time and interoperability around the globe and is poised for an exponential growth.



## 9 Publication Acknowledgements

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This white paper was developed by the Smart Card Alliance Payments Council to describe the value propositions of contactless EMV payments for issuers and merchants.

Publication of this document by the Smart Card Alliance does not imply the endorsement of any of the member organizations of the Alliance.

The Smart Card Alliance wishes to thank the Payments Council members and guests for their contributions. Participants involved in the development of this white paper included: Advanced Card Systems Ltd.; American Express; Bell ID; Capgemini; CH2M; Chase Paymentech; CPI Card Group; Discover Financial Services; First Data; Fiserv; Gemalto; Giesecke & Devrient; GlobalPlatform; Ingenico; Metropolitan Transportation Authority (MTA); NXP Semiconductors; Oberthur Technologies; Quadagno & Associates; TSYS; Verifone; Visa Inc.; Wells Fargo; Whole Foods; Xerox

The Smart Card Alliance thanks the following Council members who wrote content and participated in the project team for this document:

- **Andreas Aabye**, Visa
- **Philip Andreae**, Oberthur Technologies
- **Aron Clark**, Visa
- **Deana Cook**, Chase Paymentech
- **Jose Correa**, NXP Semiconductors
- **Brady Cullimore**, American Express
- **Michael DeVitto**, MTA
- **Mike Fisher**, CPI Card Group
- **Steve Frazzini**, Xerox
- **Allen Friedman**, Ingenico
- **Imran Hajimusa**, Verifone
- **Sarah Hartman**, TSYS
- **Jack Jania**, Gemalto
- **Oliver Manahan**, Independent
- **Joshua Martiesian**, MTA
- **Ken Mealey**, American Express
- **Cathy Medich**, Smart Card Alliance
- **Mike Mercado**, Whole Foods
- **Bob Merkert**, Advanced Card Systems Ltd.
- **Nick Pisarev**, Giesecke & Devrient
- **Peter Quadagno**, Quadagno & Associates
- **Lokesh Rachuri**, Capgemini
- **Sophie Rainford**, American Express
- **Brian Stein**, CH2M
- **Mike Strock**, Smart Card Alliance
- **Sree Swaminathan**, First Data
- **Jamie Topolski**, Fiserv
- **David Worthington**, Bell ID
- **Robert Yates**, Xerox

The Smart Card Alliance also thanks Payments Council members who participated in the review of the white paper including:

- **Jay Bozicevich**, Wells Fargo
- **Hank Chavers**, GlobalPlatform
- **Cindy Custers**, Discover
- **Simon Hurry**, Visa
- **Shane Irvin**, TSYS
- **Ellie Smith**, Discover
- **Terri Strickland**, Wells Fargo

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## About the Smart Card Alliance Payments Council

The Smart Card Alliance Payments Council focuses on facilitating the adoption of chip-enabled payments and payment applications in the U.S. through education programs for consumers, merchants, issuers, acquirers/processors, government regulators, mobile telecommunications providers and payments service providers. The group is bringing together payments industry stakeholders, including payments industry leaders, merchants and suppliers, and is working on projects related to implementing EMV, contactless payments, NFC-enabled payments and applications, mobile payments, and chip-enabled e-commerce. The Council's primary goal is to inform and educate the market about the value of chip-enabled payments in improving the security of the payments infrastructure and in enhancing the value of payments and payment-related applications for industry stakeholders. Council participation is open to any Smart Card Alliance member who wishes to contribute to the Council projects.



## 10 Glossary

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### **Cardholder verification method (CVM)**

The method used to authenticate that the person presenting a card is the valid cardholder. EMV supports four CVMs: offline personal identification number (PIN) (offline enciphered & plain text), online encrypted PIN, signature, and no CVM.

### **Chip card**

A device that includes an embedded secure integrated circuit that can be either a secure microcontroller or equivalent intelligence with internal memory, or a secure memory chip alone. The card connects to a reader with direct physical contact or with a remote contactless radio frequency interface. With an embedded microcontroller, chip cards have the unique ability to securely store large amounts of data, carry out their own on-card functions (e.g., encryption and mutual authentication), and interact intelligently with a card reader. All EMV cards are chip cards.

### **Consumer device cardholder verification method (CDCVM)**

A method that uses the mobile device's PIN or user biometric to authenticate cardholder identity in an NFC-enabled mobile contactless transaction. Also referred to as on-device cardholder verification method (ODCVM).

### **Contact chip card**

Chip card that communicates with a reader through a contact plate.

### **Contactless chip card**

Chip card that communicates with a reader over a radio frequency.

### **Contact EMV payment**

An EMV chip payment transaction that uses the contact interface of an EMV chip card and communicates with an EMV chip-enabled terminal into which the card is inserted.

### **Contactless EMV payment**

An EMV chip payment transaction that uses the contactless interface of a chip card and communicates with an EMV chip-enabled terminal using radio frequency.

### **Contactless payments**

Payment transactions that do not require physical contact between a consumer's payment device and a point-of-sale terminal

### **Dual-interface card**

A chip card that allows the chip to be accessed by both the contact plate on the front of the card and the antenna embedded in the card

### **EMV**

Specifications initially developed by Europay, MasterCard, and Visa to define a set of requirements to ensure interoperability between payment chip cards and terminals. EMV specifications now encompass contact chip, contactless chip, common payment application (CPA), card personalization, and tokenization. The specifications are managed by EMVCo, which is currently overseen by American Express, Discover Financial Services, JCB, MasterCard Worldwide, UnionPay, and Visa, Inc.

**Magnetic Secure Transmission (MST)**

A proprietary technology implemented in certain mobile phones that use RF to communicate payment account information with a magnetic-stripe-only POS terminal

**Magnetic stripe data (MSD) transaction**

A payment transaction that transfers data that is from the magnetic stripe of a credit or debit card.

**Near Field Communication (NFC)**

Standards-based wireless communication technology that allows data to be exchanged between devices that are a few centimeters apart. Contactless payments with NFC-enabled mobile devices use the ISO/IEC 14443 standard communication protocol currently used by EMV contactless chip cards.

**NFC-enabled mobile device**

A smartphone, tablet or wearable that supports NFC.

**Offline data authentication (ODA)**

A process whereby the card is validated at the point of transaction, using RSA public key technology to protect against counterfeit or skimming. Three forms of offline data authentication are defined by EMV: Static (SDA), Dynamic (DDA) and Combined DDA/Application Cryptogram (CDA).

**On device cardholder verification method (ODCVM)**

A method that uses the mobile device's PIN or user biometric to authenticate cardholder identity in an NFC-enabled mobile contactless transaction. Also referred to as consumer device cardholder verification method (CDCVM).

**Payment Account Reference (PAR)**

A non-financial reference assigned to each unique PAN and used to link a payment account represented by that PAN to affiliated payment tokens.

**Primary account number (PAN)**

Numeric value that identifies a payment card. The issuing organization associates the PAN electronically with a customer and the customer's designated accounts. The PAN is allocated in accordance with ISO/IEC 7812 and comprises 13 to 19 digits.

**Radio frequency (RF)**

Electromagnetic wave frequencies that lie in the range extending from around 3 kHz to 300 GHz.<sup>25</sup> Contactless payment uses 13.56 MHz.

**Tokenization**

For payment transactions, a process that replaces the payment card primary account number (PAN) with a surrogate value (i.e., a payment token) that is used in transactions in place of the PAN.

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<sup>25</sup> Wikipedia, [https://en.wikipedia.org/wiki/Radio\\_frequency](https://en.wikipedia.org/wiki/Radio_frequency)





# 11 References

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## 11.1 General References

"Contactless Payments Security Q&A," Smart Card Alliance,

<http://www.smartcardalliance.org/pages/publications-contactless-payment-security-qa>

"EMV and NFC: Complementary Technologies Enabling Secure Contactless Payments," Smart Card Alliance white paper, November 2015, <http://www.smartcardalliance.org/publications-emv-and-nfc-complementary-technologies-enabling-secure-contactless-payments/>

EMV Connection web site, <http://www.emv-connection.com>

Smart Card Alliance web site, <http://www.smartcardalliance.org>

Smart Card Alliance Mobile Council, <http://www.smartcardalliance.org/activities-councils-mobile-council/>

Smart Card Alliance Payments Council, <http://www.smartcardalliance.org/activities-councils-payments/>

"Smartphone Ownership and Internet Usage Continues to Climb in Emerging Economies," Pew Research Center, Feb. 22, 2016, <http://www.pewglobal.org/2016/02/22/smartphone-ownership-and-internet-usage-continues-to-climb-in-emerging-economies/>

## 11.2 Australia Statistics References

"Australia leads the way for contactless ownership and usage," NFC World+, May 13, 2015,

<http://www.nfcworld.com/2015/05/13/335191/australia-leads-the-way-for-contactless-ownership-and-usage/>

"The Evolution of Cash: An Investigative Study," Australian Payments Clearing Association, July 2014,

<http://www.apca.com.au/docs/policy-debate/evolution-of-cash.pdf>

"The Evolution of Payment Costs in Australia," Reserve Bank of Australia, December 2014,

<http://www.rba.gov.au/publications/rdp/2014/pdf/rdp2014-14.pdf>

"Performance Highlights 2015," eftpos, <https://www.eftposaustralia.com.au/about/performance-highlights-2015/>

"Survey Reveals: Cash No Longer King for Australian Shoppers," MasterCard press release, Dec. 1, 2015,

<http://newsroom.mastercard.com/asia-pacific/press-releases/survey-reveals-cash-no-longer-king-for-australian-shoppers/>

"Why do Australians lead the way in contactless payments?," BPAY Banter Payment News and Insights, Feb.

25, 2016, <http://www.bpaybanter.com.au/news-views/why-do-australians-lead-the-way-in-contactless-pay>

## 11.3 Canada Statistics References

"Canadian credit card, debit card and debt statistics," CreditCard.com Canada,

<http://canada.creditcards.com/credit-card-news/canada-credit-card-debit-card-stats-international-1276.php>

"Canadian Payment Methods and Trends: 2015," Canadian Payments Association, December 2015,

[https://www.cdnpay.ca/imis15/pdf/pdfs\\_publications/2015-12-Payment-Methods-Trends.pdf](https://www.cdnpay.ca/imis15/pdf/pdfs_publications/2015-12-Payment-Methods-Trends.pdf)

"Payments Security White Paper," Canadian Bankers Association, July 2015,

<http://www.cba.ca/contents/files/submissions/misc-2015-paymentssecurity-whitepaper-en.pdf>



## 11.4 UK Statistics References

“Annual contactless spending trebles to £7.75 billion,” UK Cards Association, December 2015, <http://www.theukcardsassociation.org.uk/news/CESDec2015.asp>

“Contactless expenditure on MasterCard’s UK network grows 375% in 2015,” MasterCard press release, February 17, 2016, <http://newsroom.mastercard.com/eu/press-releases/contactless-expenditure-on-mastercards-uk-network-grows-375-in-2015/>

“Contactless payments used for 1bn UK purchases in 2015,” The Guardian, February 26, 2016, <http://www.theguardian.com/money/2016/feb/26/contactless-cards-purchases-spending>

“Visa Europe announces record revenues as the UK goes contactless,” Visa press release, <https://www.visa.co.uk/newsroom/visa-europe-announces-record-revenues-as-the-uk-goes-contactless-1300858?returnUrl=/newsroom/index#sthash.7o7ZNXcV.dpuf>

“Visa’s contactless payments soar by 250pc in the UK, as firm reports record revenues in Europe,” City A.M., January 26, 2016, <http://www.cityam.com/233066/visas-contactless-payments-soar-by-250pc-in-the-uk-as-firm-reports-record-revenues-in-europe>