FROST & SULLIVAN

Are you looking for the world-class dual interface solution?

A Frost & Sullivan
White Paper

November 2011

Contents

Are you looking for the world-class dual interface solution?

1. Contactless Solutions Taking Over the Smart Card World

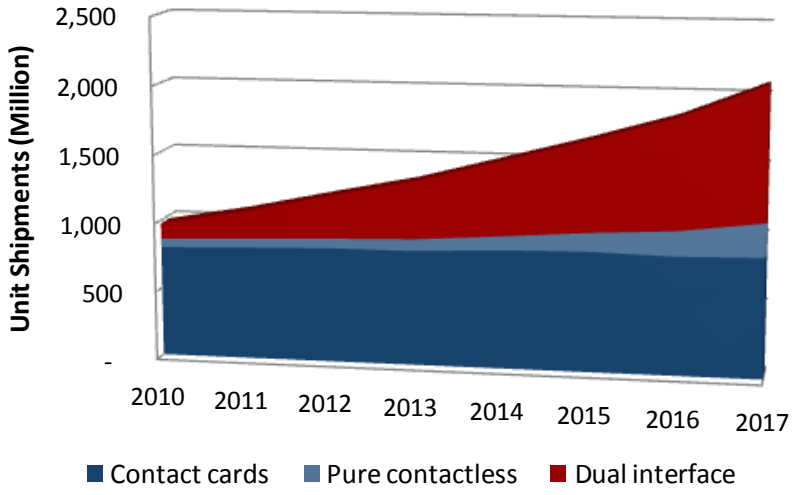
1.1 A Global Perspective

The high degree of interconnection among people, businesses, and institutions drives the use of secure authentication technologies. Historically, smart card-based solutions enabled people to safely interact, going about their everyday life activities. But in a world that is developing at an unprecedented pace, authentication technologies should not only be secure, but also fast.

Governments, as well as service providers across the banking, transport and security industries, have increasingly adopted contactless smart card-based solutions to manage a shift from security to convenience. This trend has a global scale.

In Asia Pacific, contactless cards have been widely used for fare collection systems. The Octopus card in Hong Kong and the EZ-Link card in Singapore testify to the success of contactless transport ticketing solutions. Due to the satisfactory results of these cards, their functionality has been expanded to pre-paid electronic purse (e-purse). Likewise, in North America, enterprises have implemented physical and logical control access solutions based on contactless chip cards. The contactless feature allows for simple yet reliable security systems.

Figure 1: Unit Shipment of Contact and Contactless Cards



Dual interface cards are expected to grow at a CAGR (2010-2017) of approx. 25%.

By the end of 2017, dual interface cards may amount to 45% of total shipments

Source: Frost & Sullivan

Germany, India, Morocco, and the United States are amongst the more than fifty countries that are issuing contactless e-Passports. Other nations will soon be issuing contactless e-ID cards. Poland, France, Bahrain and Brazil are some of the countries involved in contactless e-ID initiatives. Citizens of these countries enjoy faster and safer interaction with public authorities and, in some cases, with online retailers.

Bank cards are probably the most interesting contactless application of them all. Frost & Sullivan estimates that 170 million contactless bank cards had been issued by 2010. And the strategic moves of banks suggest that the number of contactless bank card shipments will skyrocket during the next 5 years.

1.2 The Emergence of Dual Interface Smart Cards

From a technical standpoint, a contactless smart card wirelessly communicates with a reader at a distance of up to 5 centimeters. Contactless smart cards differentiate from other radio frequency cards in that they are equipped with a microprocessor, providing them with cryptographic processing capabilities. Contactless cards can be characterized as *pure* contactless, dual interface, or hybrid. While, a dual interface card has a single chip with both contactless and contact functionalities, hybrid cards have two chips (one for contactless and the other for contact interaction). Table 1 provides a comparative analysis of some of the features of contact, *pure* contactless, hybrid, and dual interface cards.

"In 2011, more than 120 million cards delivered globally within the payment industry will use the dual interface technology."

David Noel-Lardin from GEMALTO

Table 1: Unit Shipment of Contact and Contactless Cards

	Contact Cards	'Pure' Contactless	Hybrid	Dual Interface
Interface	Contact	Contactless	Contact and contactless	Contact and contactless
Production costs				
Typical Applications	Payment Control Access	Transport ticketing e-purse	Payment e-ID, Control access	Payment e-ID, Control access

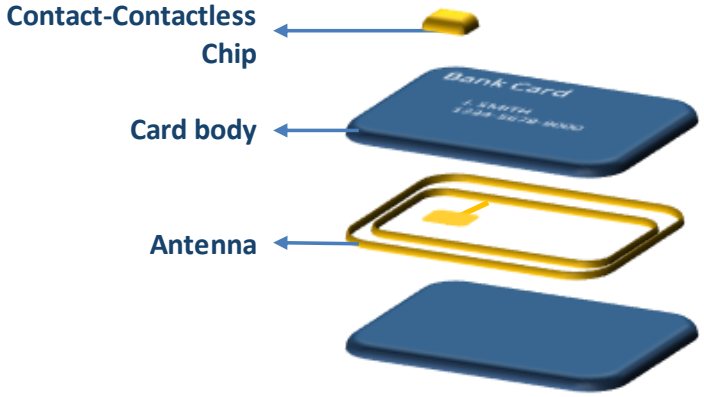
Source: Frost & Sullivan

Frost & Sullivan believes that, for years to come, shipments of contactless cards will primarily be of the 'dual interface' type. There are three reasons for this. Firstly, institutions and businesses across various verticals are realizing the advantages of secure and convenient 'contactless' card-based systems.

Secondly, dual interface cards deliver a greater customer experience than 'pure' contactless ones, because they enable end-users to interact through both contact and contactless interfaces. Moreover, dual interface cards are less expensive than hybrid cards.

This white paper will focus on the benefits of dual interface cards, the challenges surrounding their manufacturing process, and the potential solutions to these challenges. Figure 2 provides an illustration of a dual interface card.

Figure 2: Dual Interface Cards



There are various challenges attached to the production of dual interface cards. Service providers and car manufacturers should carefully assess potential solutions.

Source: Frost & Sullivan

2. Dual Interface Cards in the Banking Industry

The evolution from security to convenience is also taking place within the banking industry. To stem fraud, financial institutions migrated their card portfolio from the old-fashioned magnetic stripe cards to smart cards compliant with the EMV standard. However, in their search of differentiation and greater value-add, various financial institutions have gone even further, issuing contactless cards.

As highlighted before, dual interface cards have key advantages over other types of contactless cards: they are cheaper and they enable end users to interact through contact and contactless interfaces. Moreover, besides providing a better offering, financial institutions are able to target the large but untapped cash market.

"In the UK, we deliver millions of payment cards each year through our local partner, using the SPS solution. The technology is robust and reliable, and we have not experienced any significant field returns."

Arnaud Jullien from MORPHO

Payment schemes have played a key role in setting the pace for adoption of dual interface cards. Currently the most widely adopted applications are MasterCard

PayPass™ and Visa payWave™. As of March 2011, more than 90 million PayPass cards have been issued around the globe.

2.1 Benefits for Cardholders

- **Faster Service**: Customers spend less time queuing and paying. MasterCard has reported that the average time in the queue can be reduced from 15 to 40 percent, and the average transaction time might be reduced by as much as 40 percent.
- **Easy-to-use**: Customers just need to tap their cards onto the reader. With a contactless cards, customers avoid carrying cash and looking for small change. According to MasterCard, more than 75 percent of all transactions are less than 35 Euros.

2.2 Benefits for Merchants

- **Higher throughput**: Merchants who accept dual interface cards not only increase the average number of purchases in a given time frame, they also avoid "lost" sales during peak times. Furthermore, payment schemes have reported that holders of contactless cards may increase the average value of their purchases up to 40 percent.
- **Lower costs**: Dual interface cards enable merchants and cardholders to perform cashless low-value transactions. Thus, merchants avoid costs of handling cash.

"It seems that in Montreal, the lack of reliability of a standard dual interface card based solution for transit purpose has become a real disaster for the card manufacturer."

Benoit Guez from CPICARDGROUP

2.3 Business Opportunities and Challenges of Dual Interface Cards

"Everyone can produce a nice and beautiful dual-interface card, but it's much more complex to deliver a complete reliable dual-interface product and especially with a long lifespan"

Benoit Guez from CPICARDGROUP

The adoption of contactless technology opens up new business opportunities for market players across the value chain, in particular for smart card manufacturers and chip vendors.

Smart card manufacturers directly influence the proliferation of dual interface cards. If their products (smart cards) are highly reliable, then the customer experience will be satisfactory. And banks with satisfied customers will look for more dual interface cards. Thus, smart card manufacturers need to provide

comprehensive support to the financial institutions in providing value-added offerings to their customers.

Dual interface bank cards should provide a number of key features in order to satisfy customers:

- **Seamless communication between the chip and the antenna**: The card's antenna is the bridge between the POS terminal and the chip. Therefore, it is crucial that the communication between the chip and antenna is faultless to ensure authentication data is properly transmitted.

"All our payment cards using the SPS solution are fully compliant with Mastercard and Visa standards. Our entire supply chain from R&D to card production and personalization adheres to these standards."

Arnaud Jullien from MORPHO

- **Long card service life**: A dual interface card may have a shorter lifespan than a simple contact card. Thus, each of the components of the card (chip, antenna, and card body) should be carefully designed and manufactured to withstand to the harsh conditions of daily usage.

"It is clear for Futurecard that the SPS technical approach to overpass the usual dual-interface constraints is, at that time, the best of the market."

Yann Bacon from FUTURECARD

- **Highly secure:** End users tend to believe that contactless cards are more vulnerable to attacks that contact ones. Financial institutions need to demonstrate to their customers that dual interface cards are highly secure. Therefore, the cryptographic processing capabilities of a dual interface card should be as reliable as those of a contact cards compliant to the EMV standard.

Although it is obvious that card manufacturers should provide a highly reliable product, they also need to ensure that their solutions are cost-effective. The additional manufacturing costs of dual interface cards cannot be entirely passed on to financial institutions, as this may limit the adoption of contactless technologies. Smart card manufacturers should carefully assess the solutions open to them, to guarantee scalable and consistent manufacturing processes.

3. What should you know before choosing your dual interface solutions?

We have seen how contactless solutions and especially dual interface solutions are the dominant trends in the smart cards arena. But how can you reach this new promising market and what will be the impact on your production and your product deployment strategy?

3.1 Total cost impacts and rationalization

Introducing a new product has various challenges and costs attached. As a first step, new machines will probably be acquired. Then you will need to hire and train new people to handle the complete production cycle. Finally, new quality assurance procedures will be created. It is crucial to consider production cycle time as a key factor in achieving cost optimization.

Figure 3: Manufacturing Process Optimization

Source: Frost & Sullivan

Production quality is directly linked to the complete knowledge and optimization of the production cycle. New machines must be optimized to obtain the best quality product and reduce the number of rejected cards.

Most smart cards manufacturers - and above all chip embedders - have produced contact cards for more than a decade. They have invested heavily in their production sites, optimizing their productivity and performance. Their highly qualified workers are able to handle a complete production cycle for contact cards and are able to adjust the process to be more efficient and to have top-of-the range contact smart cards.

But for traditional dual interface module, this is a completely different story. The production site should be able to manage this new product, and all processes need to be rethinking. Due to a specific technical solution to connect the chip itself with the embedded antenna, the number of not qualified cards is dramatically huge. Finally, the Total Cost of Ownership (TCO) for the chip embedder company will

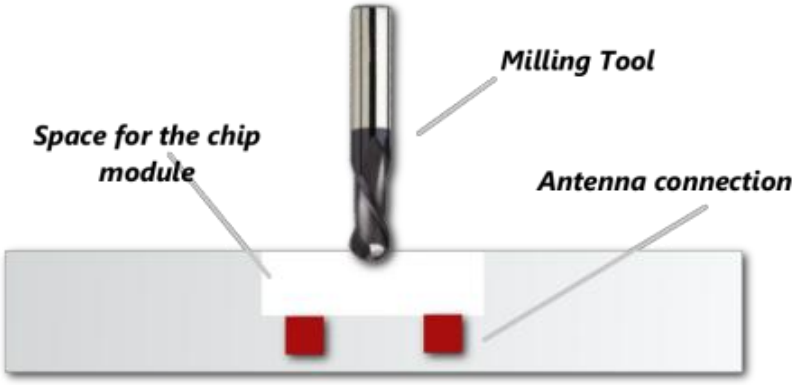
radically grow. Indeed, due to the increase of the operation expenses (such as testing costs, diminished performance, trainings and audits), a lot of new expenses will be generated. This is a key point to keep in mind.

3.2 Technical requirements and integration, vertical requirements

Cost reduction is not the only key point you should focus on. The technical solution to produce the dual interface module is also a strategic part of the complete solution. For a standard dual interface, the connection between the embedded antenna and the chip is the most critical part of the assembly. To overcome this potential difficulty, there are different approaches, but the most common solution is to use silver conductive paste.

Prior to this sensitive part of the manufacturing, a milling tool must prepare the space for the chip module inside the plastic card body. This is a critical step. The machine needs to be positioned to not damage the antenna connections. At the same time, the created space should be really closed to the antenna connection to avoid any future problems linked to antenna performance and capacity. This is possible with the use of frequency measurements. Each time the milling tool goes deeper in the card body, a spectrum analyzer will measure frequency distortion. The milling tool will continue digging until a frequency changes is detected.

Figure 4: Standard Dual Interface Manufacturing Process



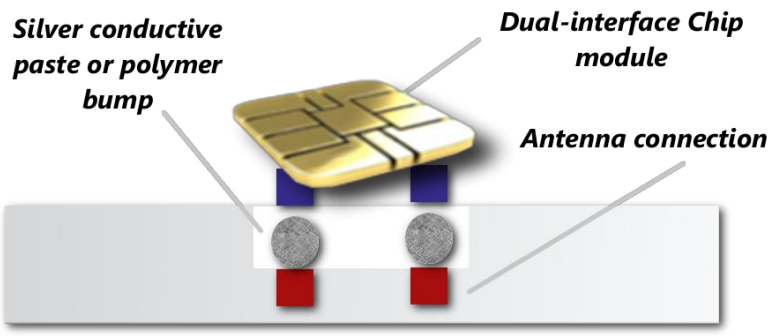
Source: Frost & Sullivan

Once the opened space is ready, an electrical connection between the dual interface chip module and the antenna connections should be set up.

This electrical connection is possible with the use of silver conductive paste. Once again, this is a critical part of the process. Indeed, the silver conductive paste must be perfectly introduced into the open space and must adhere perfectly to the dual interface chip module and antenna connections. This

mechanical manufacturing step (silver punch) will determine the efficiency of the antenna but also the durability of the complete dual interface card.

Figure 5: Silver Paste or Polymer Bump Connection for Dual Interface Communication



Source: Frost & Sullivan

For the banking and payment industry, embossing is a mandatory feature. This is also the case for other verticals such as corporate cards for logical and physical access. For a pure contact card, there is no problem in embossing directly on the card body, as there is no antenna or sensitive device included into the plastic. Unfortunately, this is not the case for dual interface cards. Embedded antennas are sensitive to embossing. If the structure of the antenna is compromised, performance, reliability and durability will be extremely reduced.

Many solutions had been proposed to overpass this problem during embossing but chip embedders have to follow quality rules and international standards. This said, the antenna structure should completely follow the embossing area but in the same hand, should also keep antenna specifications such as resistance, inductance and quality of the signal.

3.3 Product life time and quality

Lifetime and quality are crucial. The smart card is a strong authentication device, and it is inconceivable that it should malfunction due to technical or mechanical problems.

For government applications, the standard expected lifetime is around 10 years. The dual interface solution (as in Poland for the national ID card) should work for a minimum of 10 years to avoid potential renewal and costly issuance. It's true to say that this is, at that time, too early to guarantee this decade time as a minimum. A hybrid solution will probably last 5 years, but a lifetime of 10 years is unlikely. Dual interface is clearly the best solution for governments to deliver reliable and easy to use smart

cards. Undoubtedly, the contactless solution will be used to provide personal information for identification. The contact solution will be used for digital signature, to sign official documents and to provide an easy to use experience.

For payment use, card lifetime is less important, as bank cards are reissued every 2 or 3 years (depending on country and bank.

However, a payment card will be used much more than a national ID card. Payment cards are carried in wallets, bags or even pockets. So the card will be subjected to physical and mechanical damage, but also to corrosion and extreme temperatures. Unfortunately, this is a weak point. Using the card several times a day increases the risk of problems with the communication between the antenna and the chip. The conductivity of the silver paste will be affected. And finally, lot of cards will be returned to the manufacturers due to the lack of contactless features. This represents a huge cost to the card provider, a negative impact on the bank's image perception and a bad experience for the end-user.

4. Is SPS Product the Best Approach for Dual Interface Solution?

4.1 What is the concept?

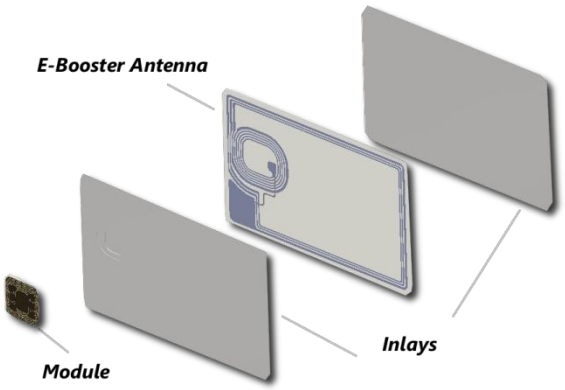
To avoid any communication problem between the chip and the embedded antenna, Smart Packaging Solution (SPS) provides an original solution to overcome the physical and, above all, mechanical problems discussed before. As we will see later, the concept is not only linked to the communication side, it will also impact the complete manufacturing process, so the total dual interface solution cost impact, and finally the global quality of the product.

4.2 Where is the value added?

- Technical solution and specificities

One of the weak aspects of a standard dual interface solution is the connection between the chip and the antenna embedded in the inlay. Without this connection, the card will become a simple contact card.

Figure 6: Innovative solution for a Dual Interface Card



Source: Frost & Sullivan

The idea here is to avoid any future mechanical and physical problems. With the use of a dedicated antenna for the chip itself, there is no need to use silver paste or physical connections. The chip will communicate with the antenna embedded in the inlay by using contactless communication. To avoid any magnetic interference and to optimize the communication time, a concentrator zone had been

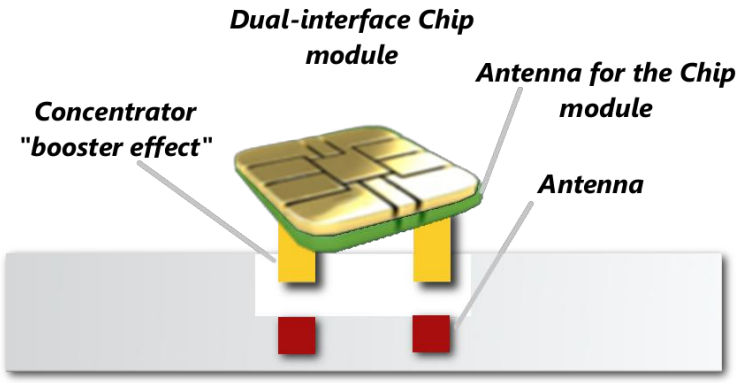
created. This zone will create a “booster effect” and will maximize the entire communication quality level.

This solution will allow card manufacturers to effectively use the embossing processes for payment cards, with the capability to use up to five lines for the embossed information.

- Easy to produce

As for all new technical solutions, the integration and production process are key points to focus on. For a dual interface card based on a standard solution, it is necessary to buy new machines to to prepare, for example, a silver paste solution. With this original solution, there is no need to reorganize your production cycle, as the dual interface chip integration will follow exactly the same production process as a standard contact chip card. Only a really small machine configuration and set-up (to adapt the dual-interface module for example) will be needed to start a complete dual-interface card production.

Figure 7: Innovative connection for a Dual Interface Communication



Source: Frost & Sullivan

It is really important to keep in mind that a standard dual interface production will have a really low production capacity due to the complexity of the assembly of the module to the card body. We can say that, with dual interface cards based on a standard solution, the average capacity is between 1000 and 1500 units per hours. From this small production output, you even have to deduct the dual interface cards not validated by quality checking. With this solution, Smart Packaging Solution (SPS) is able to reach the same production level as contact chip card. With this solution, the card manufacturer is able to reach the same production level as contact chip card, reaching more than 5000 units per hour (uph) and more than 99.5 % of yield. This is a tremendous production level for a dual interface solution, and the quality level is similar to contact cards.

- Performance, certification and standardization

Once again, a new product introduction tends to mean, a restart from scratch most of production process certification and to have the certification of final products. With this solution, the production process is not impacted, so there is no need to request a certification campaign.

Naturally, the final product - in this case a dual interface card - must reach the required standards for each vertical. It is no surprise that government and payment certification are the most complex certifications to obtain. With this innovative solution, smart card manufacturers can easily achieve the FIPS and PIV standards. At the same time, the SPS products are also certified by the official laboratory for MasterCard Paypass and for VisaWave applications.

"The mechanical, flex and torsion tests and durability tests including the killing paint shaker have demonstrated that SPS dual interface card was the best performing solution."

Benoit Guez from CPICARDGROUP

A dual interface solution should be able to be certified for mechanical and chemical constraints. Smart Packaging Solution successfully passed the ISO 10373 bending test.

- Cost effective

But the most interesting part of this new solution is the cost rationalization. Above all, to be able to fully integrate all costs we need to review the complete value chain. Firstly, you have to deal with the raw material: chip module, antenna and card body. The total cost of this innovative solution is roughly the same as a standard dual-interface card, perhaps a slightly higher to be completely precise. Then you have to integrate all costs linked to product introduction. New machines, new processes, new training, new set up, and even sometimes new teams. To this end, you must integrate the level of output and the number of rejected cards. Finally, it is essential to include the customer service cost and all cards back from the end-users because of malfunctions.

"It was an evidence for us that the dual-interface solution with the best cost rationalization and without any major investment was the Smart Packaging Solution (SPS) one"

Yann Bacon from FUTURECARD

This said, it's clear that the Smart Packaging Solution (SPS) will have definitively the best return on investment.

- Product life time, complete reliable solution

What is crucial, and especially for a dual-interface card is the product life time and the quality of the product. We already saw that if these conditions are not met, the end user perception will be drastically and definitively affected. But we can now say that the cost impact will be the major threat. This is a virtuous circle, if the product life time is excellent, then the final user will not request new cards. In the future, the total assumed cost for the manufacturer will be much lower.

Most contactless payment solutions have moved from project phase to commercial roll-out. With this complete, reliable solution and a minimum of investment, it is easier to address the needs and requirements of banks and other financial institutions. The flexibility of this dual-interface integration allows the card embedders to address all project requirements (small volume but short deadline), but at the same time to be able to address all commercial roll-out without any delay.

4.2 Conclusions

A new product introduction is a long and costly affair. Dual interface introduction is also a complex process. Given the amazing growth of dual interface card deployment for Identity management and payment, the time has come to exploit the resulting huge markets opportunities. What you should be able to answer before investing in a dual interface solution is:

- What is the size of the targeted market (only pilots, small volumes, huge volumes)
- What is the level of investments the company will need to afford:
    - New machines
    - New trainings
    - New certifications
    - New people
- What is the level of quality and reliability requested for:
    - Life time of the final product
    - Percentage of non compliant cards during manufacturing process
    - Percentage of non compliant cards during processing time.
- What is the cost of extra services to reach certification standard
    - Compliance of the supply chain
    - Compliance of the body card
    - Compliance of the antenna and connection level

By answering these questions, card manufacturers better understand their needs and are better able to choose the most relevant dual interface solution.

The table below summarizes the key points you should be able to compare. It should be used as a guideline to help each card manufacturer select the appropriate dual-interface solution by comparing well-known contact card performance indicators.

Table 2: Comparison between Contact and Contactless Cards

	Contact Cards	Standard Dual Interface	SPS Dual Interface
Reliability			
Life Time (*)			
Production			
Cost Effectiveness			

(*) Life Time for dual interface is still in a starting process as no projects at that time reached 10 years

Source: Frost & Sullivan

About Frost & Sullivan

Frost & Sullivan is a global growth consulting company with over 45 offices across the world. We have been partnering with clients to support the development of innovative strategies for 50 years. The company's industry expertise integrates growth consulting, growth partnership services and corporate management training to identify and develop opportunities. Frost & Sullivan serves an extensive clientele that includes Global 1000 companies, emerging companies and the investment community by providing comprehensive industry coverage that reflects a unique global perspective and combines ongoing analysis of markets, technologies, econometrics and demographics. For more information, visit http://www.frost.com