

Categorisation of Digital Print Security

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The use of digital printers to produce documents such as cheques, driver registration documents and certificates has been complemented by the growth of fraudulent alteration of such documents.

The Association for Payment Clearing Services (APACS) manages UK financial payments, including cheques. The production of UK cheques is highly regulated and this paper will describe how the demand for cheques printed using high speed digital printing systems led to the extension of APACS regulations into the OEM equipment sector.

The paper will describe the research and development work done at Pira on test methods to assess the susceptibility of non-impact printing to fraudulent removal of non impact print from cheques. The success of the scheme with laser printing will be demonstrated as well as the extension of the scheme into new inkjet printing technologies, and into non-cheque areas.

Secure Printing of Variable Data

The digital revolution has enabled the production of vast quantities of personalised mail. Among these largely worthless pieces of paper are the traditional high value items - business and personal cheques, and also documents of potential value like driving licences, insurance certificates, and vehicle registration documents. All of these documents carry security features such as guilloche printing, microtext, tamper evident inks, machine readable codes, ultra violet features or holograms and these help to authenticate the document itself. However the variable information printed on it is rarely protected with any degree of sophistication. We tend to rely on the features of the underlying document to tell us if the variable information has been altered or replaced.

Fraud

The intrusion of organised crime into our daily lives is increasing. It includes the infiltration of the postal service by organised gangs who look out for certain types of mail. Interception and alteration of business cheques and other documents is more common in certain geographical areas designated by postal codes, and banks are now said to know which postal areas to avoid when sending certain types of

mail, choosing to send by secure courier in the blacklisted areas.

Typical frauds include the alteration or complete removal and replacement of the amount box area and payee line on a cheque. A fraudster sets up a bogus account, pays in the stolen cheque and then closes the account. Of course in order to set up the bogus account he has to have some form of personal identification including a bona fide address. This is easily obtainable by altering a laser printed gas or electricity bill using the same techniques as are used for altering cheques.

Vehicle registration and licence documents can be extremely valuable for thieves operating in the stolen car market. Alteration is usually more difficult because of additional built in security features, but the fraudster will spend as much time as it takes to get it right.

Trends in Fraud

While reported plastic card fraud losses in the UK in 1999 were £189million, an increase of 40% over 1998, subsequent years have seen a reversal of this trend- mainly due to the introduction of 'chip' cards which are more difficult to duplicate.

In order to maintain their income, criminals have recently returned to the fraudulent alteration of business cheques.

This is illustrated by the following data:

	1996	1997	1999	2000
Counterfeit	0.2	0.5	n/a	1.0
Fraudulent Alteration	4.5	5.6	8	13

	1996	1997	1999	2000
Counterfeit	24	24	105	149
Fraudulent Alteration	31	52	50	65

(Source: BBA/APACS)

In the UK the number of cheques expected to be processed in 2001 is 2,500,000,000- falling to just over 1,000,000,000 by 2009. (Source: APACS)

APACS

APACS, the Association for Payment Clearing Services for the UK Clearing Banks regulates the production of all UK cheques through authorized security printers. The APACS3 regulations define minimum standards for the materials, layout and security features of credit and debit processing systems. Original APACS regulations stipulated that all cheque infill information (payee name and amount) was to be done with mechanical impact printers, and non-impact printers were not approved.

Historically the reason for this was the perceived relative ease of alteration of non-impact, particularly laser print. Experience in other countries particularly the USA indicated that a payee name printed with laser toner could be easily removed from a cheque using Scotch tape.

Today the replacement of mechanical ribbon impact printers by laser printers has given huge savings in document processing and has enabled a large increase in the number of letter cheques.

The APACS Scheme: History

In 1996, APACS, the Association for Payment Clearing Services for the UK Clearing Banks commissioned Pira International to examine the feasibility of making laser printed cheques more secure, thus enabling the adoption of laser printing in a regulated manner.

After studying a range of commercially available techniques, Pira concluded that there was no easy low cost 'add-on' solution to the problem. Important factors affecting toner adhesion and image permanence included the chemistry of conventional security inks, the tonal density of background inks, and the receptivity of the base paper. Proprietary 'enhanced toner adhesion' papers were judged to be effective in many cases, but not universally with every kind of toner or printer.

During this study a wide range of different laser printers were used and it was noted that some provided significantly better adhesion than others. In fact the print from some non-impact printers is comparable in permanence with that of an average impact print.

Out of this observation the Printer Qualification Scheme was developed. If we could regulate the type of printers that were used for cheque production we could allow the industry to adopt the new technology with confidence.

The key to the development of the scheme was the development of reproducible methods of toner removal and the establishment of standards.

The Grading Scheme

The basic requirement of a laser printer used for the printing of cheques is that it conforms to Pira standards for toner adhesion. Only Pira Grade 1 printers are approved by APACS for use in the production of cheques.

The list of approved printers is available from Clearing Banks, from Pira International and from APACS in London.

A qualification service is currently provided by Pira/APACS for printer manufacturers to assess the performance of their printers and, if the printer qualifies, to obtain a certificate showing the grade achieved under test conditions.

Test Programme

A non-impact printing trial is conducted with one set of conditions (print densities, fuser temperatures, etc). Blank Pira test cheques are provided. After non-impact printing the test cheques are assessed and graded.

Test Methodology

The printer qualification test is carried out under one set of test conditions, which should be recorded.

PIRA/APACS standard cheque forms should be used although other cheque forms may also be included if required.

The cheque forms should be representative of current paper and ink technology, with cheque designs conforming to APACS Standard 3.

Laser Printing

The tests will be preferably run in the presence of a Pira Consultant to ensure the conditions are satisfactory.

A description of the printer type and model number shall be provided, together with details of the print engine, speed and type of toner used.

A new toner cartridge is loaded into the printer and the image density and fuser roll temperatures are set to the desired levels.

The printer should be run continuously prior to the test run to ensure that it is at its normal operating condition.

Number of Prints

20 A4 sheets are required for laboratory testing. For low speed printers these shall be selected from the end of a test run of at least 1 minute duration.

For high speed printers, the minimum practical sample size shall be run, preferably at the end of a waste run of at least 1 minute.

Test Print Area

The test print should cover all those areas of the cheque which are normally printed with variable information and should include both text and numerical data. For convenience, the word 'Zero' and the numbers '01234' have been used in many cases, although some printers have their own proprietary alphanumeric test charts which may be used.

Paper Conditioning

Paper is conditioned to room temperature and maintained in its normal packaging before printing.

Test Methods

Three manual test methods, Blu-tack, scalpel and tape resistance are used to remove toner selectively from the test areas of the cheques. Results are then assessed visually.

Assessment of Samples

Samples are assessed visually using a video microscope by at least two observers. Toner adhesion grades are awarded by reference to a set of standard sample images, and may be confirmed by image analysis.

Blu-tack

- Grade 1 less than 10% toner removal
- Grade 2 10-50% removal
- Grade 3 50-90% removal
- Grade 4 more than 90% removal

Scalpel

- Grade 1 slight toner removal with much paper surface damage required for complete removal
- Grade 2 little toner removal with a fair amount of paper surface damage required for complete removal
- Grade 3 partial toner removal with a little amount of paper surface damage required for complete removal
- Grade 4 almost complete toner removal without paper surface damage

Tape

- Grade 1 less than 10% toner removal
- Grade 2 10-50% removal
- Grade 3 50-90% removal
- Grade 4 more than 90% removal

Printer Gradings

Printer gradings are derived from the toner adhesion gradings as follows:

- Grade 1 - adhesion grades 1 and 2 only
- Grade 2 - adhesion grades between 1 and 3
- Grade 3 - adhesion grades between 1 and 4

Note: only 'Grade 1' printers can produce cheques which are comparable with average impact printed cheques in their resistance to fraudulent attack.

Reporting

A report containing the results of the laboratory testing is provided together with a certificate showing the grade achieved under test conditions.

Ink Jet Printers

Procedures have now been established for checking the resistance to criminal alteration of infilled data on standard cheques produced according to APACS Standard 3. This means that inkjet printers can be graded according to the permanence of their print.

Ink jet printers have historically been regarded as too slow for business use, but this is now changing, and inkjet

printing has a number of niche applications in document and cheque production. An APACS sponsored research project at Pira concluded that some inkjet printers can be used as a secure alternative to either impact or approved laser printers.

Pira has now launched an inkjet printer scheme, which will be similar to the one running for laser printers. Ink jet printers will have to pass a series of tests to demonstrate that the printed output is not vulnerable to fraudulent alteration, before the printer is approved for use in cheque production.

As well as mechanical removal techniques, the print is tested to establish its resistance to chemical removal, since many early inkjet inks were non-permanent.

One of the more interesting ink jet applications is the combination of Accent Colour Sciences hot melt inkjet in tandem with high speed laser printers. The hot melt inkjet penetrates the paper and is virtually non removable without destroying the document. It can provide a variable information background mask for the laser printed text, or it can be used to print secure data leaving the less secure data fields to the laser printer.

A modification to a Tektronix desktop printer using a similar concept was developed by "SAFE" in France, and has also proved to be very secure.

Tally are the latest company to qualify an inkjet printer, the T3016 SprintJet for the cheque market.

The List of Qualified Printers

The following table has been extracted from the current listing:

Laser Printers
ATI 5060
IBM InfoPrint 60 (3160 Model 002)
IBM InfoPrint 62
IBM InfoPrint 2000 @ 600 dpi
IBM InfoPrint 4000 240dpi & 300dpi
Check Technology Ltd Imaggia MG20
Check Technology Ltd PS75 MICR
HP Laserjet 4050
HP Laserjet 8100
Lexmark Optra N
Meto LIS 1630
Meto LIS 1660
Oce PageStream 235
OCE PageStream PS 350 MICR/SN OCE PS 350 Pinless (Web 400)
OCE PageStream 440
Oce 8445

Laser Printers
Oce 8465
QMS 2425
QMS3260
Troy MICR 640
Troy MICR 1100
Troy MICR 2100
Troy MICR 4000
Troy MICR 4050
Troy MICR 8000
Troy MICR 8100 (8150)
Xeikon 918CF (Nipson)
Xeikon 6100 (Nipson)
Xeikon 7000 (Nipson)
Xeikon 7000 (Nipson)
Xerox DocuTech 6100/ DocuPrint 96
Xerox DocuTech 65/ DocuPrint 65/DC 265
Xerox DocuPrint 4230
Xerox DocuPrint 4635/4135
Xerox DocuTech 6135/135

Inkjet Printers
Accent Color Sciences Truecolor System 400
Tektronix Phaser 840
Tally T3016 SprintJet

Other Techniques

Cheque Printer qualification only establishes a basic minimum standard, which ensures that the use of non impact printing does not result in a deterioration of print

permanence standards. Qualification for cheque production also ensures a minimum standard in the production of other types of document which are susceptible to alteration. Examples of areas where Qualified printers have been selected for non-cheque use include Company Registration documents, Examination papers and vehicle license documents.

There are many other techniques in use which enhance non impact printed document security, for example the hot foil stamping of a clear holographic foil over the critical area, the in-line flexographic printing of a clear varnish containing security features, and the use of glyphs and multiple data fields. All of these techniques can be employed in addition to the basis Qualification attributes. In some cases these techniques are only effective when the toner is adequately bonded to the paper.

The Future

While cheque production is declining, the rate of decline is slow and so the financial paperless society is still a long way off. The variable data printing industry will have to face up to the challenge of developing their output devices to keep one step ahead of the fraudster.

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