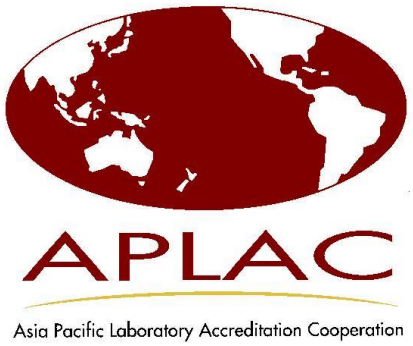


APLAC T096

Printed Document Examination Proficiency Testing Program

FINAL REPORT

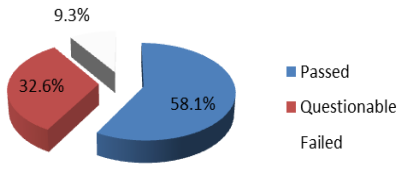
Jan., 2016

Contents

Summary

1. This proficiency testing program (APLAC T096) is an interpretive test and is designed to simulate actual casework. This program aims at assessing the participant's comprehensive ability to determine whether the pages of a questioned document were printed by the same machine or not.
2. APLAC T096 focuses on the non-destructive examination of the printed document. The test case used in APLAC T096 was designed by the leading scientists on forensic document examination from the Institute of Forensic Science, Ministry of Justice, China (IFS). The two-page Labor Contract was printed by 2 different printers. The participants are expected to determine whether the 2 pages of a questioned Labor Contract were produced by the same machine and give the description of the examination methods and their findings.
3. A total of 54 participants from 33 different economies enrolled in the program and 43 of them returned results.
4. The assigned value of APLAC T096 is known and objective, determined by the preparation of the proficiency test item. The reference description of the examination methods and findings for performance assessment was given by a group of experienced experts.
5. The criterion for performance evaluation is established by the agreement of the experts, based on the consistency between the conclusion/results from the participants and the objectivity. In addition, the adequacy and accuracy of the examination and the analysis of the findings were also taken into account. The performance evaluation of all the participants are summarized as followed:

The summary of evaluation results for returned reports

Grade	Counts	Proportion
Passed	25	
Questionable	14	
Failed	4	

1. Introduction

1.1 This proficiency testing (PT) program of APLAC T096 was proposed by China National Accreditation Service for Conformity Assessment (CNAS) and prepared by the Institute of Forensic Science, Ministry of Justice, P.R. China (IFS), under the auspices of Asia-Pacific Laboratory Accreditation Cooperation (APLAC). IFS is accredited by CNAS as the PT provider against ISO/IEC 17043.

1.2 APLAC T096 is a pilot scheme under WG4 which is established to develop the PT in inspection areas under APLAC PT Committee. The Forensic Document Examination involved typical inspection activities and plays an important role in the investigation or litigation.

1.3 Printed documents are widely employed in all manner of business and personal affairs and the examination of the printed document depends greatly upon the competency of an individual examiner. Examinations and comparisons conducted by document examiners can be quite diverse in different countries. APLAC T096 is to compare the performance of participants in examining the pages substitution by the non-destructive methods.

1.4 A total of 54 participants from 33 different countries enrolled in the program and 43 of them returned their results to the organizer. APLAC, IAAC and EA members were invited to participate. Each participant was assigned a unique laboratory code (from AP 14D01 to AP 14D54) that was used throughout the program.

2. Objective

The objective of APLAC T096 is not only to provide an exercise for participants to assess their performance in questioned document examination for page substitution, but also to explore the variations among different nations/regions and make an attempt at the inspection items..

3. Proficiency Test Items &Case information

3.1 Scenario/Case information

An employee was suing his employer company. The company provided a Labor Contract dated January 10, 2013. Disputes arose between the two parties as to

how the Labor Contract was produced. Both parties agreed to appoint a forensic science institute to determine whether the two pages of the Labor Contract were produced by the same machine.

3.2 Proficiency Testing Materials

Based on the past experiences, two different brands of color laser printers, out of 21 laser printers, were chosen to prepare the samples in this PT program. Their OPC drum diameters were 3.0 cm and 1.1 cm respectively, and the drum surface were artificially damaged. Both of them used their original toner.

At last, the two pages of the questioned contact were printed by two printers separately in the gray mode. The same type of paper was used.

Fig.1 Printer 1

Fig.2 Printer 2

(1) The questioned document: a two-page Labor Contract dated January 10, 2013.

劳 动 合 同

LABOR CONTRACT

Fig.3 Page 1 of the questioned contract

Fig.4 Page 2 of the questioned contract

(2) A DVD disc containing:

a. Instruction to Participants;

b. Receipt Form;

c. Result Report Sheet.

Fig.5 A DVD disc

3.3 Examination Request

The participants were required to examine each page of the submitted document, and answer the following question: *Were page 1 and page 2 of the submitted Labor Contract produced by the same machine?* They were required to choose their conclusion as shown in Table 1 and describe the results on the *Result Report Sheet*.

Table1 Conclusion Options

Choice	Conclusion
A	Produced by the same machine
B	Not produced by the same machine
C	Probably produced by the same machine
D	Probably not produced by the same machine
E	Cannot be identified or eliminated

4. Homogeneity and Stability Check

Before dispatching, the printing characteristics of each piece of questioned document have been checked by the organizer in accordance with the requirements of the *Proficiency Testing Guidelines for Questioned Document Examination of IFS*. Thus, the samples were confirmed to be homogeneous, and adequately characterized before distribution. With the common knowledge, the stability check was skipped for this kind of PT items.

5. Assigned Values

5.1 Known Value and Reference from Experts

The two-page Labor Contract was printed by 2 different printers, thus the assigned

value is objective, determined by the preparation. The reference description of the examination methods and findings are given by a group of experienced experts.

5.2 The Main Evaluation Basis-Discriminating Elements

Based on the objectivity of this PT program, the main evaluation basis and characteristics were designed and as shown in Table 2.

Table 2 Main Evaluation Basis

Basis	Characteristics	Significance
Printing quality	Morphological features of the words/ strokes. Toner particle distribution.	General basis
Printer trace	Cyclical defects produced by the OPC drum.	Critical basis
	Roller marks produced by the paper transport system.	
Printing material	Toner composition.	General basis

5.3 Reference for the Examination Methods

To obtain the reference results, experts provided the reference examination methods as listed in Table 3.

Table 3 Reference Examination Methods

Examination Item	Instrument
Macroscopic Examination	Naked eye; Magnifying glass
Microscopic Examination	Microscope
Printing Trace Examination	VSC6000, ESDA^2, etc.
Toner Composition	FT-IR, DART-MS, etc.

Note: VSC - Video spectral comparator
ESDA^2 - Electronic System Design Automation

5.4 Reference Examination Results

5.4.1 Morphological Examination

The microscopy showed that the morphological features of strokes on page 1 are different from those on page 2 (Fig.6 to Fig.9).

Fig.6 English letter on page 1

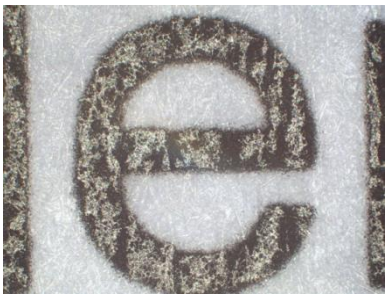


Fig.7 English letter on page 2

Fig.8 Chinese character on page 1

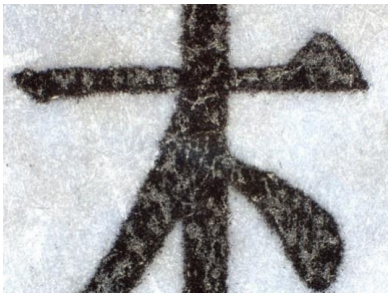


Fig.9 Chinese character on page 2

5.4.2 Cyclical Defects Examinations

According to the macroscopic and microscopic examination results, the morphology and spacing of the cyclical defects produced by the OPC drum on page 1 are different from those on page 2. Apart from this, the OPC drums diameters are different, i.e. 3.0 cm for Printer 1 and 1.1 cm for Printer 2, which were calculated from the spacing of the cyclical defects (Fig.10 and Fig.11).

Fig.10 Cyclical defects on page 1

Fig.11 Cyclical defects on page 2

5.4.3 Roller Marks Examinations

Through the indentation examination by ESDA[2], the different roller marks produced by the different paper feeding systems, were developed on page 1 and page 2 (Fig.12 and Fig.13).

Fig.12 Roller marks on page 1

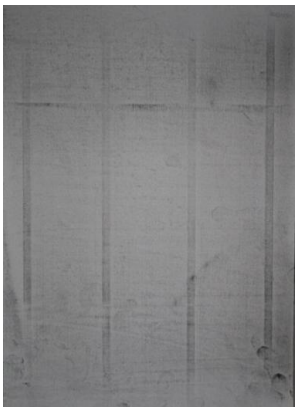


Fig.13 Roller marks on page 2

5.4.4 Toner Composition Examinations

Further, the Infrared (IR) and Mass spectra of the toner on page1 are different from those of page 2 (Fig.14 to Fig.17).

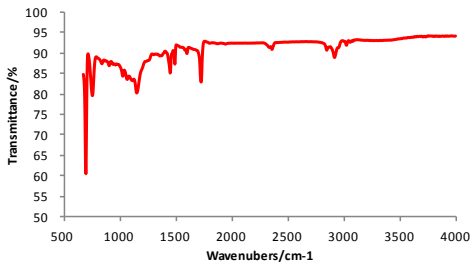


Fig.14 IR spectrum of toner on page 1

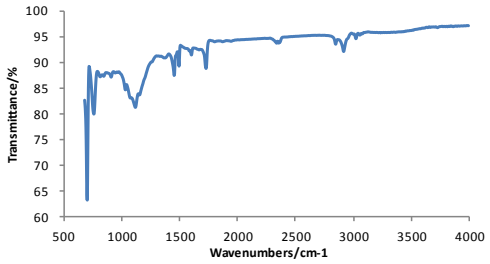


Fig.15 IR spectrum of toner on page 2

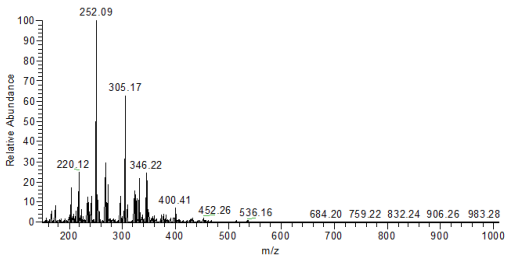


Fig.16 Mass spectrum of toner on page 1

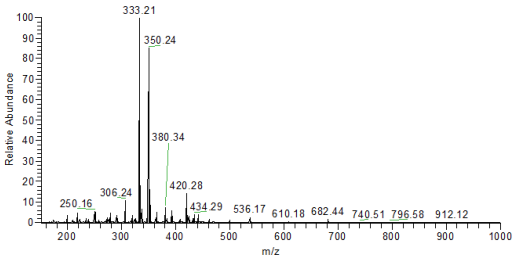


Fig.17 Mass spectrum of toner on page 2

6. Performance Evaluation

6.1 Evaluation of the Performance

The final evaluation results were given through "expert discussion" based on the following facts: whether the conclusion was consistent with the objective result, whether the examination methods were comprehensive, and whether the basis of the conclusion was adequate.

Five experts in the field of forensic questioned document examination were selected to constitute the expert panel. Two of them are from IFS, and the other three, who were invited from other forensic institutes. All of them have over 30 years working experience. The testing of the Labor Contract was also performed in IFS. The panel regarded the results of IFS as informative.

6.2 Evaluation Grades and Criteria

The final evaluation grades are “Pass”, “Questionable” and “Fail”. The details of criteria are shown in Table 4.

Table 4 Evaluation Criteria

Grade	Choice	Criteria
Passed	B/D	With no less than one item of critical basis or two items of general basis.
Questionable	B/D	With no more than one item of general basis .
	E	Adequate basis, but the analysis of the causes wasnot clear.
Failed	A/C	False conclusion.
	E	Defective examination; not adequate basis.

7. Returned Results and Evaluations

7.1 Summary of the Participants

A total of 54 participants from 33 different economies enrolled in the program and 43 of them returned their reports to the organizer. The summary is shown in Table 5. For more details, refer to the appendix Table 1.

Table 5 Summary of Participants

Economy	Enrolled	Returned	Economy	Enrolled	Returned
Argentina	2	0	Latvia	2	2
United Arab Emirates	1	1	Romania	4	4
Estonia	1	1	USA	5	3
Australia	4	3	Bangladesh	1	1
Paraguay	1	0	Norway	1	1
Bulgaria	2	2	Sweden	1	1
Poland	2	1	Switzerland	1	1
Germany	2	2	Slovenia	1	1
France	1	1	Greece	1	1
Finland	1	1	Hungary	1	1
Colombia	1	0	Israel	1	1
Costa Rica	1	1	India	4	1
Honduras	1	1	United Kingdom	2	2
Czech Republic	1	1	Jordan	1	1
Croatia	1	1	Guatemala	1	1
Hongkong China	1	1	China	3	3
Lithuania	1	1	**Total**	54	43

7.2 Summary of Conclusion Choice

Most of the participants (more than 90%) gave the correct conclusion on the basis of their examinations. Only one participant considered that two pages were produced by the same machine and four participants could not determine whether the two pages were produced by the same machine or not. The summary of the conclusion choices of participants is shown in Table 6.

7.3 Summary of the Examination Methods

The distribution of examination methods used by the participants is shown in Table 7. For more details, refer to the appendix Table 2.

Table 6 Summary of the returned conclusions

Choice	Conclusion	Counts	Proportion
A	Produced by the same machine	1	
B	Not produced by the same machine	28	
C	Probably produced by the same machine	0	
D	Probably not produced by the same machine	10	
E	Cannot be identified or eliminated	4	

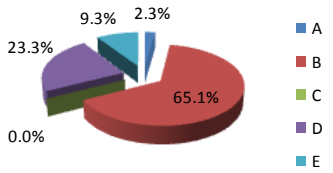


Table7 Summary of examination methods used by the participants

Method	Counts	Proportion
Macroscopic examination	19	44.2%
Microscopic examination	40	93.0%
VSC	22	51.2%
ESDA[2]	10	23.3%
Chemical Examination*	11	25.6%
Other Examination	8	18.6%

* It refers to the instrumental methods t used to analyze the chemical composition of toner, not limited to IR or MS..

7.4 Summary of Conclusion Basis

The summary of conclusion basis reported is shown in Table 8. For more details, refer to the Appendix .

Table 8 Summary of the critical basis

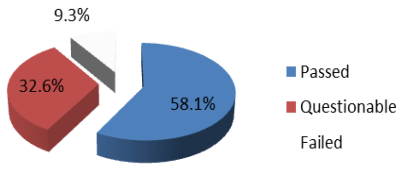
Basis	Characteristics	Counts	Proportion
Printing quality	Morphological features of words/ strokes. Toner particle distribution.	36	83.7%
Printer trace	Cyclical defects produced by OPC drum.	19	44.2%
	Roller marks produced by paper feeding system.	6	14.0%
Printing materials	Toner composition.	11	25.6%

7.5 Summary of Evaluation Results for Participants

Based on the evaluation grades, 58.1% (25) of the participants passed for having performed comprehensive examinations and drawing the correct conclusion. 32.6%

(14) of the participants were questionable for defective examination. 9.3% (4) of the participants failed. The summary is shown in Table 9. For more details, refer to the appendix Table 3.

Table 9 Summary of evaluation results

Grade	Counts	Proportion
Passed	25	
Questionable	14	
Failed	4	

7.6 Passed

Among the 25 passed participants, 68%(17) of them selected B, which means their conclusion is the two pages of the labor contract were **not produced** by the same machine. The other 32%(8) passed thought those were **probably not produced** by the same machine. The summary is shown in Table 10.

7.7 Questionable

Among the 14 participants who got "questionable" grade, 92.9%(13) of them selected B/D with inadequate basis and 7.1%(1) of them considered it was difficult to draw a conclusion of identification or elimination on the basis of their examinations. The summary is shown in Table 11.

7.8 Failed

Among the 4 failed participants, 25.0%(1) of them selected A and 75.0% of them considered it was difficult to draw a conclusion of identification or elimination, and their examinations were inadequate. The summary is shown in Table 12.

Table10 Choice Summary of the passed participants

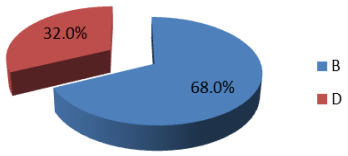
Choice	Counts	Proportion
B	17	
D	8	

Table 11 Choice Summary of the "questionable" participants

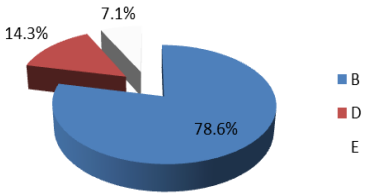
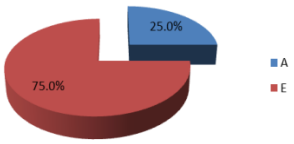
Choice	Counts	Proportion
B	11	
D	2	
E	1	

Table12 Choice Summary of of the "failed" participants

Choice	Counts	Proportion
A	1	
E	3	

7.9 Discussion and Opinion

More than 90% of the final conclusions are consistent with the objective results, although the examination methods or conclusion bases are significantly different .

Some of the participants not only came to the correct conclusion, but also had an adequate basis for it. They have carried out a comprehensive examination from the aspects of printing quality, cyclical defects and printing materials.

Some of the participants did not find the printer characteristic marks, especially the cyclic defects on the questioned document, which could reflect the model of the OPC drums. On the other hand, a few participants found the cyclical defects but failed to give interpretation for the cause or just gave an insufficiently

accurate interpretation.

Some of the participants arrived at the correct conclusion, but their basis were inadequate, for instance, only based on the difference of macroscopic characteristics, character morphology or toner particle distribution.

8. Recommendations

Though more than 90% of the final conclusions are consistent with the objective results, their examination methods or conclusion bases are significantly different. The main question is that some participants gave a conclusion without a comprehensive examination. It appears that their capabilites for printed document examination are inordinately different.

Some participants provided some constructive suggestions about this PT program, which are really appreciated and helpful to future improvement.

9. Acknowledgements and Remarks

This study was prepared by Technical Group of CNAS and IFS and approved by APLAC PT Committee. The report was drafted by **YANG Xu, JIA Rujing, CHEN Xiaohong, ZHANG Qinghua，etc.** Special appreciation is given to the expert panel, as follows：

LIANG Shizhong, the former assistant government chemist of Forensic Science Division of the Hongkong Government Laboratory, is a senior chemist in the field of forensic questioned document examination.

WANG Shiquan, the former President of National Police University of China, is a professor of Criminalistics focusing on the examination of the printing documents for many years.

ZHOU Songdong, the Deputy Director of the Forensic Center of the Information Technology Research Center of the Supreme People's Procuratorate, is a senior engineer and has over 30 years working experience in the field of forensic questioned document examination.

YANG Xu, the Director of the Department of Criminalistics of Institute of Forensic Science, Ministry of Justice .PRC, is a senior engineer and has over 30 years working experience in the field of forensic questioned document examination.

SHI Shaopei, the Deputy Director of the Department of Criminalistics of Institute of Forensic Science, Ministry of Justice .PRC, is a senior and has over 30 years working experience in the field of forensic questioned document examination.

Contributions from all accreditation bodies and participants to this program are gratefully noted. Special thanks are extended to APLAC PT Committee for their support to the program.

If anyone has any query about this report, please contact the organizers of this proficiency testing program listed as follows:

CNAS:
PT Manager:
Mr. HE Ping
Address: No.8 NanHuaShi DaJie, Dongcheng , Beijing, 100062 P.R.C.
Tel: +86-10-6710 5290 Fax(Auto): +86-10-8792 8651
Email: heping@cnas.org.cn

IFS:
Mr. LIU Yuchen
Address: No. 1347, West Guangfu Rd, Shanghai, 200063, PRC.
Tel/Fax(Auto): +86-21-5235 1397
Email: liuyc@ssfjd.cn

10. References

[1] ISO/IEC 17043:2010, Conformity assessment–General requirements for proficiency testing
[2] ISO 13528:2015, “Statistical methods for use in proficiency testing by interlaboratory comparisons”

11. Appendix

Table A1 Examination methods used by the participants

Participant Code	Macroscopic Examination	Microscopic Examination	VSC Examination	Indentation Examination	Printing Materials Examination
AP 14D01	No descriptions.	LEICA: Different printout quality(shapes and edges of letters); Different repetitive printing defects.	VSC5000:No differences.	ESDA **II**: Different positioning of detected impressions.	FTIR: No significant differences. MAGE-2, Vildis: on-magnetic dry toners on both sides.
AP 14D02	No descriptions.	Magnifier, Stereo microscope: Same printing quality.	DOCUBOX: No differences.	Not used	Not used
AP 14D03	Different spaces from up and down of the printed area.	Stereoscope: Different shape of the printed words ; Different distribution of toner particles.	Not used	Not used	Not used
AP 14D05	No descriptions.	VSC/Stereomicroscopy Leica M205FA: Different letters edges. Transmitted light: Different papers.	VSC6000: Different pages under UV-light.	ESDA: Different indented images.	SEM: Different chemical composition of toner.
AP 14D06	No descriptions.	Different distance from the left margin for printing defects; Different distance between two repetitive defects: 94 mm for page 1 , 34 mm for page 2	VSC6000: To measure the defects distance.	Not used	Not used

AP 14D07	No descriptions.	Microscope: Both pages were printed with a black toner laser printer. Different cyclical characteristic dots.	VSC6000: No evidence in UV light and IR luminescence. Different indented impression with oblique (side) light.	ESDA: No differences.	Not used
AP 14D09	Similar printing pattern including margins, font and style.	Microscope: Different individual letter printing /strokes and characteristics.	VSC: No differences.	Not used	Not used
AP 14D12	No descriptions.	Microscope(60 x): Both pages were printed by laser printers; Different structure of printed elements; Different thickness of toner.	Not used	Not used	Not used
AP 14D13	Same text formation.	Leica: Different structure of toner particles; Different marks of toner cartridge mechanism; Different shape of the same signs, surface of toner layer.	Docucenter Projectina : Not found.	Different marks of paper feed mechanism.	Not used.
AP 14D14	Same layout.	Optical microscopy: Similar aspect of toner. Different periodical defects between the two pages.	Not used	ESDA[2]: Same physical marks.	Raman, FTIR, microanalysis -X: Different composition of toner.
AP 14D15	No descriptions.	Optical microscopy: Different morphology and shape of letters. Three defects in page 1 and six other defects in page 2.	Not used	Not used	Not used
AP 14D16	No descriptions.	Stereo/3D-microscope: Different diameters of imaging drums: 2.99cm for page 1, 1.09cm for page 2.	Not used	Not used	FTIR: Different composition of toner

AP 14D17	No descriptions.	Magnifying, Microscope: No descriptions.	VSC6000: No descriptions.	Not used	Not used
AP 14D18	Different position of page numbers.	Microscope: Both pages were printed by digital laser printers, But different shape of the characters and symbols.	Not used	Not used	Not used
AP 14D21	Same measurements, margins, alignments and color. Not found security features or watermarks.	No consistent trash markings.	Similar appearance with absorption and luminescence.	Not used	Not used
AP 14D22	Different electro photographic imaging system drum faults.	Different electro photographic imaging system drum faults. Different vertical spacing of the faults.	Oblique lighting: Different roller marks.	ESDA: Different roller marks.	Not used
AP 14D23	Visual examination: No differences.	Microscope examination: Both pages were produced with laser printer.	No significant differences.	Not used	Not used
AP 14D24	Different position of the page numbers and does not overlap.	Microscope: Different morphology of letters.	No descriptions.	ESDA: Different line patterns.	No descriptions.
AP 14D25	Both pages were printed by electrophotographic printers. A red stamp and two signatures on page 2.	Optical microscope: Different surface characteristics of printed areas and different cyclical defects. Different fixed distance: 9.4cm for page 1, 3.4cm for page 2.	Not descriptions.	Not used	No difference for magnetic components; Significant differences in IR spectra.
AP 14D26	No descriptions.	Not used	Not used	ESDA: Different latent indentations.	Different toner materials.

AP 14D28	No descriptions.	Microscope: Some differences in the general "look" of the toner surface. Some vertical "stripes" observed on page 2. Some small differences in toner surface texture.	Projectina Docucenter Nirvis: Different shape of some letters.	Not used	Not used
AP 14D30	Same font style and size. Same margins and spacing.	Microscope: Different microscopic features of the printed text.	Not used	ESDA: Different printer roller marks including their position, thickness and clarity.	Not used
AP 14D31	Same printing width.	Different distribution of toner; Different intensity of the printing and shape of the some printed letters.	No spectral differences between two pages.	Not used	No used
AP 14D32	Photoshop: No significant differences.	No differences.	Not used	Not used	Raman（685-2）: No significant differences.
AP 14D33	No descriptions.	Microscope: Different surface of toner; Different shape of characters and different shape of edges of printed graphic elements.	No descriptions.	Not used	Not used
AP 14D35	Similar paper sheets. Printing on the felt side for page1 and wire side for page2.	Leica M205C: Different texts. Differences in type face of some characters/letters and in the stroke contours type. Differences in the structure strokes and in the spatter of toner particles.	VSC2000 and VSC5000: Comparative examination.	Not used	Raman: Different Raman Spectra.

AP 14D36	No descriptions.	Leica DFC: Differences in type face of some characters/letters, structure of strokes, spatter of toner particles around the characters and in the white unprinted areas.	VSC1 and VSC5000: Comparative examination.	Not used	Not used
AP 14D37	No descriptions.	Different Morphology and distribution of toner; Different paper sorts.	VSC400: Comparative examination.	Not used	Not used
AP 14D38	No descriptions.	Different morphology of toner.	VSC: Different roller and gripper marks on paper.	Not used	Not used
AP 14D39	Differences in character construction.	Differences in the surface morphology of the fused toner.	VSC6000: No descriptions.	Not used	FTIR: No descriptions.
AP 14D41	No descriptions.	Microscopic analysis: Different surface structure of the printed figures. Different individual marks.	Not used	Not used	IR: Different composition of toner.
AP 14D42	Both pages were printed by laser printers with good quality and similar fonts.	Difference in the shape for i-dots. Difference in the spacing of letters. Using different resolution. Different toner spatter.	Not used	Not used	Not used
AP 14D43	Printed by laser printer.	Microscopic examination: Different printing defects.	Different indentations caused by paper forwarding mechanism.	Not used	Not used
AP 14D44	No descriptions.	Nikon SMZ 800 stereomicroscope: the printing was made with a laser printer. Different shape and repeatedly displayed dots（different diameter of the cylinder）.	VSC6000: Comparative examination.	Not used	Not used

AP 14D45	Ditto	Ditto	Ditto	Ditto	Ditto
AP 14D46	No descriptions.	Microscopic: Both pages were printed by laser printer. Different cyclical defects.	Not used	Not used	Not used
AP 14D47	Ditto	Ditto	Ditto	Ditto	Ditto
AP 14D49	No descriptions.	Microscopic examination: Different print patrons.	VSC: Different morphology of same characters.	Not used	Not used
AP 14D50	Eight sets of drum defect marks were observed along the vertical axis about 5.3cm from the left margin on page 2.	Microscope: Different defect marks. Different printing details of some Chinese characters and numerals.	Different position of the page numbers. No differences in UV fluorescent.	No indented writing or roller marks were observed.	Not used
AP 14D51	Both pages have repetitive trash marks, but they are different shape, intensity and distance in every page.	Serrated diagonal of some characters in page 1, edges in page 2 are smoother. Different morphology in some characters or its elements.	Not found	Not used	Not used
AP 14D52	Different layout, and relative position of pager number between page 1 and page 2.	Different cyclical defects from left margin and different distance between two repetitive defects: 94 mm for page 1, 34.5mm for page 2.	Not found obvious differences.	Not used	Not used

AP 14D53	No descriptions.	Different cyclical defects from left margin and different distance between two repetitive defects: 9.45 cm for page 1 , 3.48cm for page 2. Different thickness of the toner between page 1 and page 2.	Not used	Not used	Not used
AP 14D54	No descriptions.	Different tone distribution on the edge of characters between page 1 and page 2. different printing defects from left margin and Different distance between two repetitive defects: 94mm cm for page 1 , 34.5 mm for page 2.	Not used	Not used	Not used

Table A2 Evaluation & Conclusions from the participants

Participant Code	Choice	Evaluation result	Evaluation basis or criteria
AP 14D01	B	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system, but failed to carry out a comprehensive examination for the printing materials.
AP 14D02	A	Fail	The conclusion was not consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D03	B	Questionable	The conclusion was consistent with the objective result. However, The cyclical defects which could reflect the model of OPC drum and roller marks produced by paper feeding system were not detected. No examination results for the printing materials.
AP 14D05	B	Pass	The conclusion was consistent with the objective result. Having observed the roller marks produced by paper feeding system and analyzed the printing materials. But failed to detect the cyclical defects which could reflect the model of OPC drum.
AP 14D06	D	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum, but failed to detect the roller marks produced by the paper feeding system or analyze the printing materials.
AP 14D07	E	Questionable	The conclusion is “cannot be identify or eliminate”. Failed to give interpretation for the causes of the defects on page1 and page2. No examination results for the printing materials.
AP 14D09	B	Questionable	The conclusion was consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D12	B	Questionable	The conclusion was consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D13	B	Pass	The conclusion was consistent with the objective result. Having observed the defects which could reflect the model of OPC drum, but failed to analyze the printing materials.

Participant Code	Choice	Evaluation result	Evaluation basis or criteria
AP 14D14	D	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum and analyzed the printing materials.
AP 14D15	D	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum, but failed to give interpretation for the causes. No examination results for the printing materials.
AP 14D16	B	pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum and analyzed the printing materials.
AP 14D17	B	Questionable	The conclusion was consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D18	B	Questionable	The conclusion was consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D21	E	Fail	The conclusion is “cannot identify or eliminate”. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system and analyze the printing materials.
AP 14D22	B	Pass	The conclusion was consistent with the objective result. Having observed cyclical defects which could reflect the model of OPC drum and given an accurate interpretation for the cause. And also Having observed the roller marks produced by the paper feeding system, but failed to analyze the printing materials.
AP 14D23	E	Fail	The conclusion is “cannot be identify or eliminate”. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D24	D	Pass	The conclusion was consistent with the objective result. Having observed the roller marks produced by the paper feeding system, but failed to detect the cyclical defects which could reflect the model of OPC drum and analyze the printing materials.
AP 14D25	B	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum and analyzed the printing materials, but failed to detect the roller marks produced by the paper feeding system.

Participant Code	Choice	Evaluation result	Evaluation basis or criteria
AP 14D26	D	Pass	The conclusion was consistent with objective result. Having observed the roller marks produced by the paper feeding system and analyzed the printing materials, but failed to detect the cyclical defects which could reflect the model of OPC drum.
AP 14D28	D	Questionable	The conclusion was consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D30	B	Pass	The conclusion was consistent with the objective result. Having observed the roller marks produced by the paper feeding system, but failed to detect the cyclical defects which could reflect the model of OPC drum and analyze the printing materials.
AP 14D31	B	Questionable	The conclusion was consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D32	E	Fail	The conclusion is “cannot be identify or eliminate”. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. Apart from this, the examinations of the printing materials were not comprehensive.
AP 14D33	B	Questionable	The conclusion was consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D35	B	Pass	The conclusion was consistent with the objective result. Having found that the printing quality of the strokes of characters were different. And also having analyzed the printing materials, but failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system.
AP 14D36	B	Questionable	The conclusion was consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D37	B	Questionable	The conclusion was consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. And also failed to analyze the printing materials. Apart from this, the determination of the paper kind was not consistent with the objective result.

Participant Code	Choice	Evaluation result	Evaluation basis or criteria
AP 14D38	D	Pass	The conclusion was consistent with the objective result. Having found the differences of toner morphology and observed the roller marks produced by the paper feeding system, but failed to detect the cyclical defects which could reflect the model of OPC drum or analyze the printing materials.
AP 14D39	D	Questionable	The conclusion was consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D41	B	Pass	The conclusion was consistent with the objective result. Having found the differences of toner morphology and the cyclical defects on page 1. Having analyzed the printing materials, but failed to detect the cyclical defects on page 2 and the roller marks produced by the paper feeding system.
AP 14D42	B	Questionable	The conclusion was consistent with the objective result. Failed to detect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D43	B	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system,but failed to analyze the printing materials.
AP 14D44	B	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum, but failed to give interpretation for the causes. Failed to analyze the print materials or detect the roller marks produced by the paper feeding system.
AP 14D45	B	Pass	Ditto
AP 14D46	D	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum, but failed to analyze the print materials and detect the roller marks produced by the paper feeding system.
AP 14D47	D	Pass	Ditto

Participant Code	Choice	Evaluation result	Evaluation basis or criteria
AP 14D49	B	Questionable	The conclusion was consistent with the objective result. Failed todetect the cyclical defects which could reflect the model of OPC drum and the roller marks produced by the paper feeding system. No examination results for the printing materials.
AP 14D50	B	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum on page1, but missed those on page2. No examination results for the printing materials.
AP 14D51	B	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum, but failed to detect the roller marks produced by the paper feeding system or analyze the printing materials.
AP 14D52	B	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum, but failed to detect the roller marks produced by the paper feeding system or analyze the printing materials.
AP 14D53	B	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum, but failed to detect the roller marks produced by the paper feeding system or analyze the printing materials.
AP 14D54	B	Pass	The conclusion was consistent with the objective result. Having observed the cyclical defects which could reflect the model of OPC drum, but failed to detect the roller marks produced by the paper feeding system or analyze the printing materials.

Table A3 Details from the Participants

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
AP14D01	B	Based on differences in printout quality and differences in roller marks of page 1 and page 2 as well as the presence of repetitive printing defects on page 1 which are not present on page 2 and vice versa, it can be concluded that page 1 and page 2 of the questioned Labor Contract were NOT produced on the same machine (the same laser printer).	**Examination under various light sources (VSC 5000)** – no differences in absorption/reflection or luminescence properties of dry toners. **Examination of magnetic properties (MAG-2, Vildis)** – no differences (non-magnetic dry toners on both sides). **Fourier Transform Infrared Spectroscopy (FTIR)** – no significant differences in FTIR spectra on page 1 and page 2. **Examination of indented impressions (ESDA II)** – different positioning of detected impressions caused by printers' feed roller mechanisms on page 1 and page 2. **Microscopic examination (stereomicroscope, LEICA)** – differences in printout quality (shapes and edges of many letters (for example – letters "r", "t" and "i" in word "Article", etc.). On page 1 are present specific clusters of toner particles which have the same shape and are located at the same distance from the edge of the paper, as well as from each other. Because those marks are repetitive, it can be concluded that are caused by defects on printer photosensitive drum. Those marks are not present on page 2. Furthermore, on page 2 are present different repetitive printing defects (different in size and shape and positioning on paper) which are not present on page 1.
AP14D02	A	The visible impressions on the obverse side of the page one (1) and two (2) corresponding to LABOR CONTRACT dated January 10, 2013, from the same printer body. (not professional translation)	To carry out this analysis we proceeded to use the comparative analytical grafoscopical physical method, so we proceeded to perform a systematic observation of the document in question, both pages; using the suitable instruments such as: hand magnifiers different magnifications; stereo zoom microscope; DOCUBOX equipped with different types of lighting – in this exercise using white light, ground and episcopic – . Were determined in this way the characteristics individualizing left by the printer being that the document in question, then proceeded to compare the pages of the contract, reaching the following assessment: in both groups of prints print the same characteristics, such as sharpness in printing characters, and granular appearance shiny, unprinted areas containing carrier particles left by the printer body, a tactile effect is observed. (not professional translation)
AP14D03	B	The pages 1 and 2 of the questioned Labor Contract, were not produced by the same machine.	We used a stereoscope to analyze the kind of printing system and shape of the printed words. Also we used different light sources to analyze the whole document. We found different papers and shape of the words, the spaces up and down of the printed area are different and distribution of toner particles are also different.

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
AP14D05	B	Page one and page two of the questioned Labor Contract were produced by different machines.	Electrostatic detection device - to develop latent images. Page 1 and page 2 had different indented images caused by the paper feed mechanism of the machine. ·Transmitted light – page 1 and page 2 papers were different. Differences are caused by the paper machine mesh during producing process. ·Video spectral comparator VSC6000 – page 1 and page 2 are different under the UV-light ·VSC/Stereomicroscopy Leica M205FA – page 1 and page 2 letters of the text had differences in letters edges. Page 1 letters were like rasterized, page 2 letters edges were smooth. ·SEM – to analyze toners. Page 1 toner has different chemical composition than toner at page 2.
AP14D06	D	Pages 1 and 2 of the questioned document were probably not produced by the same machine at a single printing job.	Microscopic examination was conducted for the questioned pages. Repetitive print defects were found on both pages (pages 1 and 2). The defects observed on page 1 differ in shape from the defects observed on page 2. The defects on page 1 are positioned at approximated distance of 36 mm from the sheet's left margin. On page 2, the corresponding distance of the defects from the sheet's left margin is 53 mm. The distance between two repetitive defects on page 1 is approx. 94 mm and on page 2, the distance between two repetitive defects is approx. 34 mm. For measurements of the defects' distances, VSC 6000 was used.
AP14D07	E	According to the results of the investigations, we can't make the conclusion that page 1 and page 2 of the questioned Labor Contract were produced by the same machine. However, based on examination we can say that the whole Labor Contract was not printed at the same time.	Page 1 and page 2 of the questioned Labor Contract were examined with microscope. We found out that they were printed with a black toner laser printer. With further examination we saw that page 1 has characteristic dots. The dots appear horizontally three times with the same margin and same distance from left edge of the paper. Page 2 also has characteristic marks but they don't appear in the same position as the dots on page 1, and the marks appear more frequently than dots on page 1. Furthermore, with VSC 6000HS we examined page 1 and page 2 reactions in UV light (365 nm, 312 nm and 254 nm) and IR luminescence, there was no evidence. With oblique (side) light on page 1 we saw form of indented impressions presumably made by paper-feed grippers or rollers. The next step was electrostatic detection with ESDA, but there was no evidence. We examined page 2 with oblique (side) light, there were indented impressions, but the intensity was worse compared to page 1. There was no results with electrostatic detection (ESDA). Therefore all the

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
			results with oblique (side) light can't be used in our conclusion.
AP14D09	B	On the basis of comparisons, it is opined that the exhibits Page-1 and Page-2 of the Labor Contract were not printed/produced by the same printer/machine.	The exhibits Page-1 and Page-2 of the Labor Contract were thoroughly examined under microscope, Video Spectral Comparator (VSC) and compared to each other and the following observations were made: The printing pattern including margins, font, style of the exhibits Page-1 and Page-2 were found to be similar. The individual letter printing/strokes by the printer on the exhibits Page-1 and Page-2 were found to be different. The individual characteristics left by the printer on the exhibits Page-1 and Page-2 were found to be different .
AP14D12	B	1)Pages 1 and 2 of the questioned Labor Contract were made by the same type of printing equipment using electrophotographic technique. 2)Page 1 of the questioned Labor Contract was not produced by the same machine than Page 2.	To conduct given examination, expert used microscopic method using light microscope (magnification up to 60x). First of all expert determined method of printing technique which definitely is electrophotography (laser printer). Then the expert compared two pages to each other. The observations were the differences in the structure of printed elements between two pages – positioning of the toner in the printed lines and next to the lines and differences in the thickness of toner. Given observations leaded expert to the conclusion, that two pages of the questioned document were not produced by the same machine.
AP14D13	B	Page 1 and page 2 of the questioned Labor Contractnot produced by the same machine.	**Apparatus and equipment:** Docucenter Projectina MagMouse Regula 4097 Leica microscopes, Inverted microscope UV lamps Software – ImagePro Plus Ruller **The coincidence of two pages:** - Text formation (line and paragraph spacing, font etc.); - Both pages printed with black non-magnetic toners; **Differences in the characteristics:** - structure of toner particles (The approximate size and variation) - marks of toner cartridge mechanism (drum/roller) - systematic distribution of points on the same line (the difference in points and the distance between them) - the shape of the same signs (letters, points, commas), aureole of the toner particles around the signs and their elements - marks of paper feed mechanism - allocation of toner pollution - surface of toner layer

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
AP14D14	D	The two pages of the contract were printed by two cartridges of different toners and may be two different photoconductors. Given that the mechanical tracks correspond on two pages we cannot assert with certainty that two printers were used.	**Optical macroscopy**: The layout is the same on the two pages of the contract. **Optical microscopy** : The aspect of the toner is similar, fixed by heating and pressing. On each page, a periodical defect is observed. The defects are different between the two pages, they result from one of the different cylinders which may belong to the same photoconductor or not. **Chemical examination (Raman, FTIR, microanalysis –X)**: Toners have different compositions. **ESDA2 Electrostatic detection** : The same physical marks on the paper caused by rollers and the pick-up mechanism of the machine are revealed.
AP14D15	D	We would use the statement D as it is mentioned above with no further changes.	We performed our examination by using optical microscope (high power). We noticed that the morphology and shape of letters in page 1 and page 2 are different. Finally, in page 1 there are three defects in the printing surface while in page 2 there are six other defects in totally different position.
AP14D16	B	The toner powder on page 1 is not the same as page 2. Furthermore recurring marks were detected on both pages that indicate the drum dimensions of the used printers. The marks on page 1 differ in form, size and distance to each other the ones found on page 2. Therefore the two pages were NOT produced on the same machine.	The composition of the toner powder on page 1 is not the same as on page 2 (FTIR). Marks of imaging drums were detected on both pages(stereo-/3D- microscope) Diameter of imaging drum which page 1 was produced; approx.2.99 cm Diameter of imaging drum which page 2 was produced; approx.1.09 cm
AP14D17	B	Subtle differences found in the formation of same printed letters in the two pages of the questioned contract.	Microscope and Magnifying glass. Video Spectral Comparator 6000.
AP14D18	B	Page No. 1 of Labor contract is produced by a laser printer which is different from the laser printer used to produce page number 2, i.e. , the two papers are not produced by the same machine.	After examining the two papers comparatively using a microscope magnifying (up to 90 times) we noticed the following: 1.Both papers are produced by the same type of printers (Digital Laser Printers). 2.We have noticed differences in the shape of some of the characters and symbols among the papers, for example, the shape of the letter (t) (same style and font size) in page 1 in all its positions and repetitions is different from the shape of the same letter (t) in page 2. this also applies in many of the characters and symbols. When matching the two pages it is noticed that the page Numbering is not completely in the same point in the two papers, while the Numbering of the document pages produced by the same machine should be exactly

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
			in the same position in all pages of the same document.
AP14D21	E	Based on the evidence received. there is no basis for an identification or elimination of the questioned documents as having been produced by the same machine.	The documents were viewed macroscopically and microscopically and with the aid of various light sources and filters. Page 1 and page 2 appear to be the same in measurements, margins, alignments and color. Both documents appear to react similarly with absorption and luminescence. Both documents also appear to be mechanically printed toner images. Neither document appears to contain any security features or watermarks. Page 1 and page2 also appear to contain a mixture of both the English language and Mandarin characters. Additionally the documents appear to be printed on coated paper. One document appears to be printed on the coated side and the other appears to be printed on the non-coated side. This results in a sharpness difference between the two documents. However, this difference does not necessarily indicate a different machine. The questioned documents, page 1 and page 2, do not have consistent trash markings. These features also do not necessarily indicate a different machine. It might be helpful to submit known exemplars from any machine found in the vicinity of the questioned documents for comparison.
AP14D22	B	Both pages of the questioned Labor Contract have been produced using a dry toner electrophotographic printing process. However, the pages have different individuating print characteristics. Based on the these characteristics it is my opinion that page 1 and page 2 of the Labor Contract have been produced on different printers.	Macro and microscopic examination of the pages of the contract identified different electrophotographic imaging system drum faults on each page. This shows that different imaging systems have been used to produce each page. The vertical spacing of the faults on each page also differs, showing that the fault on page 1 was on a drum with a significantly larger diameter than that on page 2. Using oblique lighting and ESDA, roller marks were located on the rear of each page. These showed different patterns on each page, consistent with page 1 having traveled through a different paper transfer path than page 2.

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
AP14D23	E	Inconclusive: There may be both similarities and differences between the questioned material, the examiner is unable to determine the significance of these similarities and differences	Visual examination, measurements, microscope examination and examination under specialized lighting conditions. Also: micrometer (paper thickness), weight, size, watermark, fibers and other security features. Stamp /signature – original? -Both documents are produces with laser toner. -We did not find any alterations in signature or stamp. -No watermark in the paper. -Fetters/fonts were compared and aligned – and no discrepancies were found. -Also examined in order to find traces of any defects in paper and/or print – without any finding. The questioned documents has also been examined for indented impressions – no findings.
AP14D24	D	I have found indications that the two pages of the questioned contract were printed on two different machines. Amongst other findings, I have found that the margins of some of the printed letters on the first page are saw-toothed whilst the same letters on the second page have relatively smooth margins.	1.Microscope: On the first page, some of the letters (especially the letter "w" which has many diagonal lines) have saw – toothed edges, while on Page 2, those some letters are relatively smooth and without "teeth". 2.Transmitted light: The position of the page numbers in the lower right – hand corner of the two pages of the contract is different and does not overlap. We conducted a few experiments where we printed a certain document on two different printers. We found that the position of the page numbers from the two different printers was different. The position remained constant for each printer individually. 3.ESPA – We developed different line patterns on each of the two pages of the contract.
AP14D25	B	Several observations revealed that page 1 and page 2 of the questioned document were not produced by the same machine: While both pages originate from an electrophotographic printing process, different traces of toner particles evidently show that the printers used to print page 1 and page 2 respectively have different mechanical properties. Moreover, two different toners have been used.	Both pages originate from electrophotographic printers and are produced using black toner material only. Page 2 additionally contains a red stamp and two signatures. Thorough investigations using an optical microscope reveal obvious differences in the surface characteristics of printed areas as well as several accumulations of toner particles that are vertically aligned and are located at a fixed distance from each other. These accumulations indicate a defect on the optical photoconductor (OPC) drum of the printer and are thus a 'fingerprint' of the OPC drums' circumference. The value that could be measured for page 1 was approx. 9,4 cm. However, the circumference that was found on page 2 was approx. 3,4 cm, thus giving a strong evidence of different mechanical properties. This cannot be explained by two different drums within the same machine since each of the two defects is found solely on one page and not on the corresponding other page. Both toner materials from page 1 and page 2 respectively were tested for magnetic components and showed no differences (both non-magnetic). On the other hand, significant differences have been found in the spectra resulting from non-destructive infrared (IR)

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
			spectroscopy so that both materials can be distinguished from each other. Altogether these observations lead to the above-mentioned conclusion that page 1 and page 2were not produced by the same machine.
AP14D26	D	One Toner can be distinguished from the other. The use of the same machine is rather unlikely but can't certainly be eliminated.	FT-IR-Analysis results in 2 different toner materials. ESDA: Latent indentations are on different paper sides LIBS: Both Toners are FE-free
AP14D28	D	The results of the examination support that page 1 and page 2 of the questioned Labour Contract were not produced by the same machine (Level -2).	**Method**: Microscopic examination (low magnification) **Observations**: Both pages toner (only black). Some differences in the general "look" of the **toner surface**, some vertical "stripes" observed on page two. These stripes may originate from a visible difference in paper surface structure between the two pages **Method**: Superimposition (in Projectina Docucenter Nirvis) **Observations**: Some small but distinguishable differences in the shape of some letters between page one and page two. **Method**: Microscopic examination (high magnification) **Observations**: Some small differences in toner surface texture between the two pages, a smoother more melted surface on page 2.

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
AP14D30	B	In my opinion, the evidence provides support for the proposition that the pages 1 and 2 of the Labor Contract were not produced by the same machine at the same time.	The two pages of the Labor Contract were examined using an Electrostatic Detection Apparatus (ESDA) to determine if there were any impressions relevant to the examination present upon the pages. Printer roller marks were detected on the rear of both pages, with differences observable in these marks between the two pages, including their position, thickness and clarity. No other impressions of interest were detected. The Contract was examined macroscopically and microscopically. The font style and size, margins and spacing are consistent between the two pages in areas that are comparable. However, differences were observed in some microscopic features of the printed text including the shape and size of the base of the letter t, the thickness of the staff of the a, the height of the connection of this body of the letter, and the thickness of the serif at the base of the numeral 1.
AP14D31	B	The observed printing features revealed that page 1 and page 2 of the questioned Labour Contract were not produced by the same machine.	I have subjected Page 1 and Page 2 of the Labour Contract document to visual, microscopic, overlay and instrumental examination, to determine whether or not Page 1 and Page 2 have been produced by the same machine. As a result, the following features have been observed: • Toner distribution on Page 1 is even while that on Page 2 is uneven. • Intensity of the printing (color) on Page 1 is lighter than that of Page 2. • Shape of the some printed letters on Page 1 is different to that on Page 2. (E.g. letter “r” & “t”). • No spectral differences between Page 1 and Page 2 have been observed. • Printing width of Page 1 and Page 2 are the same.
AP14D32	E	It is my opinion that the text entries on Page 1 and Page 2 of the contract were printed using an Electrophotographic Toner process. No significant differences were detected between the toner on Page 1 and the toner on Page 2 and as a consequence, it is not possible to exclude the possibility that these pages were produced on the same machine.	The Electrophotographic Toner entries on both pages were observed and compared both macroscopically and microscopically. An in-house technique to enhance the surface morphology using Adobe Photoshop was applied and the Raman Spectra were compared using the Foster & Freeman Foram 685-2. In each case, no significant difference was noted between the toners on Page 1 and Page 2 of the contract. Printing determination is an exclusory type of test where a detected difference would show that the entries were produced on different machines but no detected difference would not necessarily mean that the entries were produced on the same machine (i.e. the possibility that two different machines of the same type were used).

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
AP14D33	B	The first page of the Labor Contract was produced on a different machine than the second page of questioned document.	Optical methods (Optical microscope, High resolution multi-spectral imaging system for questioned documents [VSC 6000 – Foster + Freeman]) Observations: Our conclusion was supported by the following differences observed between the first and the second page of the contract: different surface of toner, different shape of characters and different shape of edges of printed graphic elements
AP14D35	B	The questioned Labor Contract consists of two pages. Bilingual texts in Chinese and English are computer-generated and printed on one side of two sheets of white paper A4. The paper sheets are similar in appearance, look through appearance and optical properties. Page 1 is printed on the felt side of the paper sheet and page 2 is printed on the wire side of the paper sheet. Differences between the texts on page 1 and page 2 have been established during the nondestructive comparative examination of the questioned Labor Contract under microscope Leica M 205C, Video Spectral Comparator VSC200 (incl. Video microscope CVM 2000) and VSC5000 and Raman Spectrometer as follows: - differences in type face of some characters/letters (for example: “a”, “y”, “g”, “i”) and in the stroke contours type (see images below); -difference in the structure of strokes, i.e. the amount of deposited toner particles and the toner fusing/melting pattern (see images below) -difference in the spatter of toner particles around the characters and in the white unprinted areas (see images below) -difference in toners’ Raman spectra on page 1 and page 2. On the ground of the above	Stereo microscope and metallographic microscope for optical examination of the printouts Video Spectral Comparator VSC2000 and VSC5000 for comparative examination Bruker Senterra for Raman Spectroscopy

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
		mentioned results it can be concluded that page 1 and page 2 of the questioned Labor Contract WERE NOT PRODUCED BY THE SAME MACHINE.	
AP14D36	B	In a comparative examination of the questioned Labor Contract under microscope Leica DFC and Video Spectral Comparator VSC1 and VSC5000 we established differences between the texts on page 1 and page 2 as follows: differences in type face of some characters/letters (see figure 1 and 2 in Appendix); differences in the stroke contours type (see figure 3 and 4 in Appendix) differences in the structure of strokes, i.e. the amount of deposited toner particles; the toner fusing/melting pattern(see figure 5 and 6 in Appendix) the spatter of toner particles around the characters and in the white unprinted areas (see figure 7 and 8 in Appendix) Conclusion: Page 1 and page 2 of the questioned Labor Contract WERE NOT PRODUCED BY THE SAME MACHINE	microscope Zeiss– Stemi 2000–CS Video Spectral Comparator VSC1 Video Spectral Comparator VSC5000
AP14D37	B	1. Commencement and finishing of same word in the page one and page two are dissimilar. 2. Relative position of the alphabet `Y' of the word 'party' of the page one and page two are not same. 3. Diacritics of the same Alphabet in the page one and page two are found distinctively different; however it seems to be same apparently.	Both pages of the document were examined following indiscriminating non-destructive method. Each and every alphabet and words were compared. The letter characteristics and their strokes in the first page were checked individually whether they are having same characteristics or not. They were examined by the biological eye, optical instruments like magnifier, Carson Magniscope, microscope and video Spectral Comparator (VSC)-400. At first, letters of the first page were examined by the eyes and geometrical instruments. Some of them which were found apparently confusing and they were measured. Their length, Width, height was thoroughly examined whether they are of same letter font.

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
		4. Dots of alphabet 'i' of the page one and page two are not visible in the same manner. Some of them are exactly round shaped where some of them are found different.	Some words were composed ''Bold''. Bold letters were compared with the bold letters of the same page. Letters in bold in the same page were found identical whereas different with the other page. Letters pattern, their loops, angles, curvature were examined. Intra-letters and words spacing, their relative position were examined. Some of them of page one and two are showing divergences. Peculiarities of some letters were minutely observed. Some of the letters of page one are having same peculiarity however that sorts of peculiarity were not found in the same letters of page two.
AP14D38	D	The examination of page 1 and page 2 strongly supports the proposition that page 1 and page 2 were not printed on the same printer.	The paces were examined using a microscope in order to determine the appearance of the printed matter. Any possible composition differences between the printing inks/toners were examined under UV/FR/visible lights using the (foster&freeman) video spectral compartor. Examination for any roller and gripper marks left on the paper as it passes through the printer were examined under low angled light. Differences were found in the appearance of the toner printing. And the roller/gripper marks between pages 1 and 2. No further examinations were carried out. Alternative hypotheses were considered which might explain the differences if the pages were printed on the same printer. These could be the printer warming up from page 1 to page 2 or the toner beginning to run out between page 1 and page 2. These were considered to be unlikely scenarios. As the printer was not available for examination – the comparison of roller and gripper marks had to be under taken making certain assumptions. These factors resulted in a qualified opinion being given.
AP14D39	D	There are a number of differences between characteristics on Page 1 and Page 2 of the contract, including: Differences in character construction (for example the "i-dot" in Article and the shape of the bottom left hand serif in the numeral "1") Differences in the surface morphology of the fused toner The nature of the differences is such that it is unlikely that the two pages were produced on the same printer.	For observations see above. **Examination methodology included**: Visual examination Microscopic examination FTIR Use of VSC-6000 (multiple light source and filters)

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
AP14D41	B	Page 1 was produced by different machine then page 2. -The toner on page 1 differs in chemical composition -Surface structure of the printed figures is different -There is an individual mark (by cylinder) on page 1 -There are not any individual marks on page 2	IR-spectroscopy – analyses of the electrophotographic toners -The toner of page 1 differs in chemical composition. Microscopic analyses - -Surface structure of the printed figures is different -An individual mark on page 1 page 1 – an individual mark by the cylinder page 2 – different structure of the toner surface
AP14D42	B	Both pages of the disputes contract are printed on good quality , office machine laser printers and contain similar Times roman and Ariel fonts for the printing that is in English . However , there were important differences between the two pages that lead me to conclude the two pages were probably printed on different machines .	During a microscopic examination of the contract , I studied an recorded selected printed letters and Chinese characters when I observed difference . I identified small but significant differences in the shapes for i-dots in both the Times Roman and Ariel fonts, as well as differences in the spacing of letters in the “rt” combinations in words “Article” as examples ,it is common for fonts in the same family to show slight variations depending on the entity that is reproducing them . The following illustration shows one example of the result of the comparison in the i-dots and spacing between the “r” and the “t” in the word “Article” in the Times Roman font . I also noted that many typed lines on page 1 showed a more pixelated or aliasing effect than the lines on page 2 of the contract. This is an indication of machines using different resolutions. The following illustration compares the aliasing effect of the top horizontal line on the same Chinese character from pages 1 and 2 of the contract. In addition, there was more toner spatter in certain areas of page 1 that was not present or not as pronounced as on page 2. To determine if there was additional evidence that would support the conclusion, I also examined the pages with an ultraviolet source and took indented writing lifts from the two pages of the contract. The results showed similar fluorescence for both pages, and no indentations were developed on either lift.
AP14D43	B	The contract was produced by means of laser printer but with two different machines. The second page of the contract contains weld defined printing defects which are different from the first page features. The back of the paper sheets consist different indentations caused by the paper forwarding mechanism.	microscopic examinations, visual comparison, side-light examination, optical examinations under UV- and IR-light,

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
AP14D44; AP14D45	B	It cannot be determined whether the two sided pages of the contract were printed on the same machine.	In order to due the examination we use LUCIA Forensic Soft, Nikon SMZ 800 stereomicroscope and VSC 6000/HS video spectral comparator. As a result of the microscopic examination of the sheet of paper, we found out that the printing was made with a laser printer and it showed clusters of black dots and no color dots, which means that the printing was the result of a monochrome laser printer. After microscopic examination we found that the two pages show the printing of the same groups of dots that are not part of the text and are repeatedly displayed on the page in the some shape and placement. The dots have a different shape and display on the 2 pages. The shape of the dots on the first page of the contract is presented in photos nr. 1-2 and their location on the page is determined and presented in photo nr. 3-4. Photos nr. 1-2: Details of the two clusters of dots on page 1. Photo nr. 3-4 The groups of dots are placed on an imaginary vertical line situated at the distance of 36, 2 mm from the left side of the page. On this imaginary line, the groups of dots are placed at a distance of 94,3 mm between them. The repeatability of the group of dots is given by a full rotation of the cylinder that created them, therefore the diameter of the cylinder can be determined using the formulas $L=2\pi r$ and $D=2r$ where L is length of the circle, r is radius of the circle, D is the diameter of the circle and n is 3, 14 constant value. $94,3mm = 2 \times 3,14 \times r$; $r = 15,01$ $D=2r=30,02mm$ The shape of the dots on the second page of the contract is presented in photos nr. 5-6 and their display on the page is determined and presented in photo nr. 7-8. Photos nr. 5-6: Details of the two clusters of dots on page 2. Photo nr. 7-8. The groups of dots are placed on an imaginary vertical line situated at the distance of 53,2 mm from the left side of the page. On this imaginary line, the groups of dots are placed at a distance of 34,5, mm between them. The repeatability of the group of dots is given by a full rotation of the cylinder that created them, therefore the diameter of the cylinder can be determined using the formulas $L=2\pi r$ and $D=2r$ where L is length of the circle, r is radius of the circle, D is the diameter of the circle and n is 3, 14 constant value. $34,5mm = 2 \times 3,14 \times r$; $r = 5,49$ $D=2r=10,98mm$.

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
AP14D46; AP14D47	D	Page 1 and page 2 of the questioned Labor Contract were probably not produced by the same machine.	After the examination under the microscope of the two pages of the contract we found that their printing was done with laser printer according to Photo no. 1. On each page of the contract was found a series of two forms like points that are not part of the text and have repeatability in shape and layout (position in page), which leads to the conclusion that they are not an 'error' print but a 'trace' left by the printer. The shape and arrangement of these points is different on the two pages. So, on the first page of the contract the points shape is shown in photo no. 2 and the way of layout on the page is shown on photos no. 3-5 The shapes (points) are placed on an imaginary vertical line at a distance of 36.2 mm from the left edge of the page. On this imaginary line, the series of two dots have a distance of 94.3 mm apart. On page 2 of the contract the points shape is shown in photo no. 6 and the way of layout on the page is shown on photos no. 7-9. The shapes are placed on an imaginary vertical line at a distance of 53.2 mm from the left edge of the page. On this imaginary line that series have a distance of 34.5 mm between them.
AP14D49	B	The page 1 is not produced by the same machine because it presents different print patrons, it's evident with an over position photography; the page 1 over the page Z, shows the residues of ink out of the coincidence print patrons, conclude it isn't the same machine.	1. Observe the questioned documents with the magnification lens. 2. Inspect each sheet separate with the video spectrum comparator using different incidence of light, search the similitude or difference between it. 3. Make an over position picture whit both pages, verify the print patron coincidence. 4. Take the pictures necessary for make evident the results of the page comparison. 5. Prove the results in de comparator Forensic Microscope. 6. Emit the report.

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
AP14D50	B	Pages 1 and 2 of the questioned Labor Contract were examined . The tests on then were found to be printed with black toners . Repeated drum defect marks were found along the vertical axis about 5.3cm from the left margin of page 2, which where absent on page 1. Microscopic examination revealed differences in the printing details of some Chinese characters on page 1 and 2 , e.g. Ragged edges were found in slanting strokes of the characters on page 1 while smooth edges were found on similar characters on page 2; difference in the detail at the beginning of horizontal stokes in some Chinese characters on page 1 and 2 . In view of the collective findings , I am of the opinion that page 1 and page 2 were not produced by the same machine .	Visual and microscopic examination; Eight sets of drum marks were observed along the vertical axis about 5.3 cm from the left margin on page 2 of the questioned Labor Contract . Each set of defect marks was separated by about 3.5cm along the axis . Under microscope , the drum defect marks were found to be similar in size and shape . The defect marks were absent on page 1. Transmitted light examination; The page numbers on page 1 and 2 were not in the same position. Microscopic examination; Under microscope , it was found that both pages 1 and 2 were printed with black toners. Also, the printing details of the same Chinese characters and numerals on page 1were different from those on page 2 . For example :(i) ragged edges were found in the slanting strokes of the same Chinese characters and numerals printed on page 2; (ii)difference in the detail at the beginning of the horizontal strokes in some Chinese characters on page 1and page 2.
AP 14D51	B	The page 1 and page 2 of presented to examination LABOR CONTRACT dated 2013-01-10 are printed by different machines(laser printers or copiers).	Observation magnifying and measuring: both pages have repetitive trash marks, but they are different shape, intensity and distance in every page. There are ~92 mm distance in page 1 and ~35 mm in page 2. It shows different circumferences of printing cylinders. Microscopic examination: there are serrated diagonal edges of some characters(e.g., y, s, k, A) in page 1, edges in page 2 are smoother. Microscopic examination: there are difference in some characters or its elements. The dots above letters “i” in words “Article” and following words printed with the same font(in brackets) are hexagonal in page 1, these elements are rounded in page 2. The dots above letters “i” in English text word are quadrate in page 1, in page 2 they are rectangular. The commas in English text in page 1 are smaller than in page 2. There are slight difference in shape of some letters in English text between page 1 and page 2. Some of these letters are: r, t, e(in bolded titles ‘article’ text), t, u, s(in ordinary English text). See the appendix.

Participant Code	Conclusion	Wording of Conclusion	Support for Conclusion
AP 14D52	B	The page 1 and page 2 of presented to examination LABOR CONTRACT are printed by different machines	There are differences in the layout, relative position of pager number between page 1 and page 2. 3 cyclical defects on page 1 and 8 cyclical defects on page 2 were observed. The causes of that are the damage of the OPC drum.
AP 14D53	B	Page 1 and page 2 of the submitted Labor Contract were not produced by the same machine.	The mechanical defects of the first sheet are different from the second sheet. Page 1 and page 2 is not come from the same batches. The thickness of toner accumulation of the printer of page 1 and the printer of page 2 is different. Participants are encouraged to provide a formal report in their own format.
AP 14D54	B	Page 1 and page 2 of the questioned Labor Contract were not produced by the same machine.	Using non-destructive methods, we choose optics microscope to magnify the printing features and compare it of page 1 and page 2. First, we found that the characters of page 1 and page 2 are both composed of tones, which means that page 1 and page 2 are printed by toner printer. Second, there are obvious differences in the tone distribution on the edge of characters between page 1 and page 2. Third, a trace feature exists on the OPC(Organic Photoconductor) of page 1 printer. The distance of the features to the left margins is nearly 36mm, and the distance of the repeat two trace features is nearly 94mm. On the page 2, we have also see one trace feature, the distance of which to the left margins is nearly 53mm, and the distance of the repeat two trace features is nearly 34.5mm. The shape of trace features also has obvious difference.

Related Materials

中国合格评定国家认可委员会
China National Accreditation Service for Conformity Assessment
Address: 8 NanHuaShiDaJie, Dongcheng District, Beijing 100062, P.R. China； Email: heping@cnas.org.cn

APLAC Proficiency Testing Program
APLAC T096 Printed Document Examination

1. Objective

Questioned document examination is a branch of forensic science which focuses on the analysis of documents in dispute or doubt. Printed document examination is an important issue in questioned document examination due to the widespread use of office machines. It is involved both in criminal cases and in civil cases. The determination of whether different pages of a document are produced by the same machine is of valuable information and is a frequent requirement in casework for questioned document examiners. This PT program proposed here is to evaluate the performance of the participants in analysis of the printing process and characteristics of the questioned document. The results of this program could somehow provide objective evaluation of forensic laboratories for administration offices and courts.

2. Organization and Responsibilities

China National Accreditation Service for Conformity Assessment (CNAS) is the proposer and the Institute of Forensic Science (IFS), Ministry of Justice, PRC, is the PT provider. This program is organized under the auspices of APLAC.

CNAS is responsible for proposing this program for approval by the APLAC Proficiency Testing Committee, inviting participants, circulating the final report to participants and acting as a coordinator between APLAC, ABs, participants and PT provider.

IFS, which is accredited by CNAS as the PT provider to ISO/IEC 17043:2010, is responsible for preparing, packaging and dispatching PT items, evaluating PT results, handling participants' queries and preparation of final reports.

3. Selection of Participants

APLAC members as well as other non-APLAC members are invited to participate in the program. Participating accreditation bodies will be asked to nominate participants (the accredited or unaccredited units from law enforcement agencies, such as police, other forensic document examination laboratories or from universities or colleges) and indicate the accreditation status of the participants for the test.

4. Proficiency Testing Materials

(1) The questioned document: A printed Labor Contract with two pages.

(2) A DVD disc containing:

a. Instruction to Participants: Scenario, Description of the Questioned Document, Examination Request;
b. Receipt Form;
c. Result Report Sheet.

5. Homogeneity Testing and Stability Check

Before dispatching, the printing characteristics of each questioned document will be checked by a technical expert in accordance with the requirements of the *Proficiency Testing Guidelines for Questioned Document Examination of IFS*. Thus, the samples are guaranteed to be uniform/homogeneous, properly and adequately characterized before being issued.

6. Methodology

Participants are required to examine the submitted questioned document **using their routine non-destructive methods (Don't damage the questioned document)**, and answer the question: *Were page 1and page 2 of the questioned* Labor *Contract produced by the same machine?*

7. Submission of Results

Participants should complete the Result Report Sheet and submit it **electronically** to IFS on or before the deadline. Generally, results submitted after the deadline will not be accepted.

8. Assessment of Performance

The submitted results of participants will be evaluated and rated by experts according to following criteria:

(1) Satisfactory: the conclusion is correct in a definite statement or in a probability statement with adequate observations.

(2) Problematic:

a. The conclusion is correct in a definite statement or in a probability statement but without adequate observations.

b. The conclusion is wrong in a probability statement.

c. No conclusion is reached.

(3) Unsatisfactory: The conclusion is wrong in a definite statement.

9. Issuance of Reports

Proficiency Testing Reports will be issued to participants with the evaluation results and manufacturer's information.

The IFS will prepare an interim report and issue to the participants and/or accreditation bodies via CNAS for their comments. A draft final report will then be prepared and submitted to APLAC PT Committee for review and approval. Upon approval by the APLAC PT Committee, an electronic copy of the Final Report will be distributed to the participants.

10. Confidentiality

The organizers (APLAC, CNAS and IFS) strive to maintain strict confidentiality with respect to the information and performance of all participants. The code number assigned to each participant in this program is only made known to the contact person or authorized person of his laboratory,

the respective nominating accreditation bodies and the organizers.

11. Application Fee

Free of charge.

12. Schedule for Program

Aug-Oct, 2014	Advise APLAC members, EA, IAAC and other contacts for participating
By Oct 15, 2014	Accept nominated participants
By Nov10, 2014	Dispatch samples to participants
By Dec 20, 2014	Submit results for participants
By March 30, 2015	Draft final report

13. Contacts

CNAS:

PT Manager:
Mr. HE Ping
Address: 8 NanHuaShiDaJie, Dongcheng District, Beijing 100062, PRC.
Tel: +86-10-6710 5290 Fax(Auto): +86-10-6710 5503
Email: heping@cnas.org.cn

IFS:

Mr. Fang Jianxin
Address: No. 1347, West Guangfu Rd, Shanghai 200063, PRC.
Tel/Fax(Auto): +86-21-5235 1397
Email: fangjx@ssfjd.cn

Nomination Form of APLAC T096
Printed Document Examination

Participants should complete the details of the form and **email** to the boxes below **no later than Oct 15, 2014.**

Contact:
Mr. HE Ping, E-mail: heping@cnas.org.cn
Mr. Fang Jianxin, E-mail: fangjx@ssfjd.cn

Accreditation Body Information

Name	
Contact Person	
Email	
Shipping Address	
Country / Economy	
Phone	
Fax	

Nominated Participants

Contact Person		***Contact Person***	
Laboratory Name		***Laboratory Name***	
Physical Address		***Physical Address***	
Country/Economy		***Country/Economy***	
Email		***Email***	
Tel /Fax		***Tel /Fax***	
Accredited Status	Printed Document Examination ☐Yes ☐No	***Accredited Status***	Printed Document Examination ☐Yes ☐No
Contact		***Contact***	
Laboratory Name		***Laboratory Name***	
Physical Address		***Physical Address***	
Country/Economy		***Country/Economy***	
Email		***Email***	
Tel /Fax		***Tel /Fax***	
Accredited Status	Printed Document Examination ☐Yes ☐No	***Accredited Status***	Printed Document Examination ☐Yes ☐No

Instruction to Participants

Dear Participant,

Your organization has been nominated by your accreditation body(AB) to participate in the proficiency testing(PT) program：Printed Document Examination (APLAC T096), which is proposed by China National Accreditation Service for Conformity Assessment (CNAS) and prepared by the Institute of Forensic Science (IFS), Ministry of Justice, PRC . In this program, each participant has a unique code shown on the Result Report Sheet. Considering the rules for protection of participants' confidentiality, the unique code number will represent your organization in the final report associated with this program. The participant's information and PT results will be returned to related ABs and APLAC.

Instruction

14. Scenario

An employee was suing his employer company. The company provided a Labor Contract dated January 10, 2013. Disputes arose between the two parties as to how the Labor Contract was produced. Both parties agreed to appoint a forensic science institute to determine whether the two pages of the Labor Contract were produced by the same machine.

15. Proficiency Testing Materials

(1) **The questioned document: A two pages Labor Contract dated January 10, 2013.**

(2) A DVD disc containing: a. Instruction to Participants; b. Receipt Form; c. Result Report Sheet.

16. Examination Request

The participants are required to examine each page of the submitted document comparatively, and answer the following question: ***Were page 1 and page 2 of the submitted Labor Contract produced by the same machine?***

Please complete the examination by your routine **non-destructive** methods,and record your results on the Result Report Sheet.

The finished Result Report Sheet should be returned to the following contact **by EMAIL or MAIL no later than Feb 5, 2015.**

Note： Participants are encouraged to provide a formal report in their own format.

Enquiries

Please refer to the following contact for enquiries concerning the program.

Contact:

Mr. Liu Yuchen
E-mail: liuyc@ssfjd.cn
Address: No. 1347, West Guangfu Rd, Shanghai 200063, CHINA.
Tel/Fax (Auto): +86-21-5235 2957

Receipt Form

(For Participants)

We are pleased to know that in accordance with the distribution schedule of APLAC Printed Document Examination Proficiency Testing Program APLAC ZT105, the testing materials have been dispatched to your body/lab.

In order to monitor the status of the testing materials, we kindly ask each participant on receipt of the testing materials to fill out this RECEIPT FORM and return it by **EMAIL URGENTLY** to your accreditation body as well as the contact person listed below. New testing materials will be dispatched for any damaged claims.

Mr. Liu Yuchen

E-mail: liuyc@ssfjd.cn

Thank you in advance for your cooperation

NAME OF YOUR BODY/LAB:_____

PARTICIPANT CODE:_____

DATE RECEIVED:_____

Are there any damage to testing materials? ☐ **Yes** ☐ **No**

If yes, or any other problem, describe the problem below.

Person for contact:

Date:

Result Report Sheet

Participant Code: XXX—XXX

Name of the Participant: _____

I. Conclusion

Note: the letters A, B, C, D and E respectively refer to five conclusions:

A: Were produced by the same machine;

B: Were NOT produced by the same machine;

C: Were PROBABLY produced by the same machine;

D: Were PROBABLY NOT produced by the same machine;

E: CANNOT be identified or eliminated.

Please select one that best represents your conclusion by ticking the corresponding letter off.

Were page 1 and page 2 of the questioned *Labor Contract* produced by the same machine?

A ☐ B ☐ C ☐ D ☐ E ☐

II. Wording of Conclusion:

Note: Please use your preferred wording for your conclusion.

_____

_____

_____

_____

_____

_____

III. Support for Conclusion:

Note: Please describe your examining methods and observations for your conclusion.

_____

_____

_____

_____

_____

_____

IV. Additional Comments:

Note： Participants are encouraged to provide a formal report in their own format.

THE END