



Influence of marking engines and toner/ink types on the formed image elements in digital printing

Ivana Rilovski, Igor Karlović,
Dragoljub Novaković, Ivana Tomić

Overall quality of digital prints

- Digital printing is the most widespread printing technology nowadays
- It replaces the conventional printing technologies
- Implementation of new standards that define digital print quality is necessary



From ISO 12647 – x to ISO...

- **ISO 13660** (Information technology -- Office equipment -- Measurement of image quality attributes for hardcopy output -- Binary monochrome text and graphic images)
- **ISO 24790** (Information technology -- Office equipment -- Measurement of image quality attributes for hardcopy output -- Monochrome text and graphic images)
- **ISO 15311** (Graphic Technology -- Requirements for printed matter utilizing digital printing technologies for the commercial and industrial production)



Basic print quality attributes according to ISO 13660

Character and Line	Large Area
1. Blurriness	1. Darkness, large area
2. Raggedness	2. Background haze
3. Line width	3. Graininess
4. Darkness, character	4. Mottle
5. Contrast	5. Extraneous marks, background
6. Fill	6. Voids
7. Extraneous marks, character field	
8. Background haze, character field	



Line and text reproduction

- Some components of line quality are the average line width, line width variation, edge raggedness and line sharpness
- The text quality attribute consists of three sub-attributes, analogous to those for line quality: character fidelity, text contrast and text uniformity



Solid areas reproduction

- Uniformity of solid areas
- Defined through micro and macro uniformity
- Should be measured on primary and secondary process colours

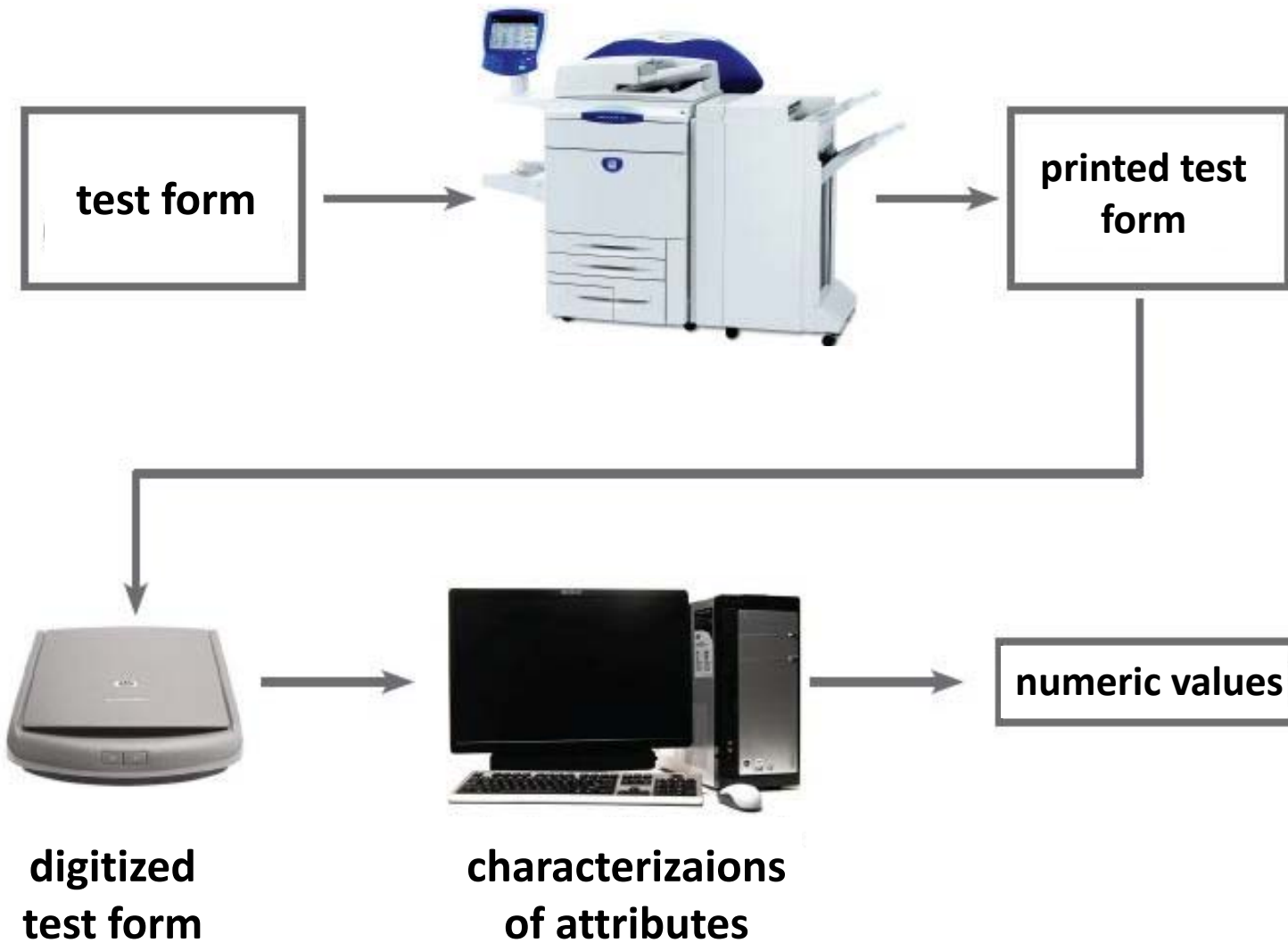


Aim of the work

- To define maximum print quality of machines with different marking engines and toner/ink types by assessing some of the quality attributes
- Attributes such as line reproduction, text quality (readability) and print mottle can be good indicators of the maximum possibility of printing device
- Better quality, determined on the basis of these attributes, should be achieved with higher print resolution



Methods and materials



Methods and materials

- The chosen printing machines are based on different digital marking engines:
- **Ink jet:**
 - o EpsonStylusPro 7800 and
 - o HP DesignJet Z5200
- **Electrophotography :**
 - o Xerox DocuColour 242,
 - o Xerox DocuColour 252 and
 - o Gestetner CS555.



Methods and materials

- Maximum print resolution:

	Resolution
EpsonStylusPro 7800	<i>2880 x 1440 dpi</i>
HP DesignJet Z5200	<i>2400 x 1200 dpi</i>
Xerox DocuColour 242	<i>2400 x 2400 dpi</i>
Xerox DocuColour 252	<i>2400 x 2400 dpi</i>
Gestetner CS555	<i>600 x 600 dpi</i>



Methods and materials

- Substrate:

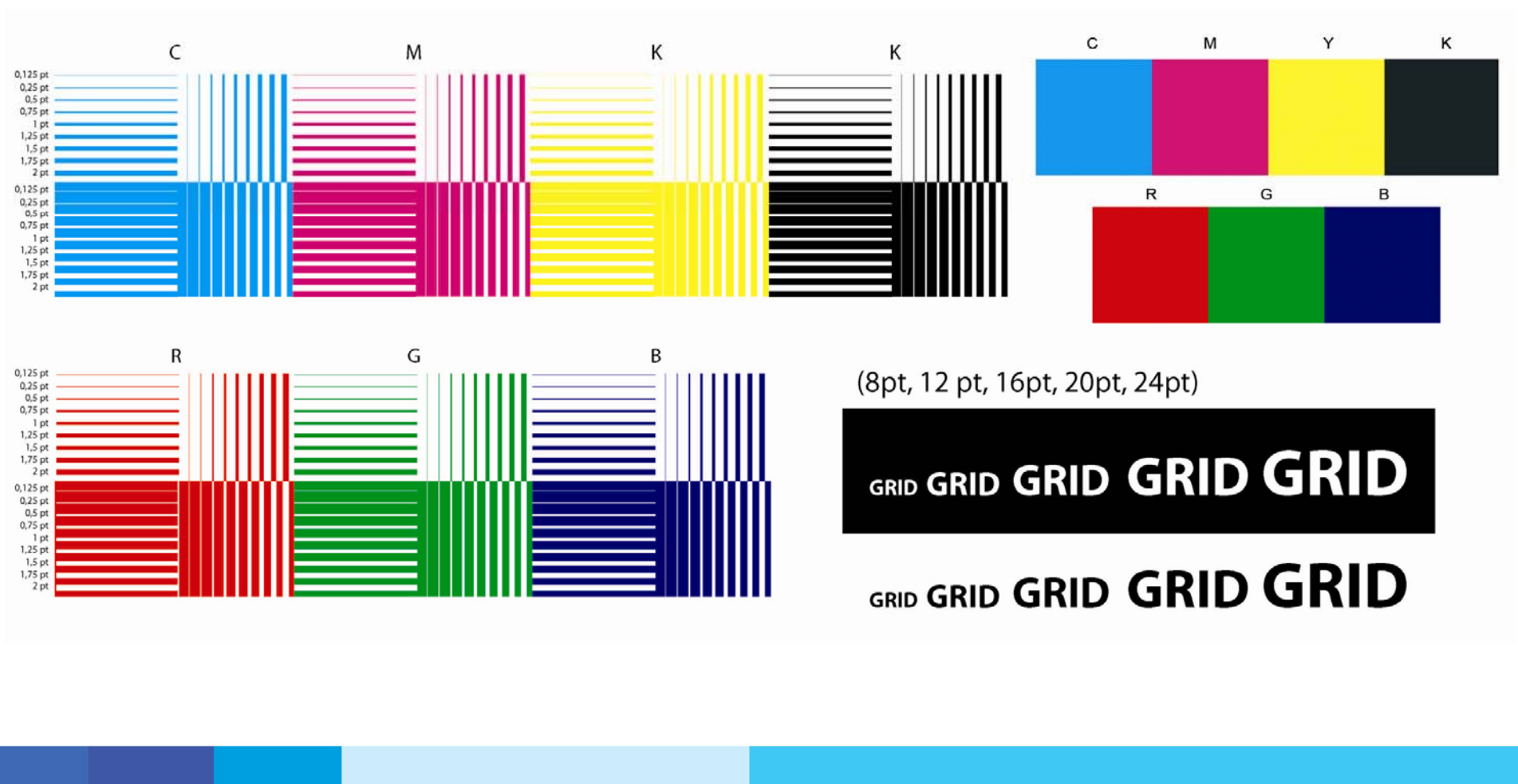
Semi glossy paper

Fedrigoni “Symbol Freelifa Satin”, 130 g/m²



Methods and materials

- Test target used for this work



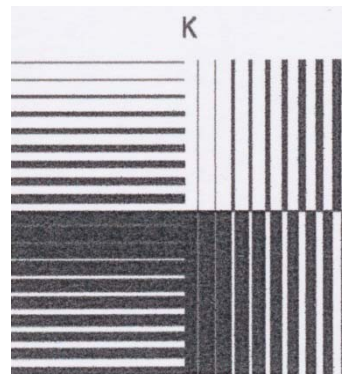
Methods and materials

- Samples were scanned with scanner Canon CanoScan 5600F at 1200 spi resolution (ISO 24790)
- Characterization was done in ImageJ software
- Attributes that were assessed: line width and perimeter, text readability (area and perimeter) and mottle (by NU number)
- $NU = U_x - L_x$

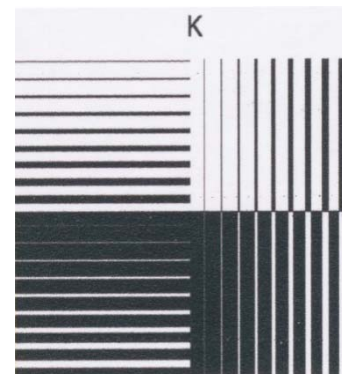


RESULTS AND DISCUSSION

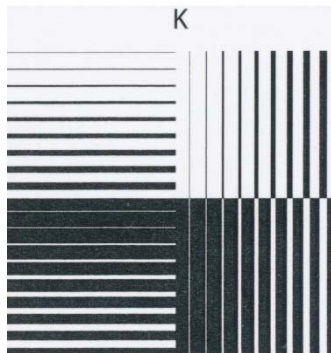
- Scanned lines reproduced on:



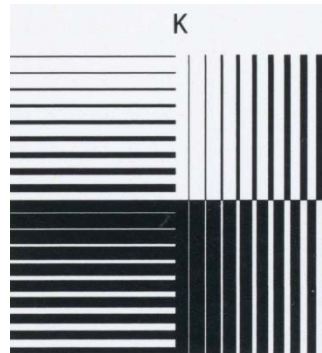
StylusPRO7800



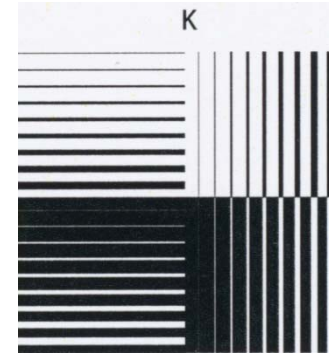
HP Z5200



Xerox 242



Xerox 252

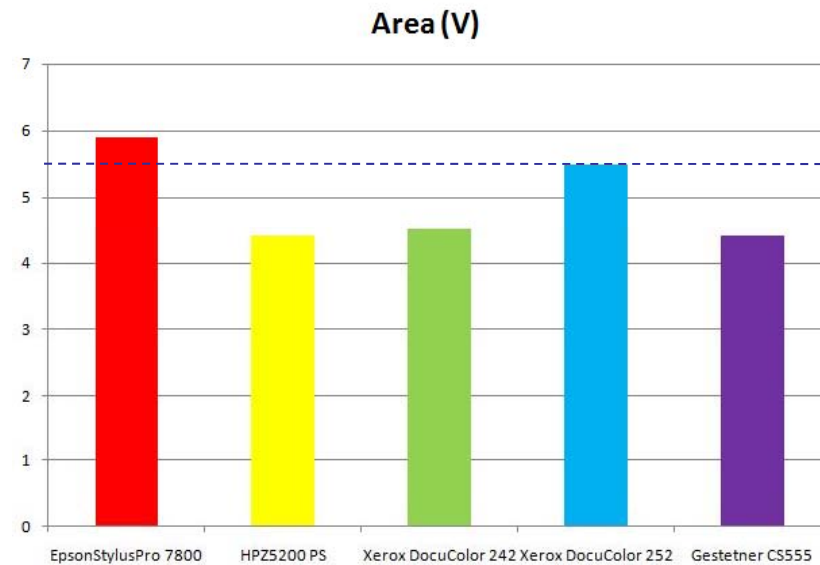
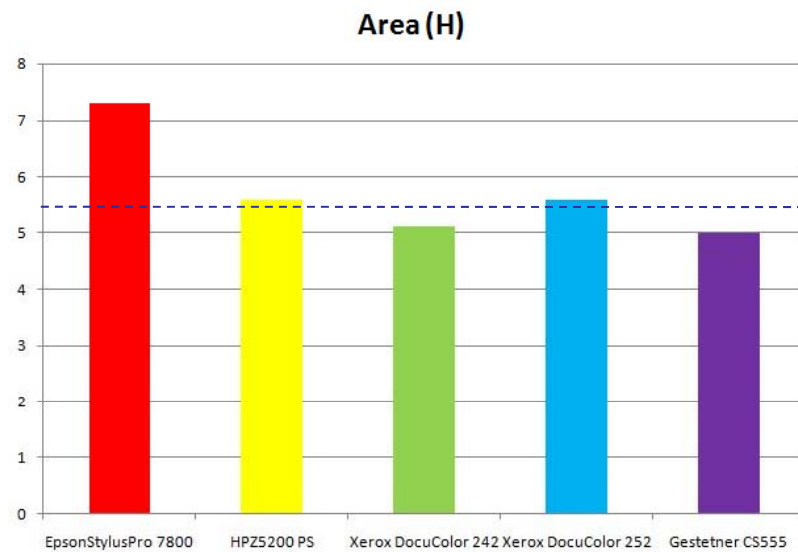


Gestetner CS555



RESULTS AND DISCUSSION

- 1 pt black line area in mm² (horizontal and vertical)

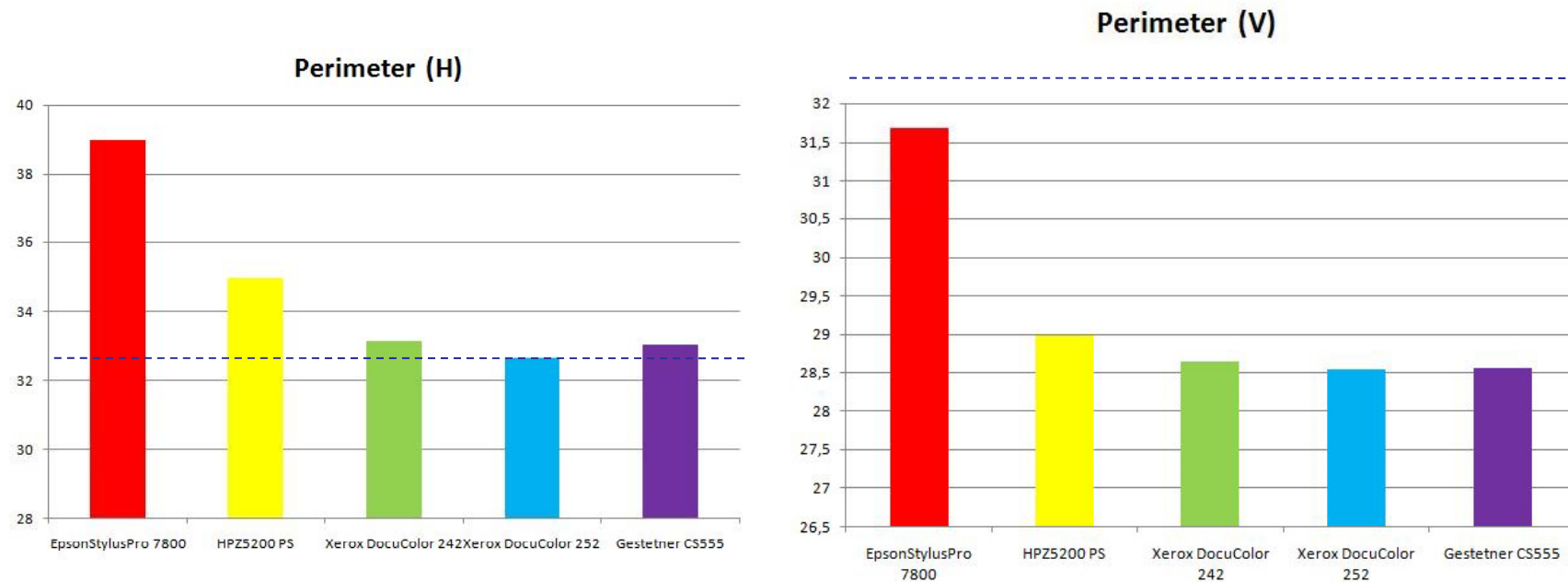


- The same trend was noticed for the other colours and other line widths



RESULTS AND DISCUSSION

- 1 pt black line perimeter in mm (horizontal and verticaly)



- The same trend was noticed for the other colours



RESULTS AND DISCUSSION

- Black text (size 16 pt) reproduced on:



StylusPRO7800



HP Z5200



Xerox 242



Xerox 252

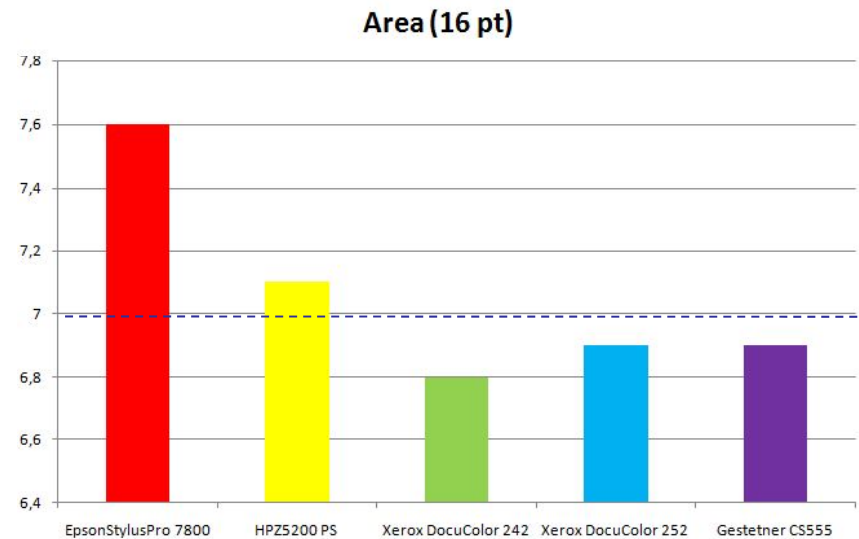
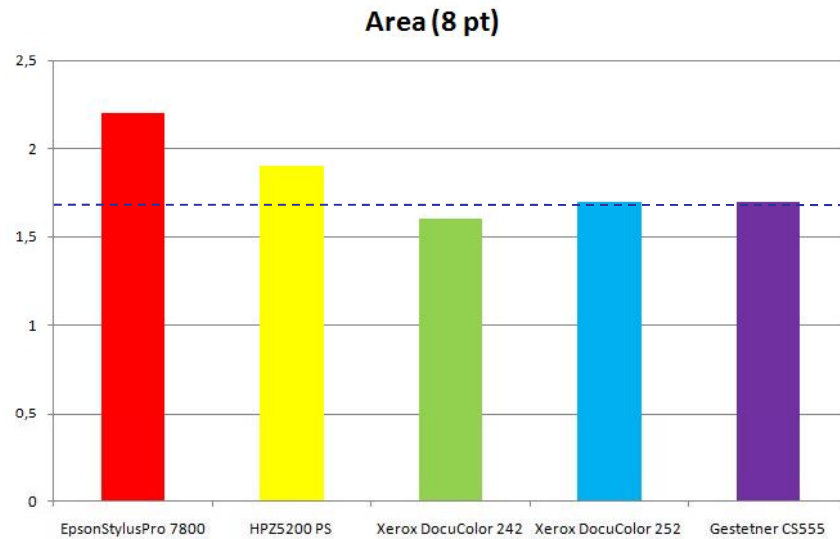


Gestetner CS555



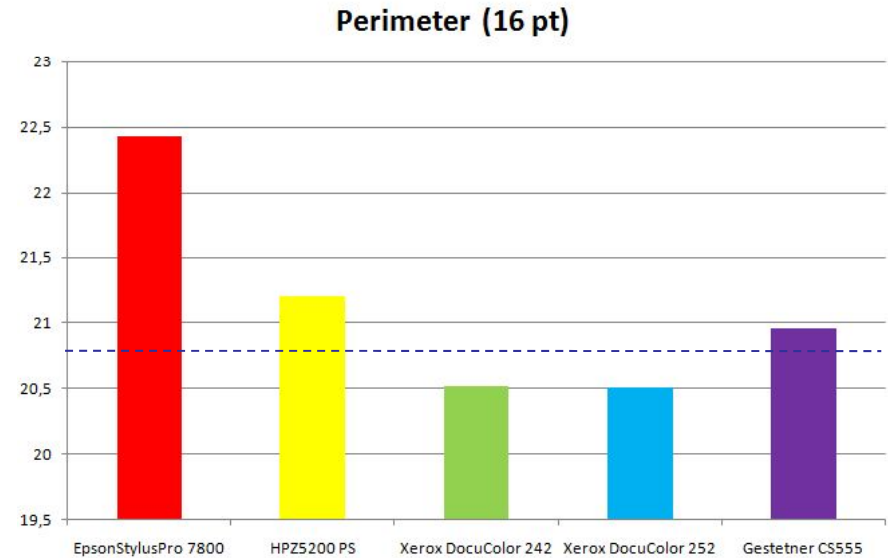
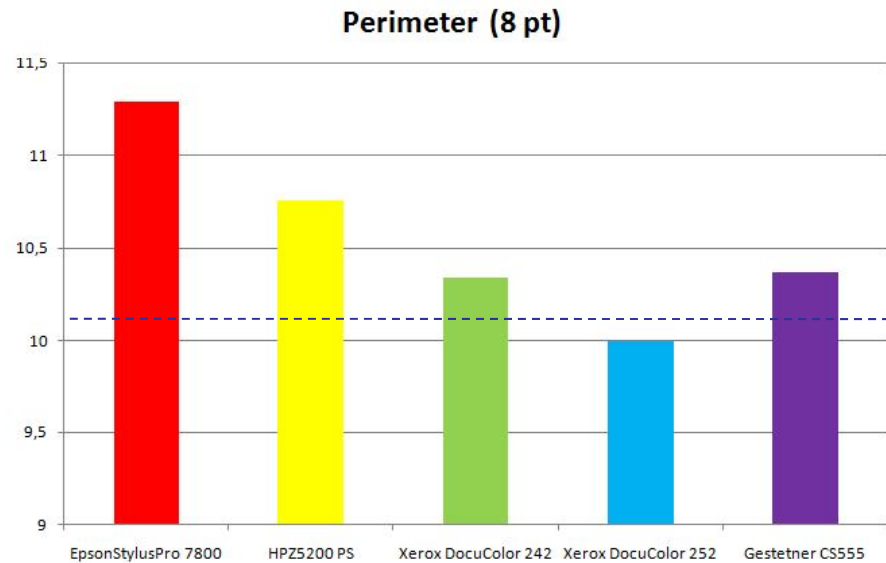
RESULTS AND DISCUSSION

- Letter G area in mm² (8 and 16 pt)



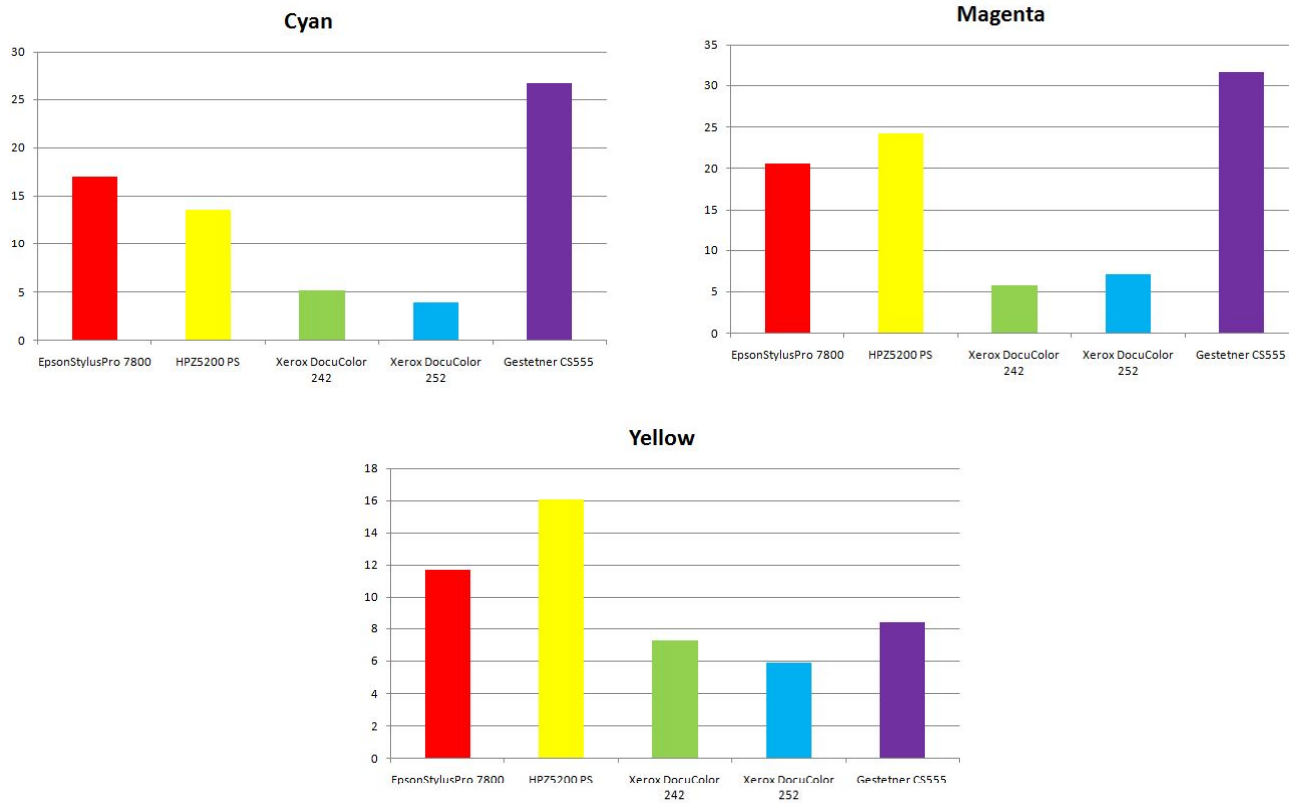
RESULTS AND DISCUSSION

- Letter G perimeter in mm (8 and 16 pt)



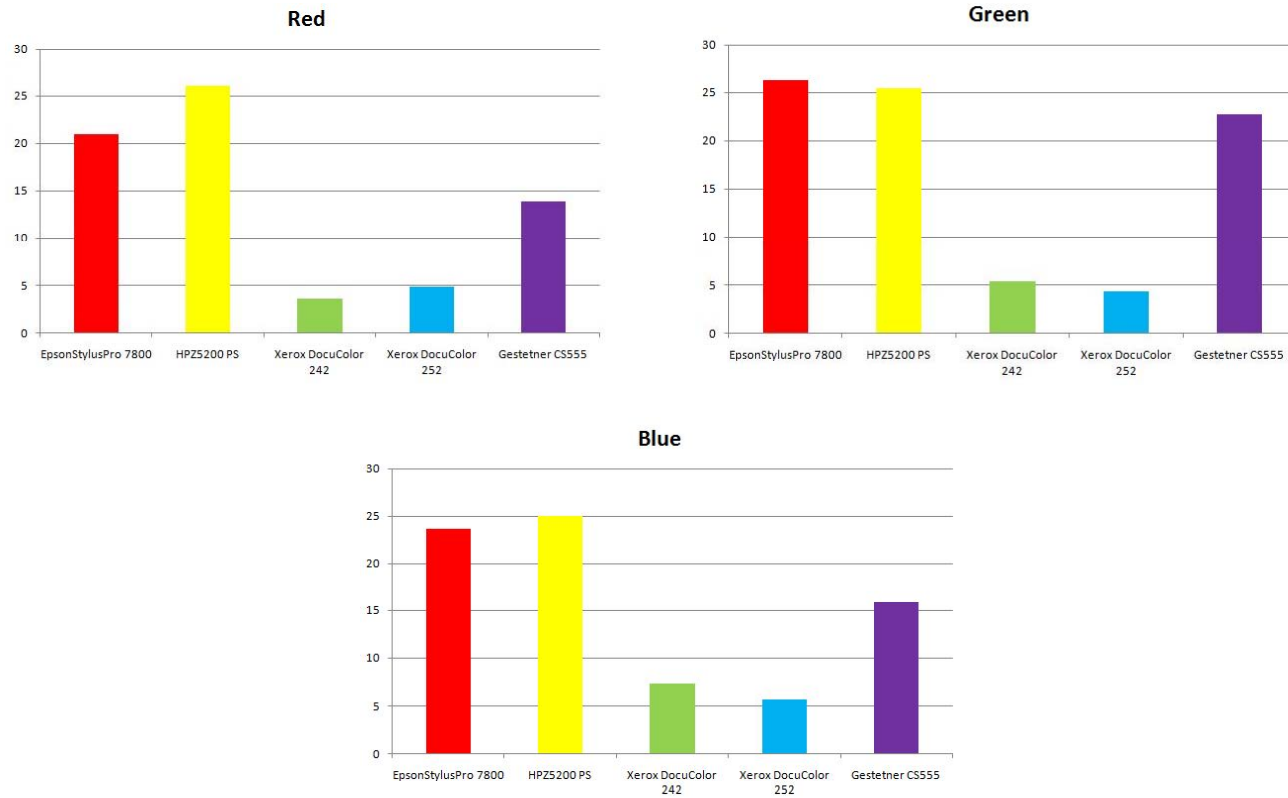
RESULTS AND DISCUSSION

- Non uniformity numbers (motling index) – C, M, Y



RESULTS AND DISCUSSION

- Non uniformity numbers (motling index) – R, G, B



Conclusions and summary

- According to assessment of line and text reproduction and also the uniformity of printed patches it can be concluded that highest print quality is obtained for XEROX DocuColor 252 prints
- Better overall quality is achieved with electro-photographic devices (compared to ink-jet) even on lowest print resolutions



Thank you for your attention

You can also send questions to > rilovska@uns.ac.rs

