

W1.1 Image Quality of Printers

W1.1 2001 – 014

Gloss and Gloss Uniformity

Yee S. Ng

February 23, 2001

Ref:

1. NCITS – W1.1 2001-001 Gloss/Gloss Uniformity Working group call for meeting (Yee Ng, January 3, 2001)
2. NCITS – W1.1 2001-002 Attributes and sub-attributes definitions for W1.1 Gloss and Gloss Uniformity Working group (draft version 1.0, 1/9/2001 Yee Ng)
3. NCITS – W1.1 2001-007 Gloss/gloss uniformity ad hoc teleconference meeting notes (1/16/2001)

Gloss/gloss uniformity ad hoc Teleconference Meeting Notes

(1/30/2001 teleconference)

Present: Yee Ng (NexPress), Eric Zeise (NexPress), Ted Bouk (Kodak), Norm Burningham (HP)

Next Teleconference: Tuesday February 27, 2001 @ 12:30 AM EST

Agenda

1. Review/modify agenda
2. Review action items
3. Discuss the refined sub-attribute definition and action items
4. Schedule next teleconference

The Gloss/gloss uniformity ad hoc met on 1/30/2001 and the ad hoc approved the agenda. The action items from the last teleconference (1/16/2001): (1) Refine the definitions of the sub-attributes by Ted Bouk (Kodak) and Jeff Wang (NexPress) and (2) Publish the refined sub-attributes list and the 1/16/2001 meeting minutes as NCITS – W1.1 2001-007 by Yee Ng were reviewed and these action items are closed by the team. The ad hoc spend the rest of the meeting discussing the refined sub-attribute list (please see NCITS – W1.1 2001-007 for detail) prepared by Ted Bouk and Jeff Wang.

The definition of the first attribute “Gloss value” was approved after discussion with no change. The definition of the second attribute “Within page gloss variability” and the third attribute “Page to page gloss variability” were considered to be fine in spirit, but are not assertive enough. The ad hoc has asked Yee Ng to make the definition of the second and third attributes more assertive as well as adding the term “flat-field” in the definition. Those modifications have been made and are enclosed in the updated proposed definitions below (additional modifications are in red color).

The definition of the fourth attribute “Differential gloss” was discussed in some detail. There is a general feeling that the evaluation of gloss uniformity can be divided into two categories: the evaluation of gloss uniformity within a flat-field of uniform density (such

as attributes 2 and 3 above), and the evaluation of gloss uniformity in the presence of differing image content. The appearance of this effect such as differential gloss is dependent on the observed spatial frequency of the image content (statement from Eric Zeise). The ad hoc agreed with Eric's statement and the team has asked Eric Zeise to redraft the definition of the attribute "Differential gloss". Eric has done that and we include the changes in the updated proposed definition below.

The definition of the fifth attribute "Global gloss value" was discussed and some wording changes are made to it for further discussion. The ad hoc asked Eric Zeise and Ted Bouk to put the new wording into the definition for further discussion. This task has been completed in the updated proposed definition below.

The definition of the sixth attribute "Gloss artifacts" was discussed, and a sentence "Gloss bands, streaks and mottle are mostly evaluated in flat fields of uniform density" was added to the definition for clarity.

The updated proposed definitions for various gloss and gloss uniformity concepts are shown below for further discussion.

Proposed Definitions for Various Gloss and Gloss uniformity concepts:

1) Gloss value

Gloss value pertains to front surface reflection that varies with angle relative to the normal to the receiver surface. Images whose front surface exhibits a highly specular reflection are high gloss while whose front surface exhibits a lambertian (matte) reflection characteristic are low gloss. Gloss values can differ depending on the measurement methodology (such as measurement angle and the image size requirement for the measurement) and the magnitude of gloss level of interest (substrate and application dependence). There are many Standards (such as (a) TAPPI T480 for "Specular Gloss of Paper and Paperboard at 75 Degrees" and ASTM D1223-93 "Standard Test Method for Specular Gloss of Paper and paperboard at 75 degree". These are typically use for lower gloss measurement. (b) ASTM Standard D523 and TAPPI T653 for gloss measurement at 20 degree. These are usually use for high gloss measurement. (c) ASTM D523 which uses a 60 degree measurement to cover a wider range of gloss applications. Our intend is to leverage the existing Standards and adapt that for use here when linked to the corresponding psychophysics.

The evaluation of gloss uniformity can be divided into two categories: the evaluation of gloss uniformity within a flat-field of uniform density, and the evaluation of gloss uniformity in the presence of differing image content.

2) Within page (flat-field) gloss variability

This takes the form of a large-scale gloss gradient (gloss value change), or fade, from one side of the image (at the same colorant laydown) to the other or from top to bottom of the image. This can generally be evaluated over large flat field

regions, as the same colorant laydown is needed over the entire region to identify this type of gloss variability.

3) Page to Page (flat-field) gloss variability

This takes the form of variability in the gloss value of the document from page to page (one-sided printing as well as two-side printing), or between adjacent pages (of the same image contents). This gloss value variation can be accompanied by any of the other gloss categories enumerated here, such as within page gloss variability or sundry gloss artifacts and can probably only be meaningfully evaluated between pages exhibiting the same image content.

4) Differential Gloss

Differential gloss, when present, is an image content and substrate dependent effect. The gloss level can change with increase in colorant laydown (such as in a continuous ramp). Thus an image with variable spatial laydown can exhibit variation in gloss level and this variation may be large enough to observe. The appearance of this effect is dependent on the observed spatial frequency of the image content. Differential gloss, in this context, is most easily quantified when observing adjacent flat-field image regions of differing content (density, color, etc).

5) Global (or mean) gloss value

A global gloss value can be characterized by measuring the fraction of incoming light reflected at any of a number of angles over several regions of a page or image. The global, or mean gloss can be treated as a large viewing distance (or DC component) manifestation of differential gloss. The value associated with the mean gloss level of a particular document is a function of several factors. Examples of these factors include viewing geometry, substrate type, and image type (i.e. Text, pictorial, mixed document, etc.). Even though it is desirable to establish a method whereby a global gloss value of a document for a given image type can be measured under specific conditions, it may be difficult to arrive at a “preferred global gloss value” as this is subjective, image dependent and application dependent, and as such, may not be a viable topic for standardization.

6) Gloss Artifacts

Gloss artifacts include such items as streaks and banding that are one-dimensional in nature, and patches that are a form of two-dimensional, possibly sparse, mottle. Gloss bands, streaks and mottle are most easily evaluated in flat fields of uniform density. In addition, gloss artifacts may include interactions of image gloss level with other factors, such as surface texture created by substrate texture or image colorant laydown. In one specific example the visibility of surface texture is enhanced when overall gloss value is high and diminished when overall gloss level decreases. We can either include such image appearance interaction effects within the scope of the gloss standardization or leave that outside of the standardization effort.

The ad hoc team also decided to change the future teleconference time to 12:30 am EST. In our next teleconference we will discuss and approve these attributes that we have already discuss. Eric Zeise has further proposed an additional attribute “Backside image gloss dependence” to be included in the discussion in the next teleconference.

The proposed definition of the attribute “Backside gloss dependence” is as follows:
The apparent gloss of frontside content can depend on the image content of a backside image. This effect is most easily seen when viewing a uniform density, flat-field frontside image in the presence of a backside image consisting of a patch array of different densities.

Next teleconference: Tuesday, Feb 27, 2001 @12:30 AM EST

Proposed agenda for Feb 27, 2001

1. Review/modify agenda
2. Discuss and the approved the previously discussed refined sub-attribute definition.
3. Discuss definition of new attributes
4. Schedule next teleconference

Yee S. Ng (Principal member, NTICS-W1)
NexPress Solutions LLC
Yee_Ng@nexpress.com
Rochester, NY 14653-7002
Phone: 716-726-3935