

DRAFT - Interoperability Conformance Specification: Architecture for process colour plus spot colour overprint simulation – Part 1: colorimetric processing

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Foreword

This document has been prepared following the [ICC Intellectual Property Policy](#). This policy is based on the ITU-T/ITU-R/ISO/IEC [Guidelines for Implementation of the Common Patent Policy](#) (23 April 2012), with [interpretations and clarifications](#) to make it specific to ICC. A [Patent Statement and Licensing Declaration form](#) is available.

ICC Interoperability Conformance Specifications, of which this document is an example, may be submitted to the competent ISO Technical Committee for consideration and development as an ISO document. If so, this foreword is to be replaced by the appropriate wording supplied by ISO.

0 Introduction

ISO 20677-1 defines specifications that provide a platform for defining extended (iccMAX) colour management profiles and systems for various colour workflow domains. It provides a platform for which domain specific specifications can be defined that make use of iccMAX extensions to the existing cross-platform profile format of ISO 15076-1. Thus there is greater flexibility for defining colour transforms and profile connection spaces to meet needs that cannot easily be met with ISO 15076-1. It is not envisioned that all colour management systems that use ISO 20677-1 will implement all the features or capabilities it specifies. Requirements specifying restrictions to iccMAX that apply to a particular workflow are defined in workflow domain specifications known as Interoperability Conformance Specifications, of which this document is an example. Additionally, for some domain specific workflows it is envisioned that workflows will connect both to profiles defined by ISO 20677-1 (iccMAX) and those defined by ISO 15076-1.

An Interoperability Conformance Specification (ICS) is approved and registered by the International Color Consortium (ICC). It defines minimum structural and operational requirements for writing and reading ICC profiles in order to address a specific problem and/or functionality that cannot readily be handled using the profile format defined by ISO 15076-1. An ICS document essentially defines restrictions to ISO 20677-1 for a specific set of use case scenarios.

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1 Scope

This specification defines color management workflows involving iccMAX profiles that allow for visualization and/or simulation of ink overprints involving device channels including both process colour and spot colour tone values when the spot colour channels are NOT managed using ICC profiles. This is the case of PDF files that have additional spot colours that are not part of the output intent profile, but are present in output device targeted by the PDF file.

All parts of this ICS define requirements for ICC profiles whose primary purpose is to convert device channels including both process color and spot color tone values which can be used with other profiles for visualization/simulation purposes outside the context of outputting to the targeted output device (repurposing).

Note: This specification only defines one or more transforms from tone values to PCS for the purposes of visualization/simulation (repurposing). Therefore it does not define any transforms for converting colorimetric or spectral PCS to output tone values for the purposes of determining ink separations for printing using extended gamut ink systems (which is the subject of a different Interoperability Conformance Specification).

This part of this ICS defines use case scenarios that utilize a profile that transforms tone values of process primaries plus spot colors to a colorimetric PCS which is connected to a colorimetrically based display or output profile for visualization/simulation. Additionally, the ability is optionally provided for named color information to be included about each process primaries and spot color input channels.

Other parts of this ICS may define additional optional transforms for additional use case scenarios that utilize a spectrally based PCS or BRDF connection. This specification defines workflow requirements and restrictions to profiles based on ISO 20677-1 for the purpose of providing overprint simulation of process primary inks with additional spot colour inks.

For each part of this specification, the required set of tags for the scenarios outlined is defined together with any optional tags that are permitted based on the set of tags and tag types defined in ISO 20677-1. The connections between profiles are described, processing elements that the CMM is required to support are identified, and CMM processing controls are outlined that differentiate between each explicit use case scenario.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 20677-1:20##, *Image technology colour management — Extensions to architecture, profile format, and data structure: iccMAX*

NOTE: The most recent version of the iccMAX specification is available on the ICC web site [2].

3 Terms and definitions

3.1 Process colour

A printing system using combinations of multiple colorants to achieve colour output objectives. Typically process primaries are cyan, magenta, yellow and black. Process colours can also be defined using an output profile that provides ink separations from colorimetric values. Ink channels defined by an output intent profile in a PDF profile can be considered as process colour channels.

NOTE: Other definitions relevant to this document are provided in ISO 20677.

3.2 Spot colour

Additional ink channels in a printing system that are not process colour channels.

4 Use case

4.1 Domain

Profiles and workflows conforming to this ICS shall apply to the domain of Packaging and the Graphic Arts.

4.2 Restrictions

ISO 20677-1 provides full details of the requirements for iccMAX profiles. This document defines a set of restrictions which apply to profiles created for the specific use case described above. Such restrictions include the sub-set of tags from ISO 20677-1 which are permitted in profiles conforming to this document.

5 Profile Sub-Classes

A supporting CMM shall support the sub-class of a profile class identified in Table 1 for conformance with this ICS. All profile classes are defined in ISO 20677-1.

Table 1. Sub-class of a profile class

Sub-class Identifier	Profile class	Class signature	Sub-class signature
plusSpotOverprintSimulation	Input	'scnr' (73636e72h)	'osim' (6f73696dh)

6 Processing Scenarios

6.1 Simulation/ visualization using colorimetric PCS processing

6.1.1 Introduction

Processing workflows conforming with this ICS connect profiles as shown in Figure 1.

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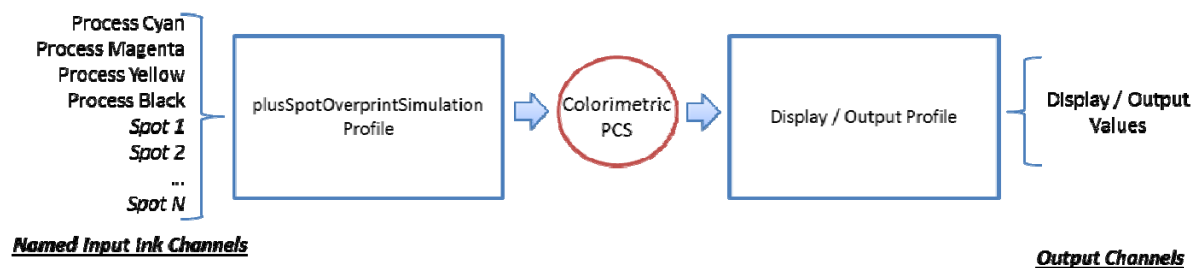


Figure 1. Workflow scenario connecting a plusSpotOverprintSimulation profile to an output or display for visualization using a standard colorimetric PCS connection

In this workflow a plusSpotOverprintSimulation ‘osim’ profile connects m channels (where m is the number of channels associated with the data field in the profile Header) to a three channel colorimetric PCS (defined by the PCS field in the profile header). The input channels shall be identified by the colorantInfoTag in the profile. A rendering intent specific AToBxTag is used to provide the transformation between input ink channel values and colorimetric PCS channels. Tag rendering intent precedence for Colorimetric PCS processing as outlined by ISO 20677-1 shall be used.

The CMM shall apply colorimetric PCS processing as outlined by Annex A of ISO 20677-1 to convert colorimetry output from the plusSpotOverprintSimulation profile to the colorimetry required by the Display / Output profile.

The Output/Display profile (from Figure 1) that transforms from colorimetric PCS values to device output channels shall be any display or output profile defined by either ISO 20677-1 or ISO 15076-1 using the PCS conversion operations appropriate to the profile and PCS definitions defined by the appropriate specification.

6.1.2 Scenario selection

This scenario shall be selected or utilized by the CMM for any of the following reasons:

1. The CMM only supports colorimetric PCS processing.
2. The CMM supports other connection processing capabilities (spectral PCS or BRDF based), but the plusSpotOverprintSimulation profile only contains A2BxTag tags.
3. The CMM supports other PCS types or connection processing, but CMM processing controls have been used to select colorimetric PCS processing.

6.1.3 Scenario options

Variations to Colorimetric PCS processing are selected using one or more of the CMM processing controls described in the following sub-clauses.

Note: As CMM processing controls can be implementation dependent, some CMM processing controls may or may not be available in every conforming CMM. In such cases default settings for each of the following CMM processing controls are identified.

6.1.3.1 Rendering intent selection

Supported rendering intent selections are outlined by ISO 20677-1

6.1.3.2 Optional profile connection conditions application

Profile connection condition (PCC) information is required by ISO 20667-1 to be present in a profile when either the observer for a profile is not the 1931 standard 2-degree observer and/or the illuminant for a profile is not D50 (non-standard colorimetry). As indicated by Annex A of ISO 20667-1, this information is utilized by the CMM when connecting to a different colorimetric PCS in the Display / Output profile. CMM processing controls can be provided to a CMM to override/replace the PCC used in these PCS processing operations.

PCC information may also be used and optionally overridden by the CMM using CMM processing controls to define behaviour for non-standard colorimetry.

If either a CMM doesn't provide support of overriding the PCC information in a profile or the application doesn't provide an override of the PCC information then the CMM shall be expected to use the PCC information in each associated profile as needed.

6.1.3.3 Specification of background colorimetry through CMM environment values

When printing on clear substrate it can be useful to be able to simulate/visualize the output when a background colour is placed behind the printed substrate (simulating having a product in a printed package). Profile implementers of this specification can utilize the CMM environment variables in Table 2 to provide the colorimetry for visualization of the background colour.

Table 2. Scenario CMM Environment variable

Sub-class Identifier	CMM environment variable signature
Background nCIEXYZ X value	'bkgX' (626b6758h)
Background nCIEXYZ Y value	'bkgY' (626b6759h)
Background nCIEXYZ Z value	'bkgZ' (626b675ah)

These CMM environment variables provide a hint to the profile implementation when performing overprint simulation modelling. The encoding of these environment variables shall be the same as nCIEXYZ values as defined in ISO 15076-1.

The profile implementation for profiles conformant to this specification using a calculator processing element to implement spot overprint simulation/visualization should check the result of the 'env' operator when getting the environment variable values to determine whether the environment values have been successfully provided, and implement appropriate default behaviour if the environment values are not provided.

Note 1: The ISO 20667-1 specification defines how calculator elements are encoded in a profile and processed by a CMM.

Note 2: When processing a profile, CMM environment variables may not be available because either the CMM does not provide CMM environment variable passing support or the calling application has not provided values for the CMM environment variables.

6.2 Other connection scenarios

This part of this specification only defines the scenario for colorimetric PCS processing. Other scenarios utilizing plusSpotOverprintSimulation profiles are defined by other parts of this specification.

7 Sub-class Profile Requirements

7.1 General

Requirements for iccMAX profiles conforming to this specification are listed, and provide additional requirements over and above those specified by ISO 20677-1. When ICC v4 profiles are used in the workflow scenarios in Clause 6 they shall conform to ISO 15076-1.

7.2 plusSpotOverprintSimulation sub-class of Input class profiles

The encoding of the profile header shall be as defined in ISO 20677-1, with the specific requirements shown in **Error! Reference source not found.**

Table 3. Profile header requirements

Header field	Required content
Profile class	'scnr'
Profile subclass	'ovis'
Profile subclass major version	1
Profile subclass minor version	0
Data colour space	'nc0001' – 'ncFFFF'
MCS	0
Colorimetric PCS	'Lab ' or 'XYZ '
Spectral PCS	0 or appropriate spectral PCS signature
Spectral range	0 or appropriate spectral range
Bispectral range	0 or appropriate spectral range

Full details of the encoding of the header fields in **Error! Reference source not found.** are given in ISO 20677-1.

7.2.1 Required tags for plusSpotOverprintSimulation subclass profiles

Profiles shall contain the tags listed in **Error! Reference source not found.**

Table 4. Required tags

Tag name	Signature	Required content
AToBxTag	'A2Bx'	multiProcessElementType containing transform

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	where x=0, 1, or 3 and represents a rendering intent specific selector	from input channels to colorimetric PCS.
colorantInformationTag	'mcta'	input channel names as defined by 5.3

The encoding of the tags listed in Table 4 shall be as defined in ISO 20677-1. The AToBxTag consists of a multiProcessorElementType containing processing elements that transform input channels to colorimetric PCS channels.

7.2.2 Supported optional tags

Profiles supported by the scenarios in this document may additionally contain the tags listed in **Error! Reference source not found.**

Table 5. Optional supported tags

Tag name	Signature	Required content
AToBxTag where x=0, 1 2, or 3, excluding the value of x selected in Table 4	'A2Bx' where x=0, 1, 2, or 3 and represents a rendering intent specific selector	multiProcessElementType containing transform from Device input channels to colorimetric PCS.
namedColorTag	'nclr'	A namedColorTag metadata tag as specified by ISO 20677-1 with named channel entries for each of the input channels defined in the colorInformationTag. This allows measurement information for various tone values of each named channel (over various backgrounds) to be provided as metadata.

The encoding of the tags listed in **Error! Reference source not found.** shall be as defined in ISO 20677-1. The AToBx tags, if used, shall have the same structure as the AToBxTag in **Error! Reference source not found.**

Tags in **Error! Reference source not found.** provide additional intents as required.

7.2.3 Additional optional tags that may be encoded in plusSpotOverprintSimulation subclass profiles

Additional optional tags may be found in plusSpotOverprintSimulaiton subclass profiles that have processing requirements that are provided by other parts of this specification. Such tags include: DToB0Tag, DToB1Tag, DToB2Tag, DToB3Tag, brdfAToB0Tag, brdfAToB1Tag, brdfAToB2Tag, brdfAToB3Tag, brdfDToB0Tag, brdfDToB1Tag, brdfDToB2Tag, and brdfDToB0Tag

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This document only defines processing requirements for the scenarios outlined in Clause 6 which prescribe the use of colorimetric based AToBx tags. These additional optional tags (if present) shall be ignored for the processing scenarios in Clause 6 and are therefore outside the scope of this document.

Note: The inclusion of these tags is merely for completeness to reflect what may possibly be encoded in a plusSpotOverprintSimulation subclass profile. Please consult the appropriate part of this specification for relevant scenario processing requirements for these tags.

7.2.4 Tag encoding details

7.2.4.1 colorantInformationTag

The encoding of a colorantInformationTag is defined in ISO 20677-1. The encoding and meaning of the n-colour device channels is domain specific.

The input channels used by the profiles defined by this ICS shall all represent ink coverage values ranging from 0,0, to 1,0 with 0,0 representing no ink and 1,0 representing the maximum coverage of ink. The naming of the colorants should be meaningful relative to the process colours and spot colours that are associated with the profile. If outside profiles are also associated with the process colors it is recommended that the names match. When CMYK inks are used it is recommended to use the names found in Table 6 to associate with the process channels.

Table 6. Process Channel MCS names

Process Color Ink	Recommended name
Cyan	Process Cyan
Magenta	Process Magenta
Yellow	Process Yellow
Black	Process Black

All other names for input channels shall follow the requirements for colorantInfoTag channel names defined by ISO 20677-1.

7.2.4.2 namedColorTag

The encoding of a namedColor is defined in ISO 20677-1. A namedColorTag can be provided with named channel entries for each of the input channels defined in the colorInformationTag. Each named channel can provide tint and measurement information used to define the transforms in the plusSpotOverprintSimulation profile. Measurements over white and black are possible.

The spectral PCS header entries shall be appropriately defined when spectral PCS based sub-tags are present in a namedColorTag.

7.2.5 multiProcessElements

A conforming CMM shall support the use of the ISO 20677-1 multiProcessElementTypes in **Error! Reference source not found.**

Table 7. ISO 20677-1 processing elements to support

multiProcessElementType	Signature	Operator support
CalcElement	'calc'	All calc operators except 'solv' operator: not required 'env ' operator: not required but recommended
CurveSetElement	'cvst'	
ClutElement	'clut'	
ClutElementEx	'cltx'	
MatrixElement	'mtx'	
TintArrayElement	'tint'	

7.2.6 Example plusSpotOverprintSimulation subclass profile

The profile X.icc is encoded according to the requirements of this ICS document and is available in the ReflccMax-Testing suite [3]. An XML representation is also provided.

8 Conformance

A profile shall be considered to be in conformance with this ICS document if it meets the following conditions:

- The profile structure and all tags conform to ISO 20677-1.
- The profile connects to the channels specified in section 6.
- The profile header includes the required content from Table 3.
- All required tags listed in Table 4 are present in the profile.
- Any additional tags present in the profile which affect the processing of the data are listed in Table 5.
- The profile only uses processing elements from the set listed in Table 7.

A CMM shall be considered to be in conformance with this ICS if it meets the following conditions:

- The CMM is able to parse profiles that conform to this ICS
- The CMM supports and is capable of processing the channels specified in section 6 and any other profiles listed in Table 1.
- The CMM is able to process the tags listed in Table 4.

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- The CMM is able to process the elements listed in Table 7.
- When processing profiles conforming to this ICS, the CMM produces results that are a close approximation to those produced by the iccMAX Reference Implementation [3] when either:
 - Level 1 – Both the CMM and iccMAX Reference Implementation have CMM control options with no CMM environment variables to specify the background colour.
 - Level 2 – Both the CMM and iccMAX Reference Implementation have CMM control options with the same values for CMM environment variables to specify the background colour as defined in 6.1.3.4.

9 Bibliography

- [1] ISO 20677-1:20##, *Image technology colour management — Extensions to architecture, profile format, and data structure*
- [2] iccMAX <http://www.color.org/iccmax/>
- [3] iccMAX Reference Implementation <http://www.color.org/iccmax/index.xalter#reficcmax>