NanoRIP DICOM dongle

User Manual

For OKI C650, OKI C844, OKI MC8x3 and OKI Pro9431 printers

IMPORTANT:

This manual describes all the functionalities available in the full-option version of NanoRIP Ver 3.0.0.x. Available functionalities of your product may be different from those described in this manual.

Notes

IP Address: …….

Serial Number: ……

Default DICOM Print SCP port Number: 11112

Default DICOM Store SCP port Number: 11114

Notes : ……

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DCMTK - A DICOM library in C

1. Presentation :

1.1 Introduction

NanoRIP DICOM dongle transforms OKI C650 or OKI C844 printers into DICOM imagers in order to produce high quality low-cost prints, on media with different sizes (A6, A5, A4, A3, etc. ..) for all medical imaging modalities. This imager can generate both GSDF compatible grayscale or color pages, and match them to the screen rendering.

Fonctions

*** High print quality with ProQ2400© multi-level technology**
*** DICOM 3.0 Embedded with advanced features**
*** Reliability**
*** Ergonomics**
*** Cost reduction.**

This document describes how to manage the DICOM Imager (NanoRIP with an OKI printer).

1.2 Document terms

The DICOM conformance statement, license, control panel and web interface messages are all provided in English in this document.

2. Start

To perform the operations described in this guide, you must have a NanoRIP dongle as well and an OKI C650 or an OKI C844 or an OKI MC8x3 or an OKI Pro9431 printer.

This section describes the procedure for configuring and using the NanoRIP with an OKI printer.

NanoRIP DICOM dongle Configuration Guide for the OKI Printers Series

Prerequisites:

- A computer connected to the same network as the printer. (See step 1)
- Graphics software such as Adobe **Photoshop**©, **MS Paint**©, **GIMP**©, etc.… (See step 6)
- Charruasoft **TestSCU** software(See step 6)
- Downloadable from the link below https://www.charruasoft.com/products/downloads/testscu.zip

Index:

Step 1: Setting up the printer.

Let's start by making sure that the printer is correctly installed with all consumables and paper, enter using the printer's control panel (see the printer documentation), the IP address, subnet mask and the gateway that will have been provided to you by the person in charge of your computer network. so that we can continue the configuration of the NanoRIP dongle.

Power off the printer

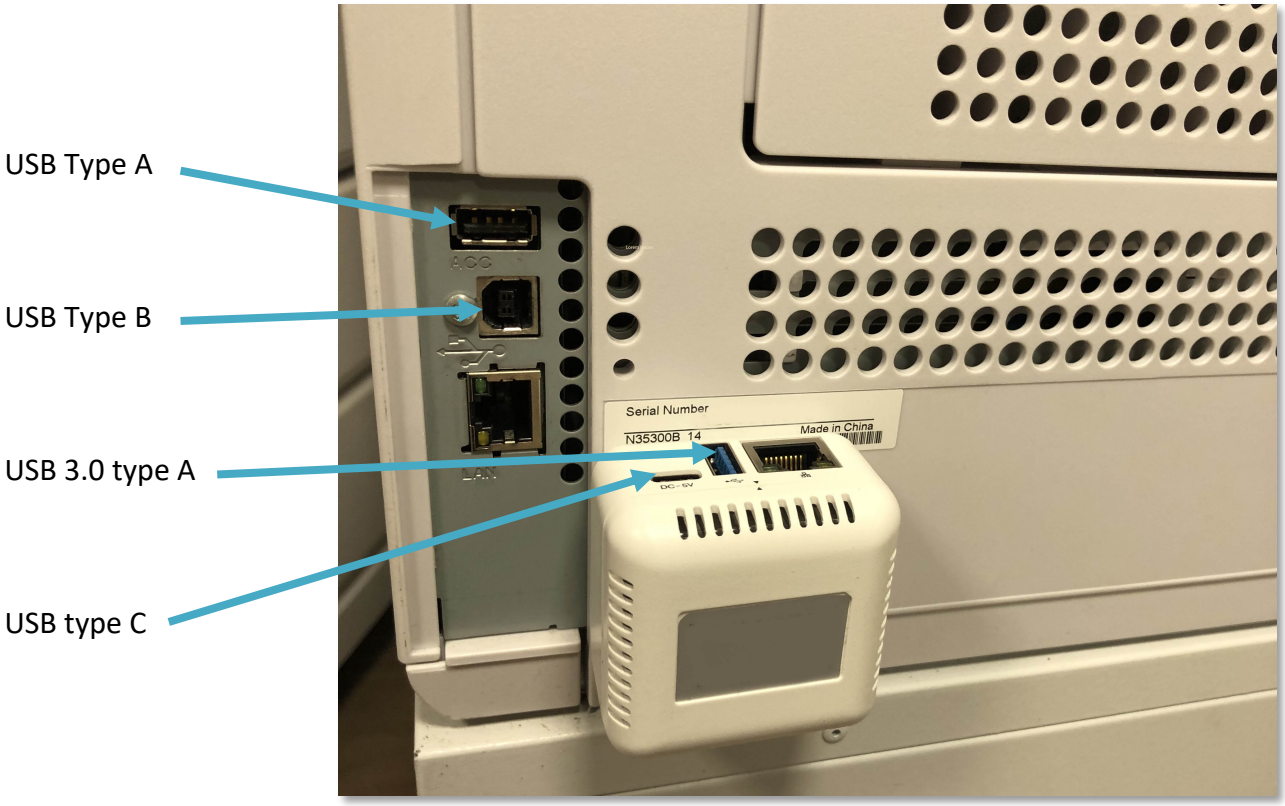
CAUTION!

You must set the printer sleep mode with a minimum value of 5 minutes (please see printer documentation).

Once the printer is ready, we will now install the NanoRIP DICOM dongle.

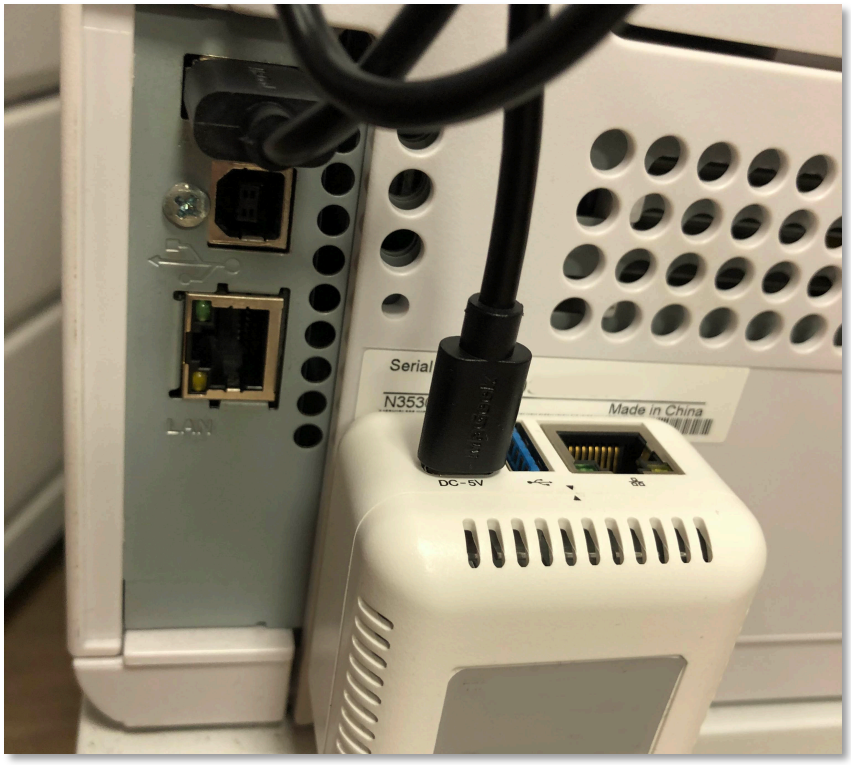
Printer must be off

Secure NanoRIP to the printer back with the fasteners provided as shown in the picture bellow.



Connect the USB power cable to the NanoRIP USB type C port, as well as to the USB type A port of the printer as shown in the photo below.

If your printer does not have a USB Type A port, please use a 5V 2A Power Adapter.



Connect the USB printing cable to the NanoRIP USB 3.0 type A port, as well as to the USB type B port of the printer as shown in the photo below.

Connect the NanoRIP using a network cable (RJ45) to your network socket as shown in the photo below.

Once NanoRIP is plugged to the printer and connected to your network, plug the printer power cable and power on the printer.

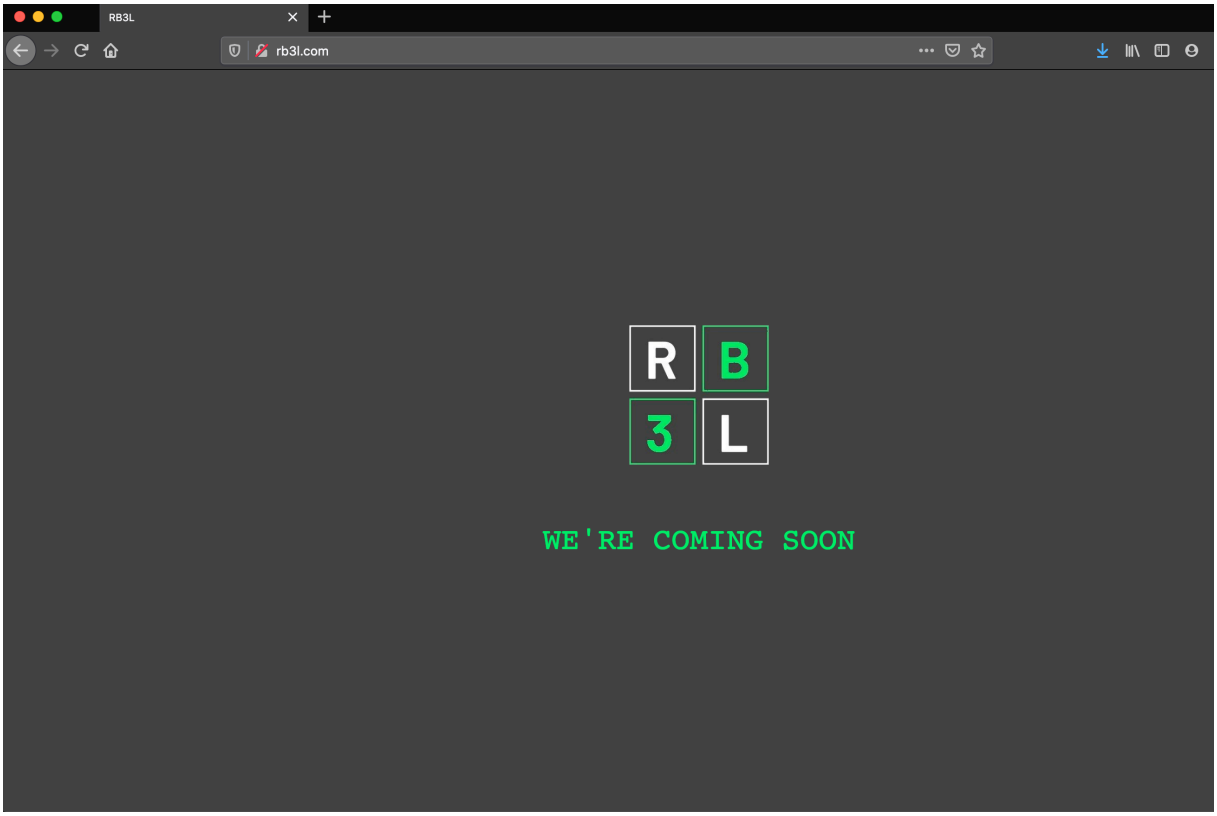
Step 2 : Access to the DICOM server home page.

Once step 1 has been validated, we can access the NanoRIP management interface. To do this, from a computer connected to the same network as NanoRIP, please launch an internet browser (Internet Explorer, Firefox etc.)

CAUTION!

When starting for the first time, NANORIP may take up to 5 minutes to configure and retrieve printer information.

A web page will be displayed:



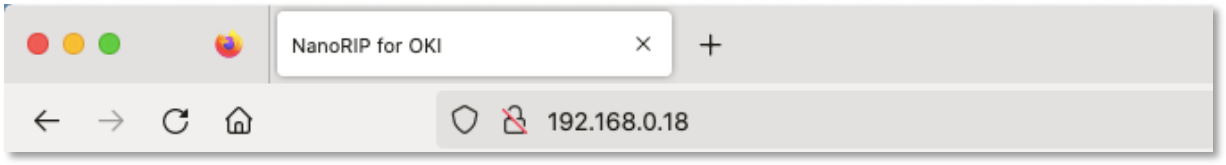
PS: If you do not have internet access, no page will appear but the procedure is still doable as long as you can access the address bar (see below)

In your web browser [address bar] enter the printer IP address (the one we has set previously):

http://<<Printer IP>>

(For our example, our printer's IP address is 192.168.0.18)

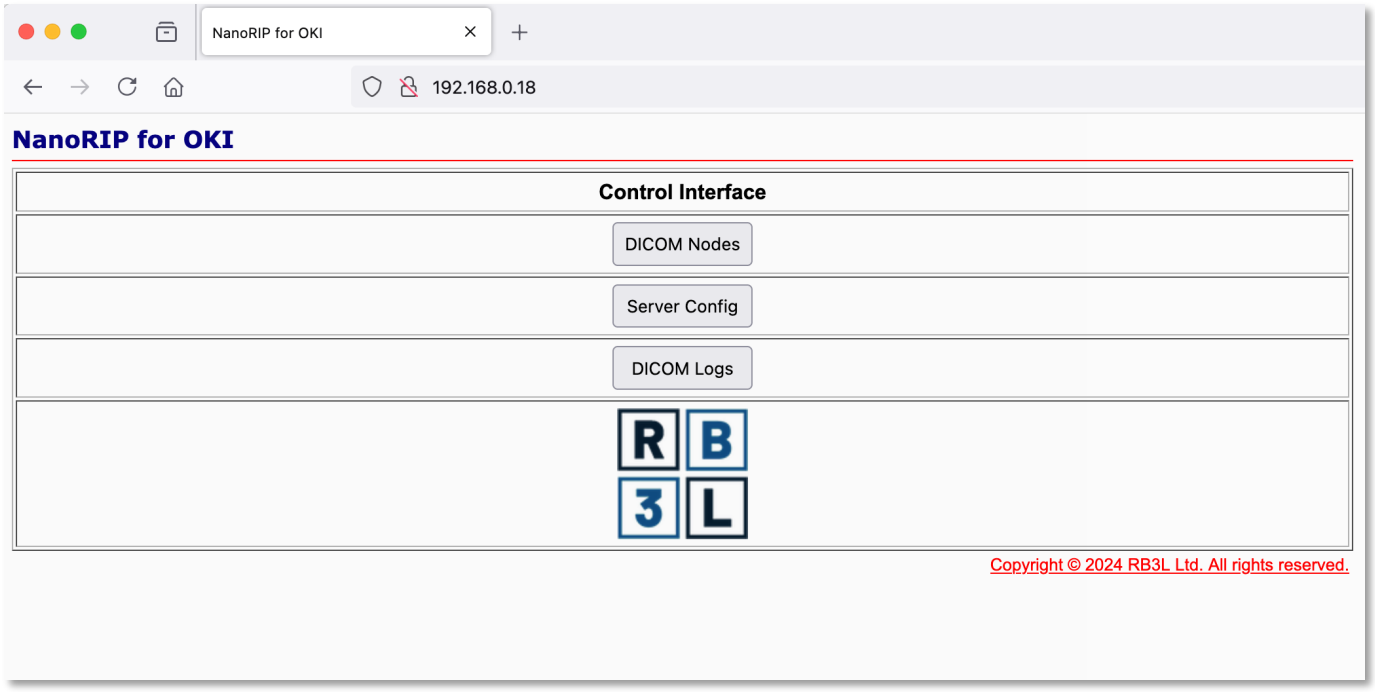
Either in our case: http://192.168.0.18



CAUTION!

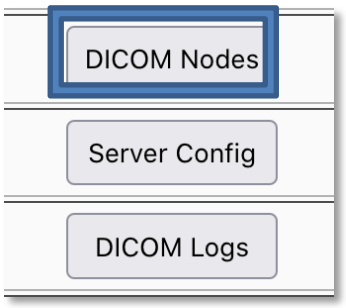
The operation may fail if performed immediately after [Ready to Print] is displayed on the printer's control panel. Please wait 5 to 10 seconds and then start again.

DICOM configuration page will then be displayed:



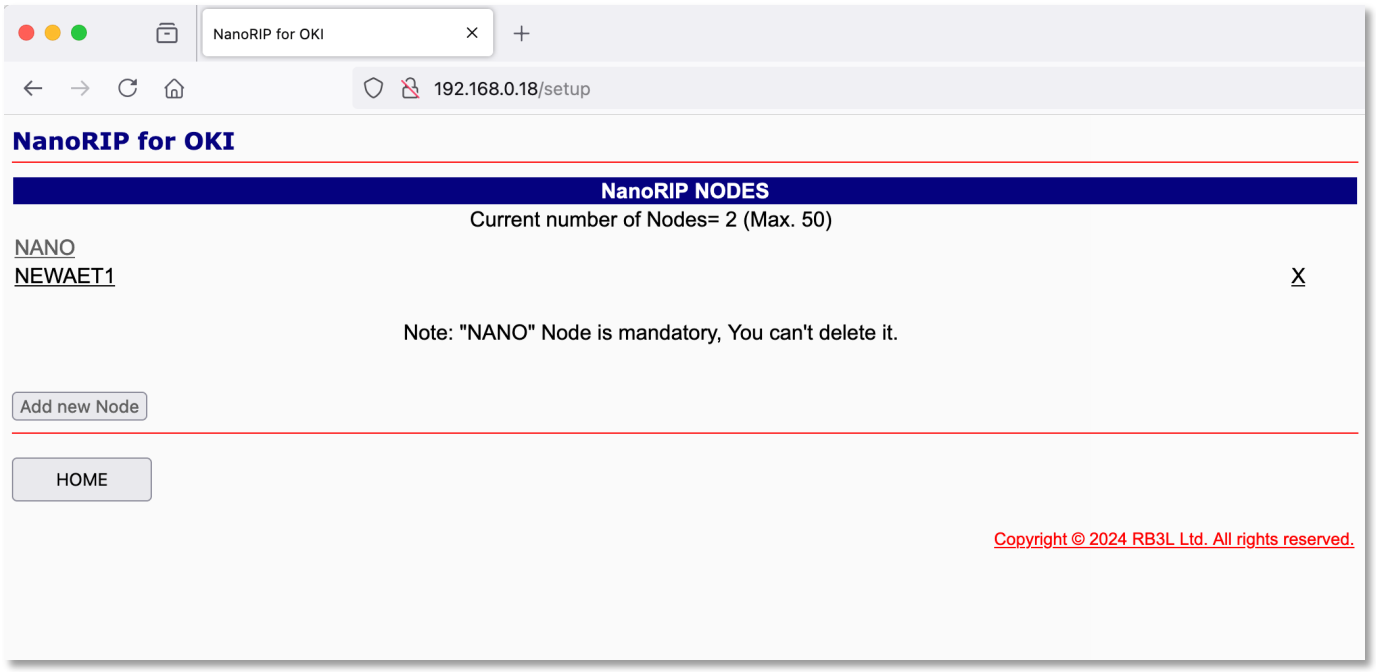
NanoRIP Home Page.

Step 3 : Description of [DICOM Nodes] menu

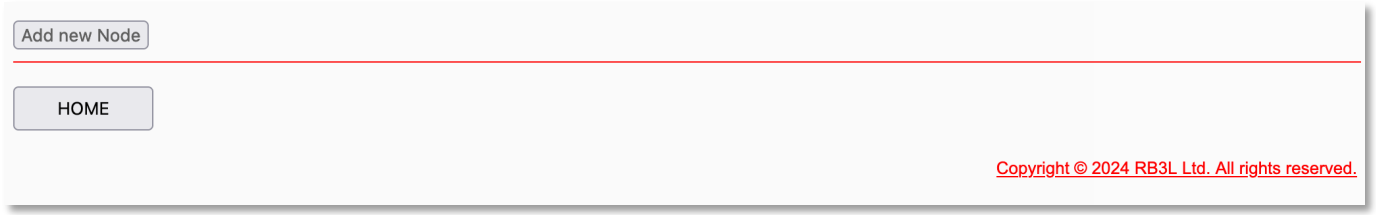


To open the Setup menu, click on the [DICOM Nodes] button.

This will show us the list of printing rules represented by their AETitle name.



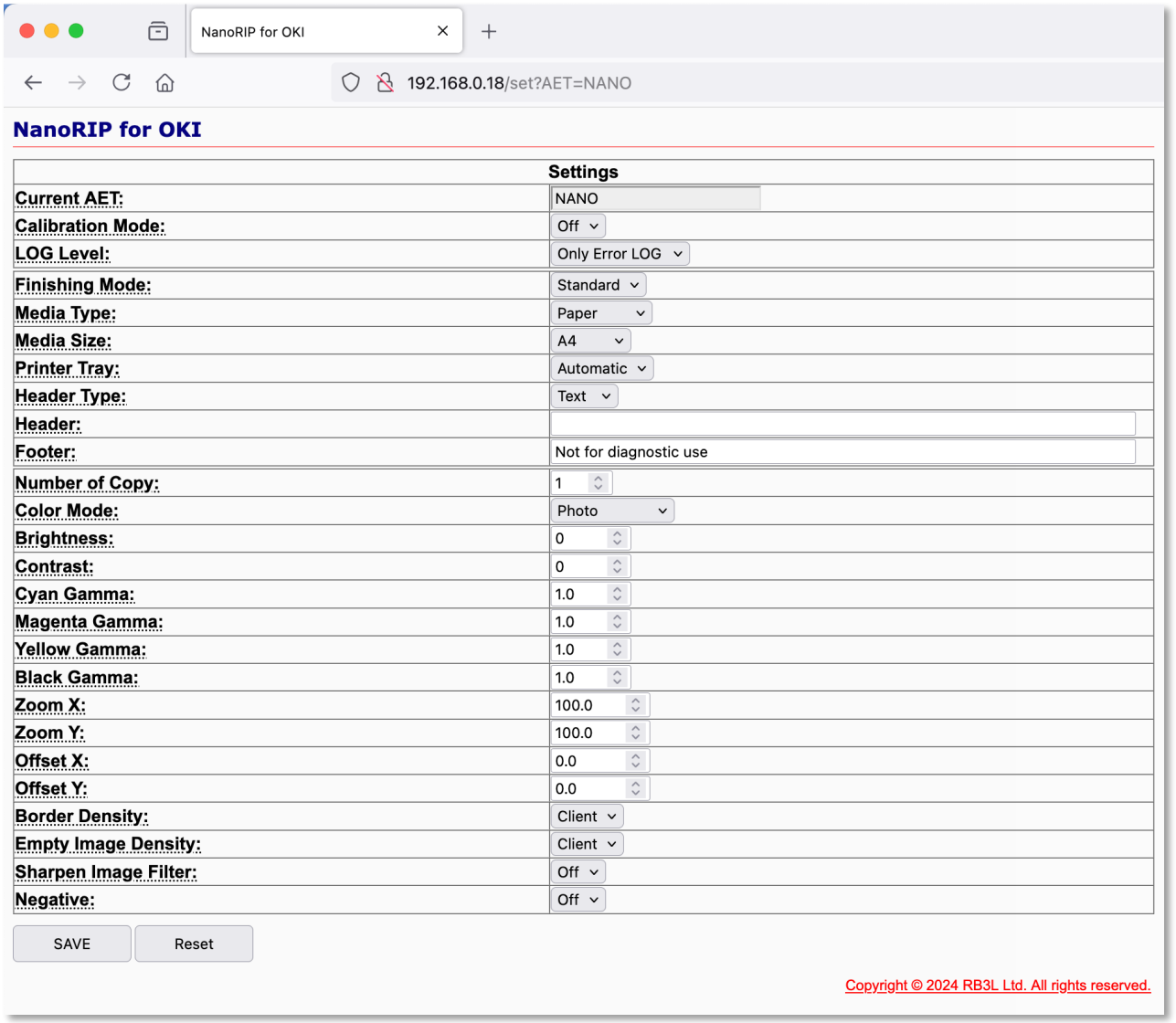
You can add new rules by clicking on [Add new Node], edit them by click on their name (in our case, [NANO]), or delete them by click on [X] in back of their name.



Please note [NANO] AET is mandatory for NanoRIP work properly and cannot be deleted.

Any time you can go back to home page by click on [HOME]

Click on NANO to edit this printing rules.



Description of the different options for the printing rules:

A large number of rules can be added, and for each, the following information is configurable:

[**Current AET**] **:** AET is an abbreviation for Application Entity Title. The invocation method is assumed to conform to the DICOM Print SCU protocol.

AETs defined in this rule have a maximum length of 16 characters (a - z, A - Z, 0 - 9).

Note: ● Names are case sensitive.
● the AET is only definable and modifiable when creating a rule.
● In error case, the printer will use the default AET [NANO] and print the overlay text: "**This AET** (with the name of the AET) **does not exist**".

[**Calibration Mode**] : This function is used to allows choosing visually the best output,
Select a key image on the modality and send it to the NanoRIP,
it will prints a calibration sheet with 3x3 matrix and different brightness and contrast values.

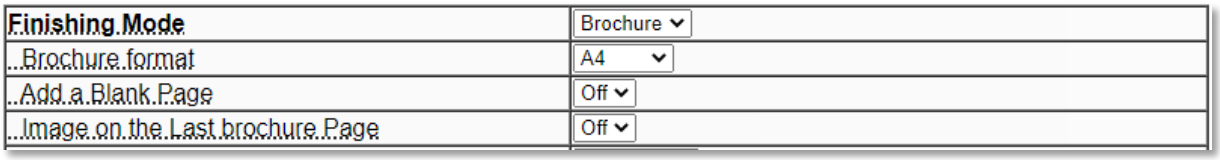
[**Off**] Calibration mode disabled.
[**On**] Calibration mode enabled.

[**Log Level**] : This function is used to display the DICOM dialog logs when printing. This is useful for identifying the source of an error in case of problems. You can manage 3x logs level, [**Only Error LOG**], and [**High Level Msg**].

[**Only Error LOG**] only display error messages.
[**High Level Msg**] displays all DICOM Tag messages.

[**Finishing Mode**] : This function allows you to choose the printout in page mode [**Standard**] or brochure mode [**Brochure**].

When brochure mode is enabled [**Brochure**] 3 x new submenus appear.

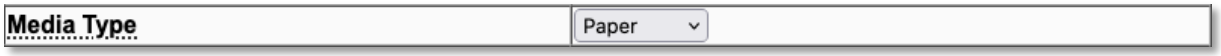


[**Brochure format**] : This function allows you to choose the printout paper format for your Brochure [**A4**], [**Letter**], [**A3**] or [**Tabloid**]

Note: ● [**A3**] and [**Tabloid**] is only available when using an OKI C844 printer.

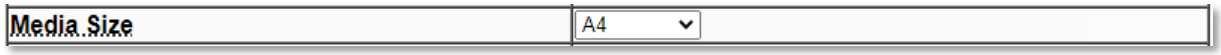
[Add a Blank Page] : This function allows you to add a blank page behind the cover page to paste a CD-Rom or to staple the examination report.

[Image on the Last brochure Page] : This function allows you to use the last brochure page to put images in place of the end cover page.



[Media Type]: This function allows you to select the suitable media. Choices are [Paper], [Clear Film] or [Blue Film] By default, [Paper] is selected.

[Paper]: Normal mode, printing on paper.
[Clear Film]: Force printer printing in composite black and [Color Mode] in Photo with high density.
[Blue Film]: Force printer printing in mirror, composite black and [Color Mode] in Photo with high density.



[Media Size]: This function allows you to select the printout paper size, the sizes range from [A6] to [A3 NOBI] depending the printer model used.

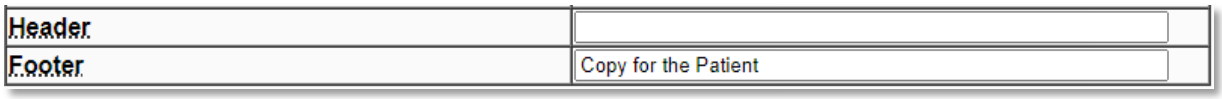
[Printer Tray]: This function allows you to choose the paper tray used for printing [Automatic] the printer will select the paper tray according to the requested format.

[Header Type]: This function allows you to choose the printout header, Choice are [Text] or [Logo] .

[Text] This customization is limited to one line of text only. Typeface is Palatino-Bold at 14 points size, available length is the width of the page minus 10mm.

[Logo] This function is used to customize the header of your printouts using an image or logo. This function allows free creation. Refer to chapter 7 of this Manual

Note: ● This function is disabled when "Brochure" is activated in [Finishing Mode].



[Header] : This function allows you to customize printout header.
Note: ● This customization is limited to one line of text only. Typeface is Palatino-Bold at 14 points size, available length is the width of the page minus 10mm.

[Footer] : This function allows you to customize the footer of your prints
Note: ● This customization is limited to one line of text only. Typeface is Palatino-Bold at 7 points size, available length is the width of the page minus 10mm.

[Number of Copy] : This function allows you to choose the number of copies. Copies numbers varies from [1] to [20.

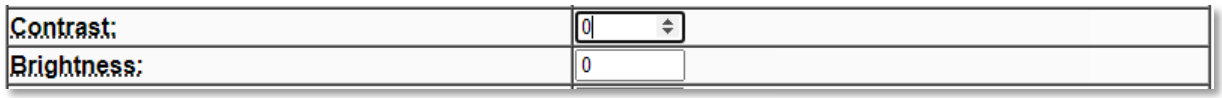
[Color Mode]: This function sets the filter action level. Choices are [Standard] [Enhanced] [Photo] or [Monochrome]. By default, [Photo] is selected.

[Standard], Sets printing color images with low toner usage (CMYK).

[Enhanced], Sets printing color images in enhanced quality (CMYK).

[Photo], Sets printing color images in highest quality (CMYK).

[Monochrome], Sets printing color images in monochrome (K toner only).



[Contrast] : This function allows you to modify printout contrast. The choices range from [-128] to [+128]. Negative values reduce contrast to flatten the image, [0] means no change, positive values increase contrast to improve the image.

[Brightness] : This function is used to change printout brightness. The choices range from [-128] to [+128]. Negative values reduce light to darken the image, [0] means no change, positive values increase light to brighten the image.

[Cyan Gamma] : This function is used to adjust printout cyan gamma channel. The choices range from [0] to [+3].

[Magenta Gamma] : This function is used to adjust printout magenta gamma channel. The choices range from [0] to [+3].

[Yellow Gamma] : This function is used to adjust printout yellow gamma channel. The choices range from [0] to [+3].

[Black Gamma] : This function is used to adjust printout black gamma channel. The choices range from [0] to [+3].

[**Zoom X and Zoom Y**]: These functions are used to define the level of zoom for X and Y from 10 % to 1000%,

[**Zoom X**] values less than 100% reduce size for X, and values more than 100% enlarge size for X. As default, [**100.0**] is selected.

[**Zoom Y**] values less than 100% reduce size for Y, and values more than 100% enlarge size for Y. As default, [**100.0**] is selected.

[**Offset X and Offset Y**]: These functions are used to define the level of offset for X and Y in millimeter

[**Offset X**] negative values do offset to the left, and positive values do offset to the right. The range is from -200(mm) to 200(mm). As default, [**0.0**] is selected.

[**Ofsset Y**] negative values do offset down, and positive values do offset up. The range is from -200(mm) to 200(mm). As default, [**0.0**] is selected.

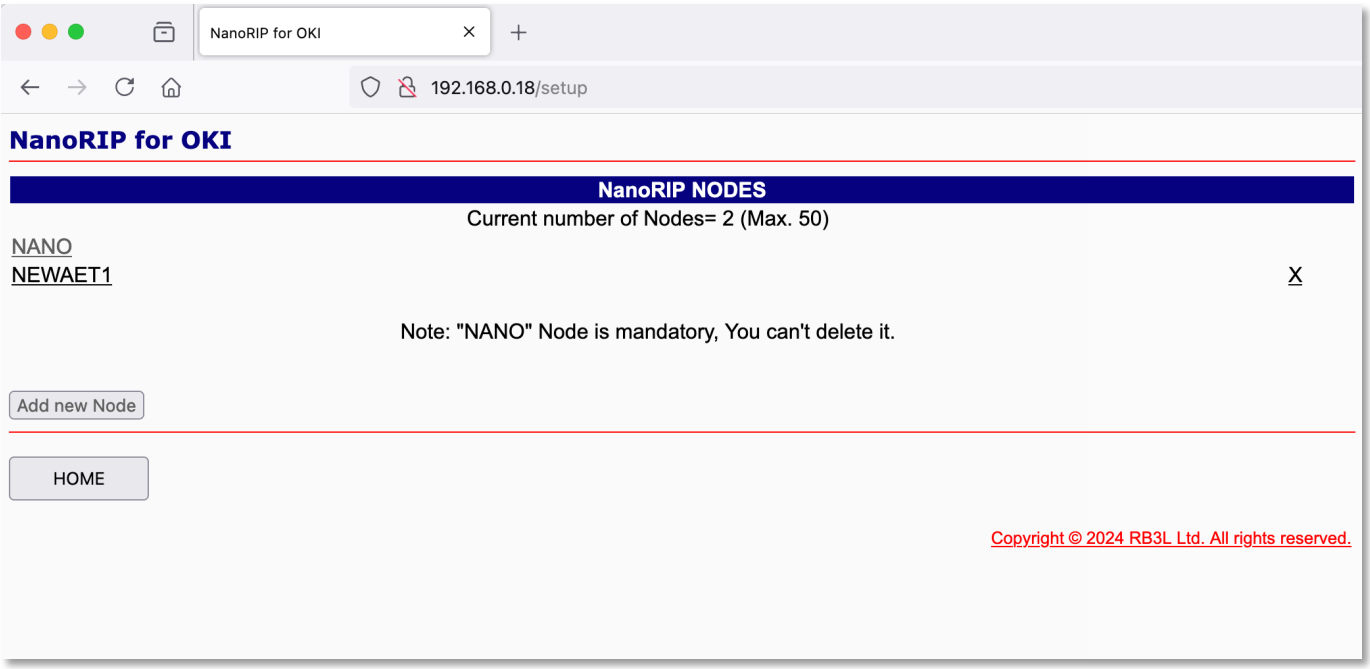
[**Border Density**]: This option defines the background images, in black or white. Choices are [**Black**] [**White**] or [**Client**]. [**Client**] means that the settings will be managed by the DICOM calling modality

[**Empty Image Density**]: This option defines the image-free zone in black or white. Choices are [**Black**] [**White**] or [**Client**]. [**Client**] means that the settings will be managed by the DICOM calling modality

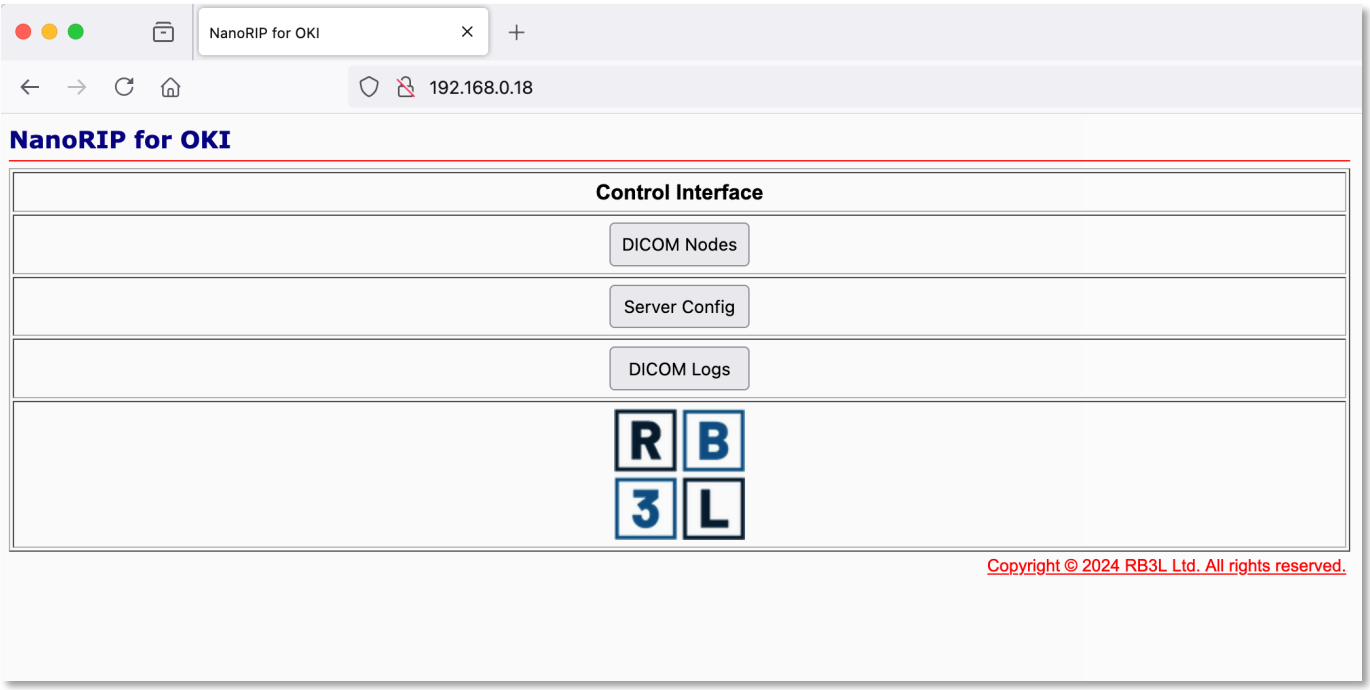
[**Sharpen Image Filter**]: This function is used to change level of black & white images sharpen. Choice varies from [**Off**] to [**6**], positives values increase the sharpening level to enhance the images.

[**Negative**]: This function allows you to set the images printout to [negative] or [positive].

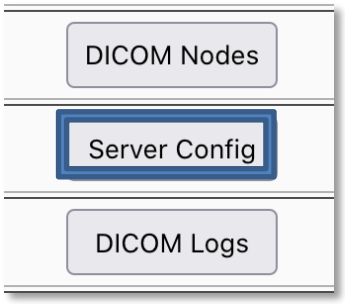
Once the values have been edited, you can save this configuration by click on [**SAVE**] or return to the previous values by click on [**Reset**]. Click on [**SAVE**] to saves and sends you to the AETs list page.



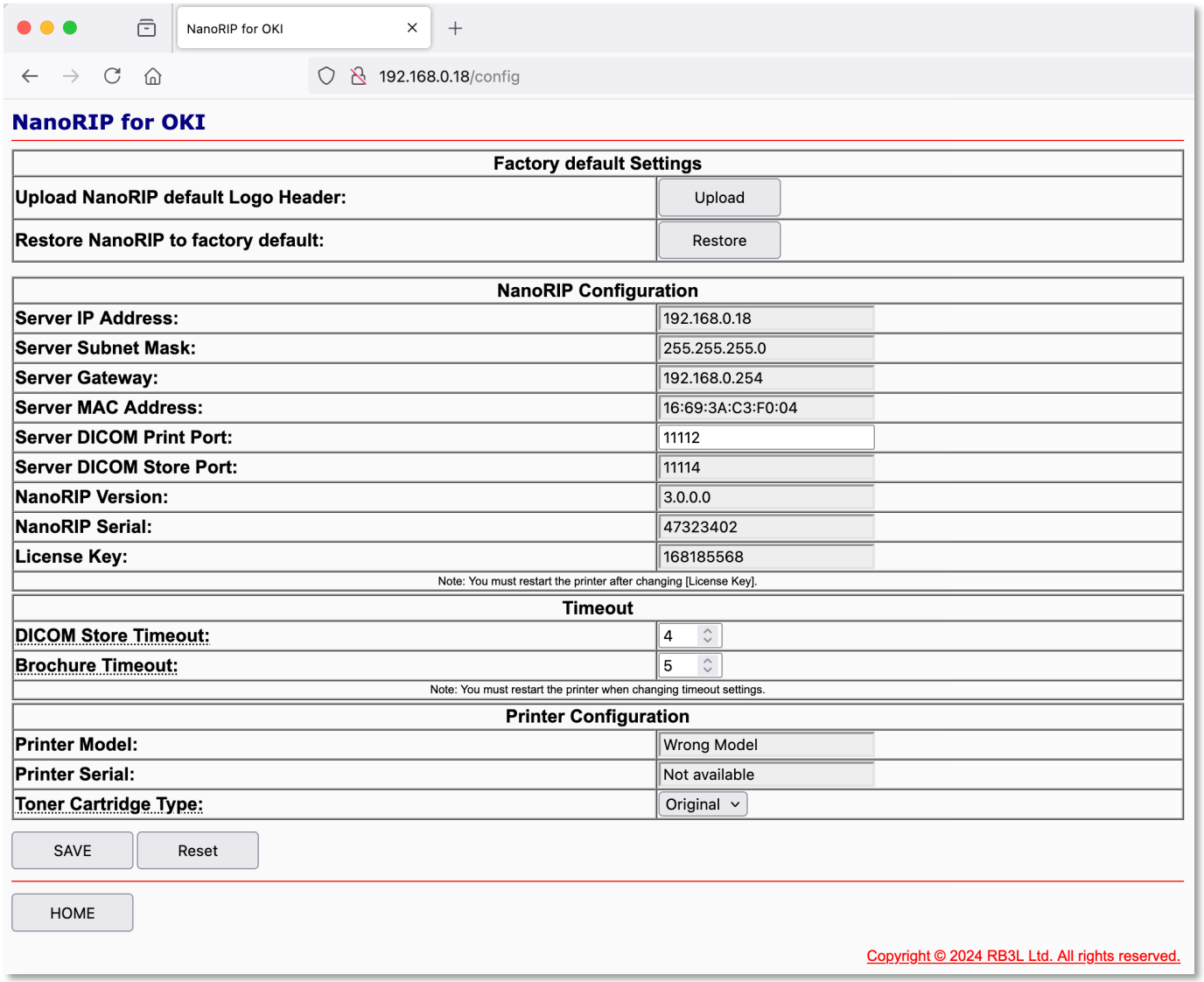
Click on [**HOME**] to go back to the home page.



Step 4 : Description of [Server Config] menu



Click on [Server Config] to enter in the config menu.



Upload NanoRIP default Logo Header:	Upload

[Upload NanoRIP default Logo Header] This function is used for factory restore Logo header of the NanoRIP.
Note: ● All logos header will be replaced by NanoRIP ones.

Restore NanoRIP to factory default:	Restore

[Restore NanoRIP to factory default] This function is used for factory restore the NanoRIP,
.
Note: ● All the DICOM Nodes will be deleted and default settings will be applied.

Server IP Address	192.168.1.37
Server Subnet Mask	255.255.255.0
Server Gateway	192.168.1.1

[Server IP Address] : Displays the NANORIP IP address.
[Server IP Subnet Mask] : Displays the NANORIP subnet mask.
[Server IP Gateway] : Displays the NANORIP gateway.

Server DICOM Print Port	11112
Server DICOM Store Port	11114

[Server DICOM Print Port] This function is used to display the input DICOM PrintSCP port.
[Server DICOM Store Port] This function is used to display the input DICOM StoreSCP port.

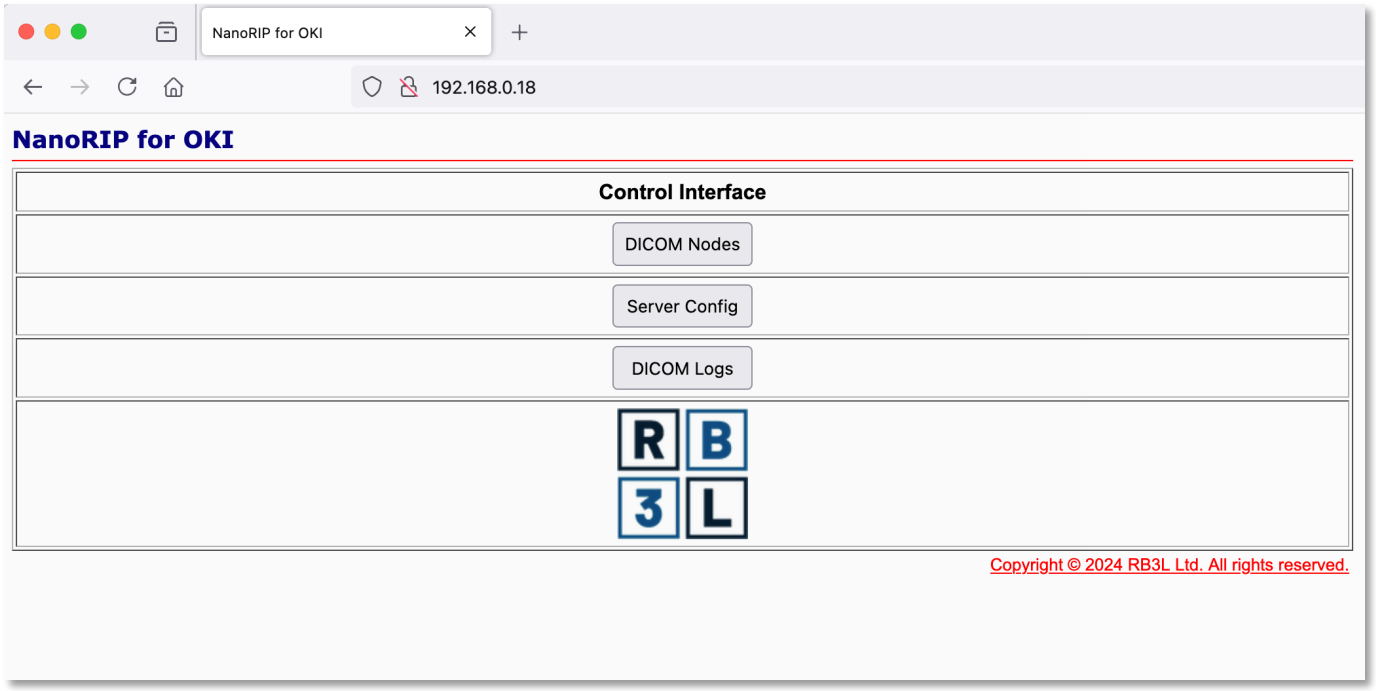
DICOM Store Timeout:	2
Brochure Timeout:	5

[DICOM Store Temporization] : This function is used for StoreSCP to set the waiting time to get all images before sending DICOM printing request. The choices are from [1] to [60] seconds.
[Brochure Temporization] : This function is used for PrintSCP to set the waiting time to get all images before sending Brochure printing request. The choices are from [1] to [60] seconds.

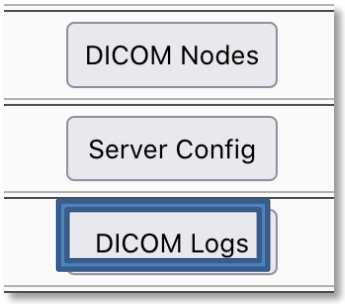
Printer Model	C834
Printer Serial	AL54007618

[Printer Model] : This function is used to display the connected printer model.
[Printer Serial] : This function is used to display the printer serial number.

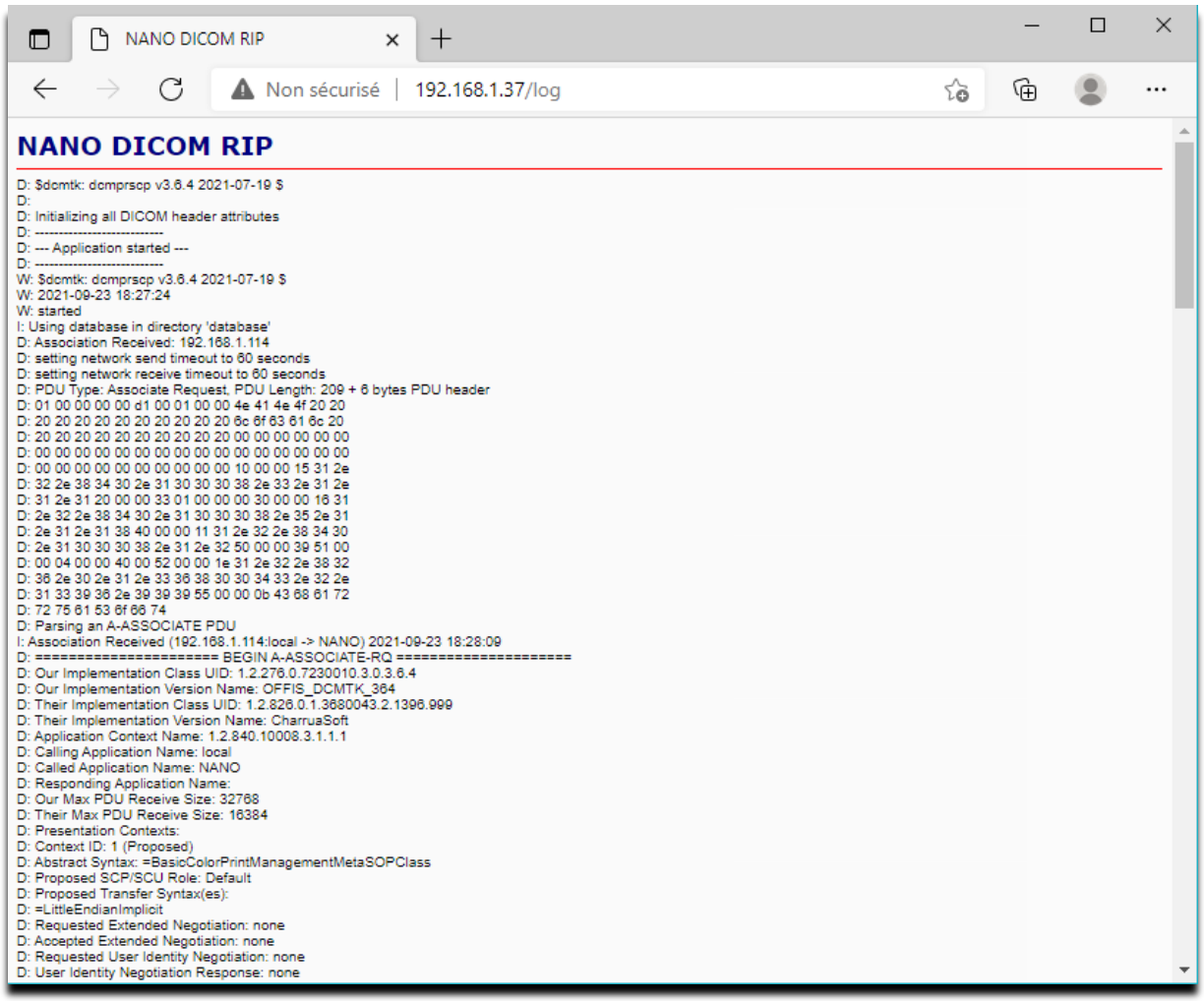
Click on [HOME] to go back to the home page.



Step 5 : Description of [LOGS] menu



Click on [DICOM Logs] to enter in the logs menu.



This page displays the Logs of DICOM exchanges during printing, it is useful to debug in a problem event in order to identify the error source.

Step 6 : Brochure customization.

6.1 Introduction

NanoRIP can print your exams as an A4, Letter, Tabloïd or A3 brochure with customizable cover and end pages. We will see here how to proceed with these pages creation.

Prerequisites :

- A computer connected to the same network as the printer. (See step 1)
- Graphics software such as Adobe **Photoshop**©, **MSPaint**©, **GIMP**©, etc… (See step 6)
- Charruasoft **TestSCU** software(See step 6)
- Downloadable from the link below https://www.charruasoft.com/products/downloads/testscu.zip

6.2 Step 1

From your computer, using your graphics software, create a Jpeg A4 image size for A4 or A3 brochure or Letter for a Letter or Tabloid brochure in order to use it for your brochure cover page. Repeat the same operation for the brochure end page.

CAUTION!

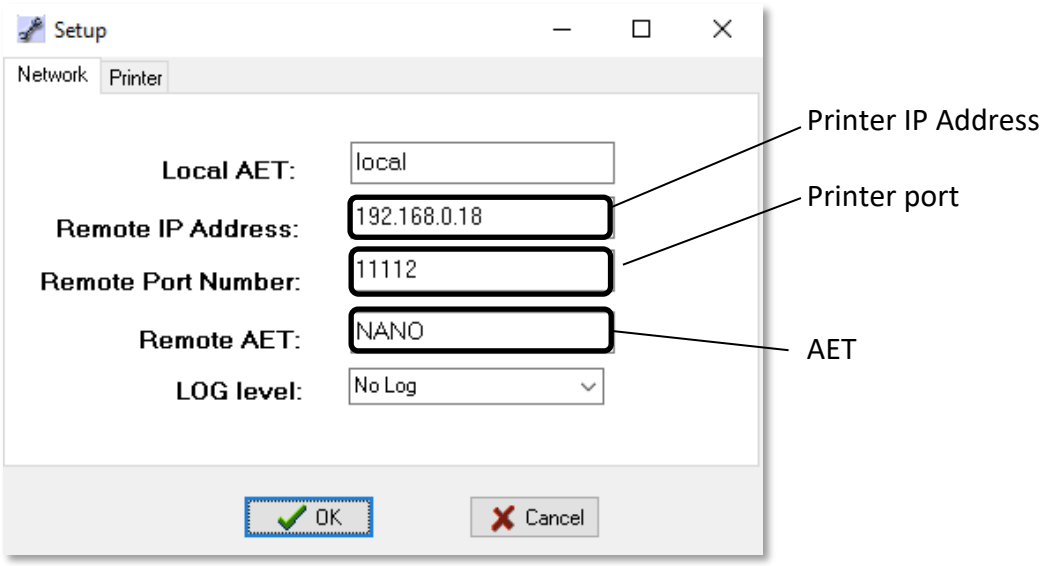
To use the previously created cover and end pages, we need to send them to the NanoRIP server using TestSCU.exe set with specific AETs for the cover and end pages. It is not necessary to create these AETs on NanoRIP.

Once these operations have been performed, and still from your computer, unzip the testscu.zip file and double-click on TestSCU.exe to start it

At the top of PrintSCU software, there is a list of buttons

Click the setup button to configure the software to connect to the printer.

Enter the printer's DICOM settings in this window as shown in the photo below.



Enter the NanoRIP IP address in the Remote IP Address box (for our example, we entered 192.168.0.18)

Enter the NANORIP server port in Remote Port Number box (we entered 11112 which is the NanoRIP default port)

Important:

The AETs to be used for brochure cover page are:

[**A4-COVER**] for A4 and A3 paper size or [**LETTER-COVER**] for Letter and Tabloid paper size.

The AETs to use for brochure end page are:

[**A4-BACK**] for A4 and A3 paper size or [**LETTER-BACK**] for Letter and Tabloid paper size..

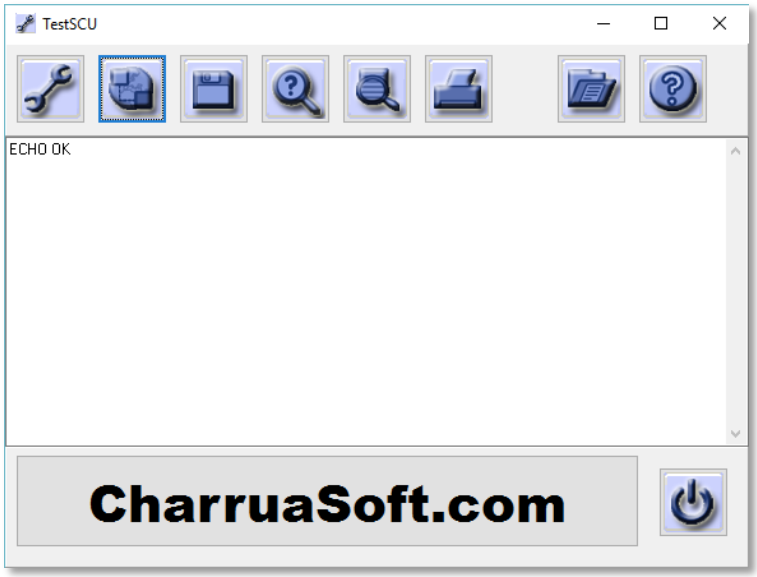
Enter the proper AET to use in remote AET box (for our example, we want to create the A3 brochure cover page , we entered A4-COVER)

Once you have finished entering all the parameters, you must click [**OK**] to save and start using TestSCU.

You are now on the main TestSCU window.

We are going to test the DICOM connection, click on the echo check button

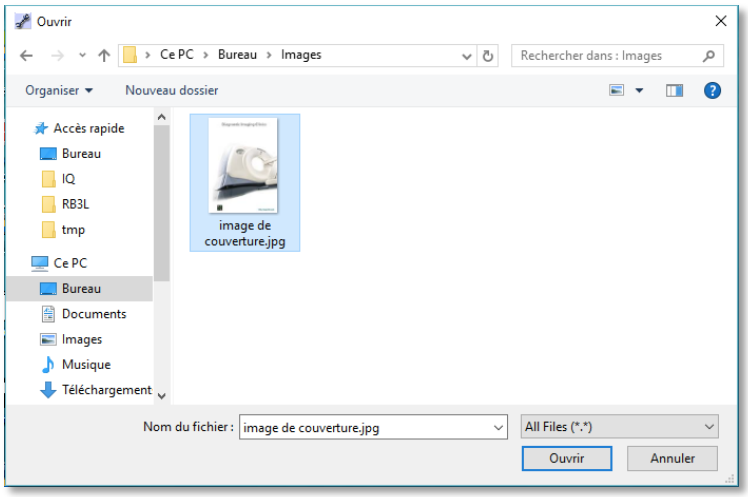
If the parameters you entered are OK, this window will appear with the message <<ECHO OK>>.



We will send now our cover image to the NanoRIP server

Click on the DICOM Print button

Select the Jpeg file of your cover image then click [Open].



After a few seconds, the image will be loaded into the NanoRIP server and the message <<PRINT OK>> will appear in this window.

Restart the operation to install the brochure back page in NanoRIP server.

Your printer is now ready to print in brochure mode with your cover page and end page elements.

Step 7 : Logo Header Creation.

7.1 Introduction

NanoRIP can print your exams with a Logo header on each page. We will see here how to proceed to create these logos.

Prerequisites :

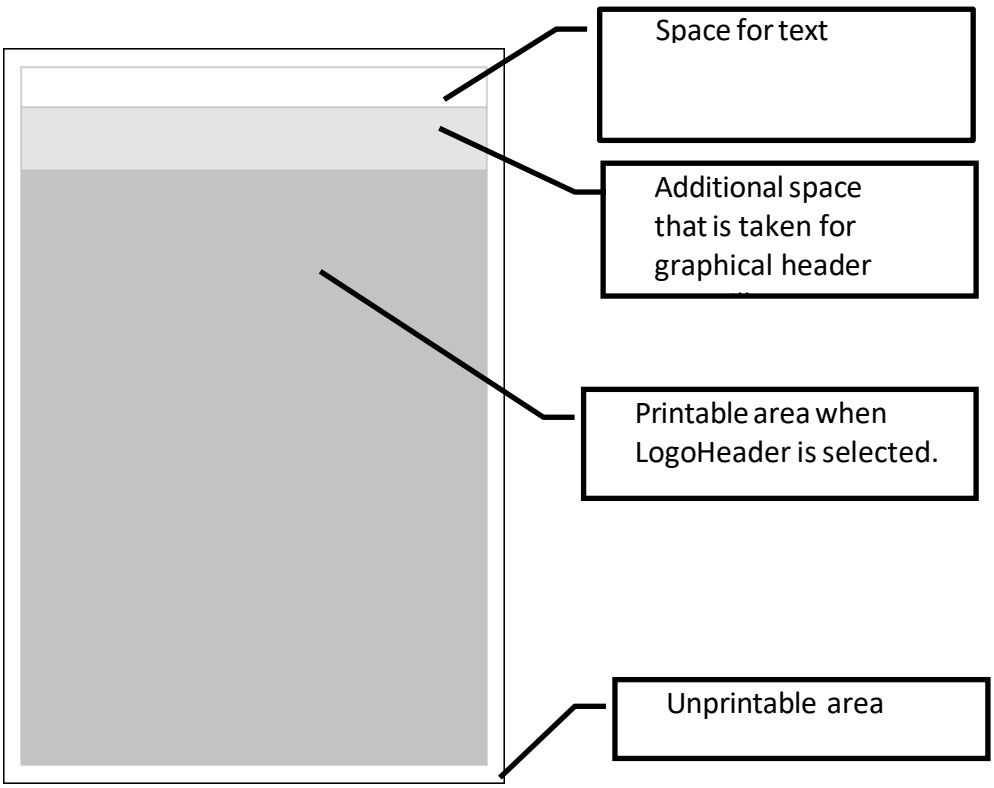
- A Windows based computer connected to the the printer.
- Software such as Adobe **Photoshop**©, **MSPaint**©, **PowerPoint**©, etc…
- OKI Postscript drivers installed on the computer
- OKI software tools: (**Storage Device Manager**) or (**Configuration Tool**).

CAUTION!

You must use a MS Windows computer as OKI software tools (Storage Device Manager) and (Configuration Tool) are only available for this platform.
OKI PostScript printer driver must be installed on your computer

7.2 Header Page Layout

A space for text header is reserved at the top of the page. This space isincreased in case of use of graphical “Logo Header”.



The reserved space on the DICOM page for the logo is always at the top .

The DICOM print area begins one inch (25.4mm) below the paper edge.

The unprintable area is 5mm around the page thus the remaining space is20.4mm for the Logo and/or text. If you want to have an equilibrated spacing with the DICOM maximum area printout, we recommend creatinga 15 to 16mm height artwork starting at 5mm from top of page.

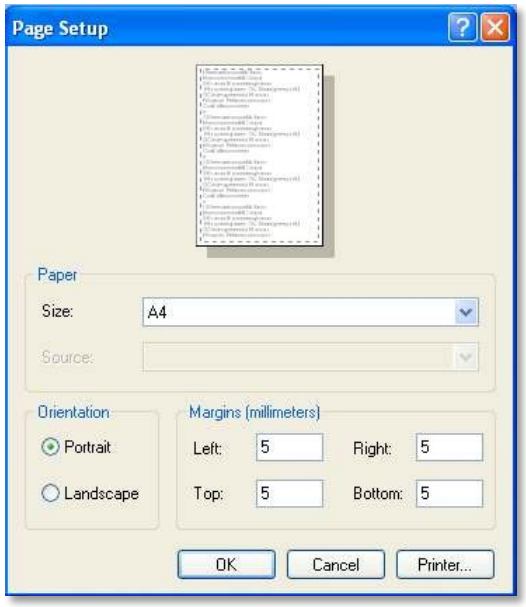
7.3 Using MS WordPad or MS Word for Headers

Open a new document in MS WordPad or MS Word.

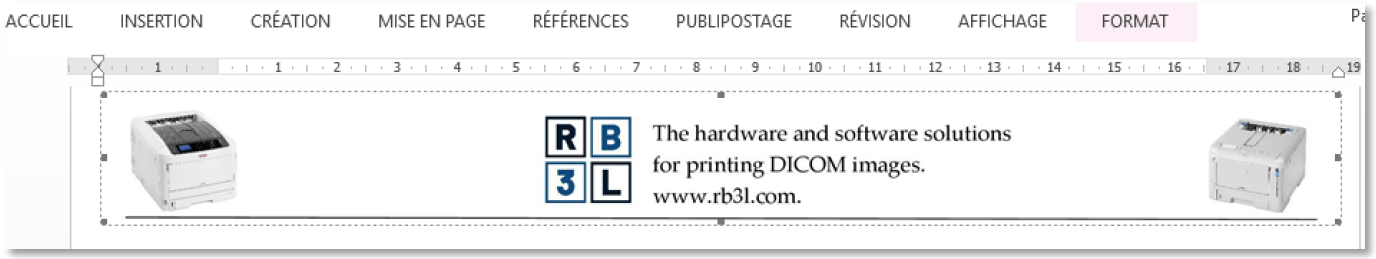
First step is to select the paper format you want to produce accordinglywith the format you want to DICOM print with the header.

1) Set the paper format to desired size 8x10, A4, Letter, 10x12, 11x14, A3 or Tabloid.
2) Keep the page orientation in Portrait even if you intend to produce Landscape DICOM printouts.
3) Adjust the margins for the printer printable area to 5 mm each side.

Page format margins

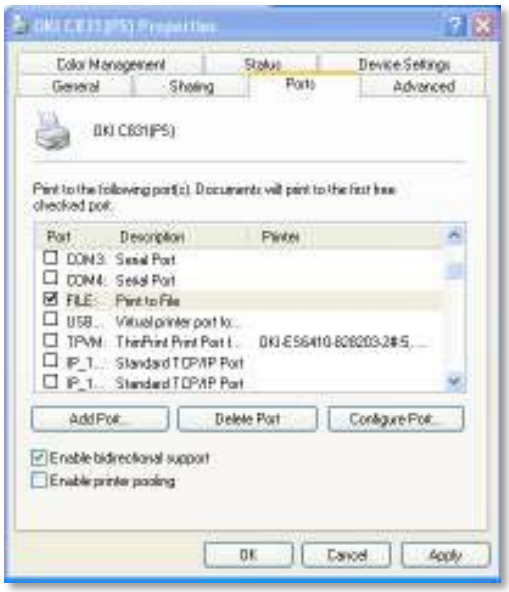


4) Type text and/or paste your logo in the upper part of the page.



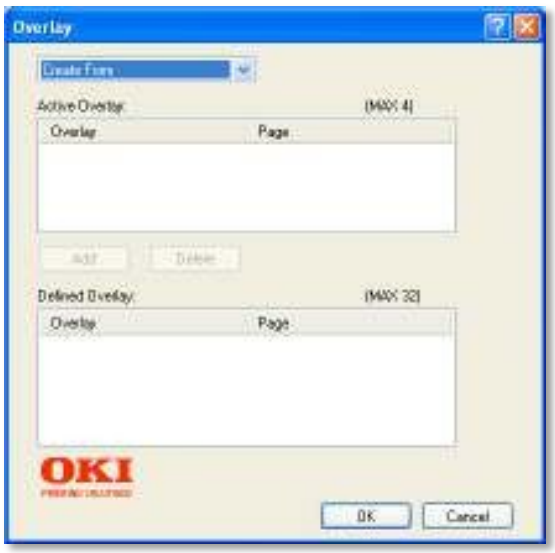
5) Print to file option.

Up to the used version of Windows and Office, you may have to setup the driver for printing into File.
Open the Configuration Panel and edit the PS printer properties.
Then in the “Ports” Tab, select File and apply.

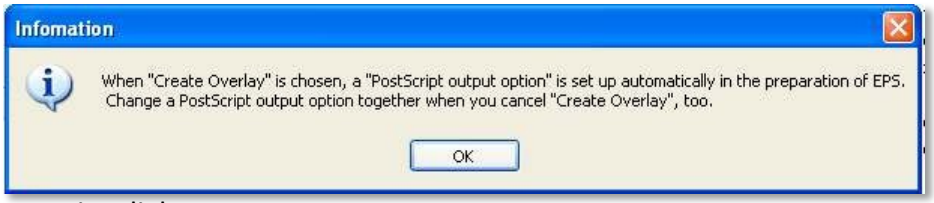


6) Set up the PostScript printer driver for forms creation.

In the print dialog from Word, open Printer Settings.Then Job Option Tab and click on “Overlay” button.Select “Create Form”.



You should get a warning popup.



Apply and close Printer setting dialog.

7) Print to generate the file.

Print your job.
A popup window will appear asking you for the file name you wantto use.

Use full path naming for saving i.e. “C:\Dicomheaders\Header-A4.hst”.

Names should be:

Header-A5.hst, for A5 paper

Header-8X10.hst, for 8inx10in paper

Header-Letter.hst for Letter paper

Header-A4.hst for the A4 paper

Header-10X12.hst for the 10inx12in paper

Header-11X14.hst, for 11inx14in paper

Header-Tabloid.hst, for Tabloid paper

Header-A3.hst, for A3 paper

Header-TabloidExtra.hst for Tabloid Extra paper (Pro9431 only)

Header-SRA3.hst for the SRA3 paper (Pro9431 only)

Header-215.hst for the A3 NOBI paper (Pro9431 only)

The following formats are not possible in MS word, see next page of this document how to work them with MS PowerPoint:

Header-215X900.hst for the 215 x 900 mm paper

Header-297X1200.hst for the 297 x 1200 mm paper

Header-328X1200.hst for the 328 x 1200 mm paper (Pro9431 only)

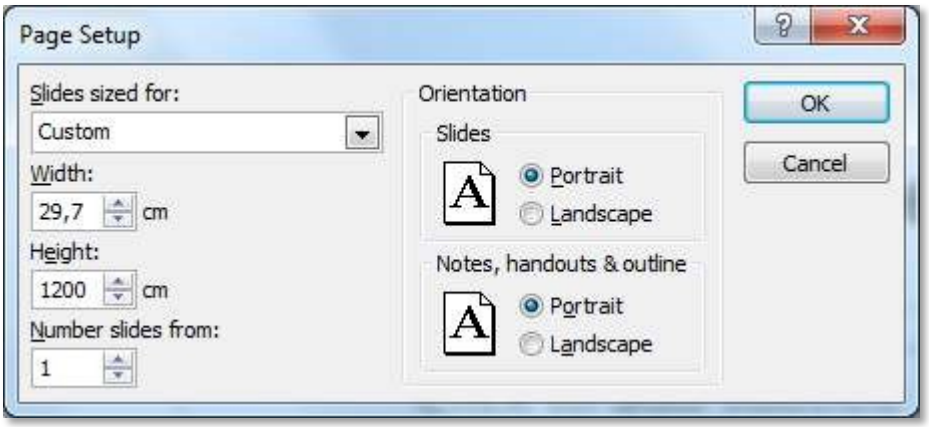
7.4 Using MS PowerPoint to create Headers

As you may have noticed MS Word is limited in format and can't handle"banner" sizes having dimension over 55.87 cm.

Open a new document in MS PowerPoint.

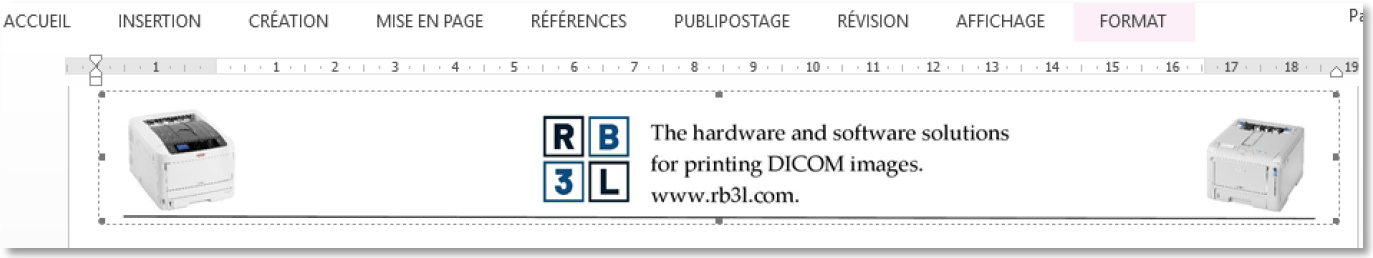
First step is to select the paper format you want to produce accordinglywith the format you want to DICOM print with the header.

a. In Design, Page Setup Set the paper format to desired size.

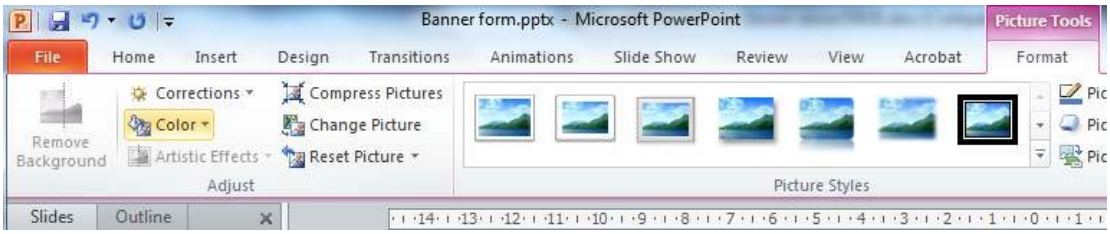


a. Keep the page orientation in Portrait even if you intend to produceLandscape DICOM printouts.

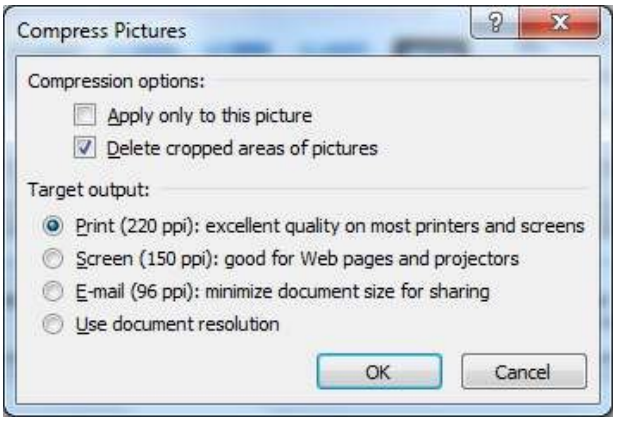
b. Type text and/or paste your logo in the upper part of the page.



c. Open the picture tool window in PowerPoint.

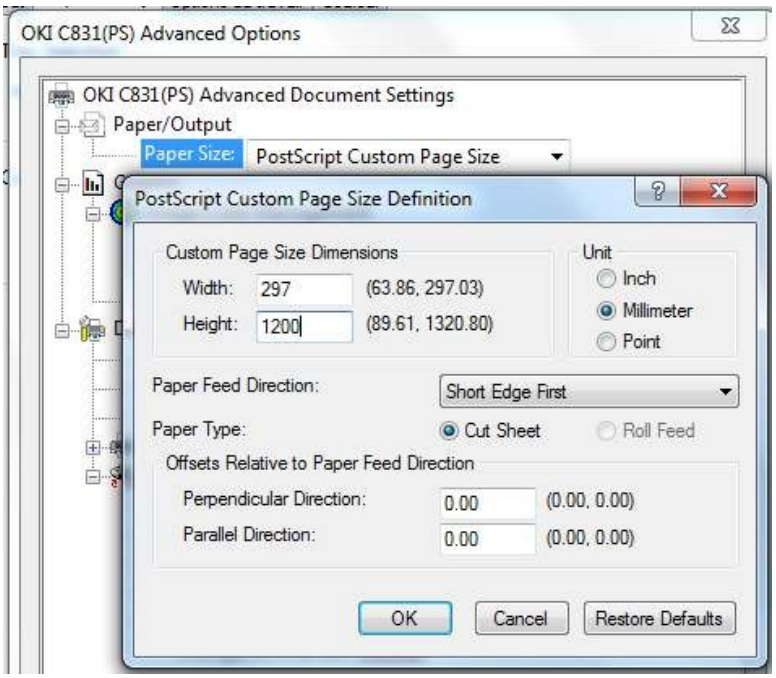


Select the compress picture tool.



Use the above settings or 150 ppi to reduce the size of your graphic elements for better printing speed, and click OK.

d. Before printing, specify the custom paper format in the printer advanced settings.



e. Follow naming scheme of your files as per following:

Header-A5.hst, for A5 paper

Header-8X10.hst, for 8inx10in paper

Header-Letter.hst for Letter paper

Header-A4.hst for the A4 paper

Header-10X12.hst for the 10inx12in paper

Header-11X14.hst, for 11inx14in paper

Header-Tabloid.hst, for Tabloid paper

Header-A3.hst, for A3 paper

Header-TabloidExtra.hst for Tabloid Extra paper (Pro9431 only)

Header-SRA3.hst for the SRA3 paper (Pro9431 only)

Header-215.hst for the A3 NOBI paper (Pro9431 only)

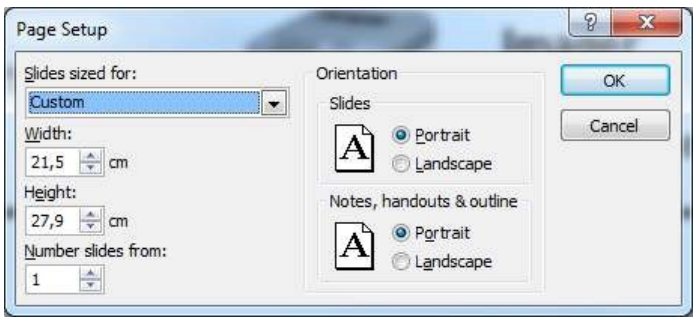
Header-215X900.hst for the 215 x 900 mm paper

Header-297X1200.hst for the 297 x 1200 mm paper

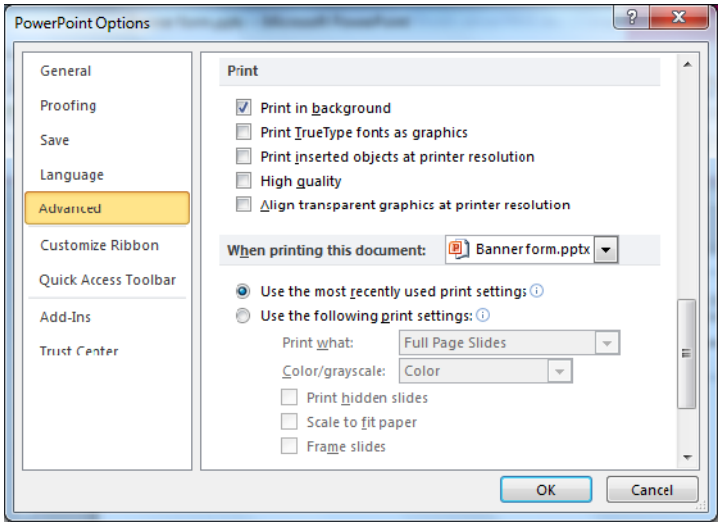
Header-328X1200.hst for the 328 x 1200 mm paper (Pro9431 only)

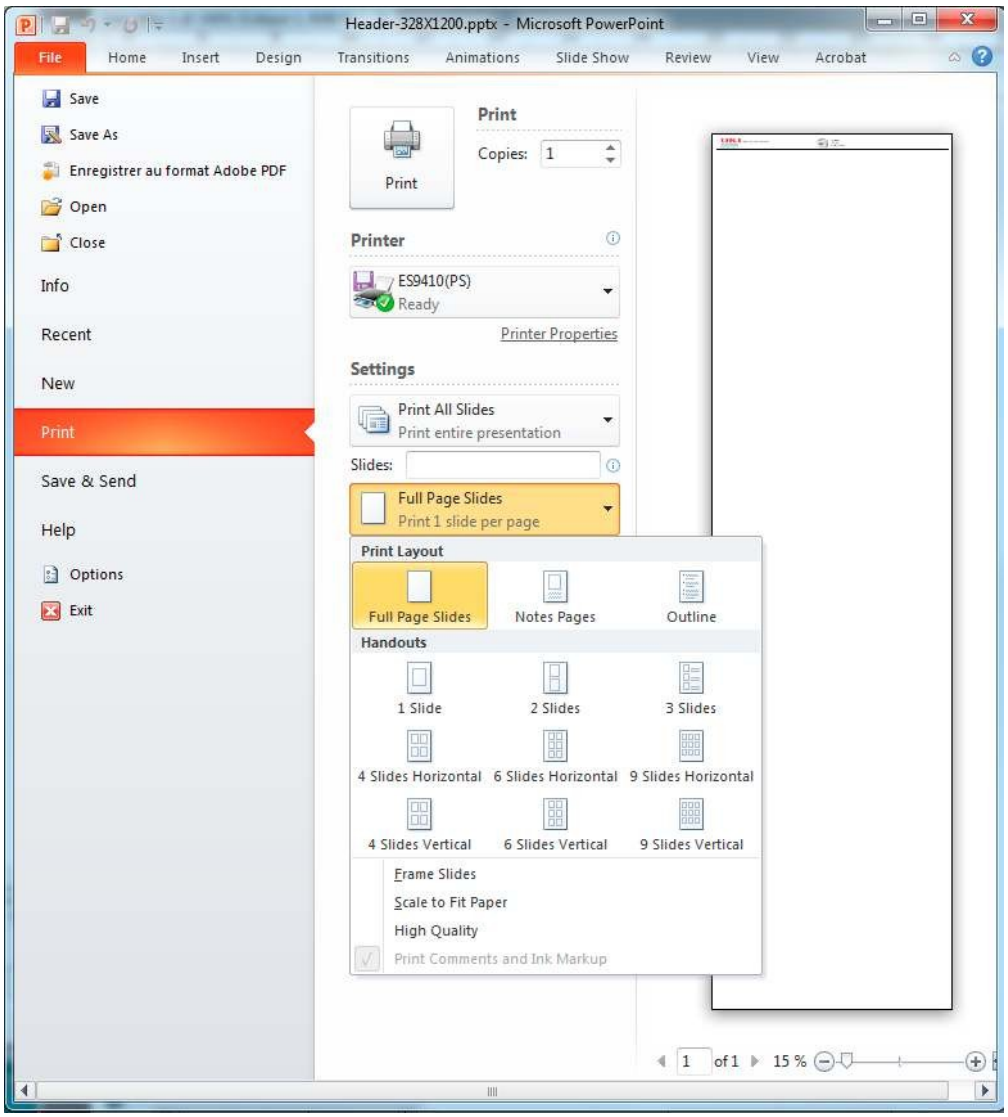
Be careful when creating the document to always use custom format inPowerPoint even for already defined paper size.

i.e. for Letter create page as custom:



Also make sure that the scale to fit paper option is disabled in bothdialogs:


PowerPoint Options
General
Proofing
Save
Language
Advanced
Customize Ribbon
Quick Access Toolbar
Add-Ins
Trust Center
Print
Print in background
Print TrueType fonts as graphics
Print inserted objects at printer resolution
High quality
Align transparent graphics at printer resolution
When printing this document:
Banner form.pptx
Use the most recently used print setting:
Use the following print settings:
Print what:
Full Page Slides
Color/grayscale:
Color
Print hidden slides
Scale to fit paper
Frame slides
OK
Cancel


Header-328X1200.pptx - Microsoft PowerPoint
File
Home
Insert
Design
Transitions
Animations
Slide Show
Review
View
Acrobat
Save
Save As
Enregistrer au format Adobe PDF
Open
Close
Info
Recent
New
Print
Save & Send
Help
Options
Exit
Print
Copies: 1
Printer
ES9410(PS)
Ready
Printer Properties
Settings
Print All Slides
Print entire presentation
Slides:
Full Page Slides
Print 1 slide per page
Print Layout
Full Page Slides
Notes Pages
Outline
Handouts
1 Slide
2 Slides
3 Slides
4 Slides Horizontal
6 Slides Horizontal
9 Slides Horizontal
4 Slides Vertical
6 Slides Vertical
9 Slides Vertical
Frame Slides
Scale to Fit Paper
High Quality
Print Comments and Ink Markup
1 of 1
15 %

7.5 Package the Forms and send them to the Printer, using Configuration Tool

CAUTION!

The computer must be connected straight to the printer instead the NanoRIP.

Install OKI Configuration Tool 1.6.5 or later on your computer if not yetdone.
Application software is available on the Software DVD delivered with theprinter and also on OKI web sites. User Documentation is included in theSoftware Help menu.

Start Configuration Tool.

Step a: Register your printer.

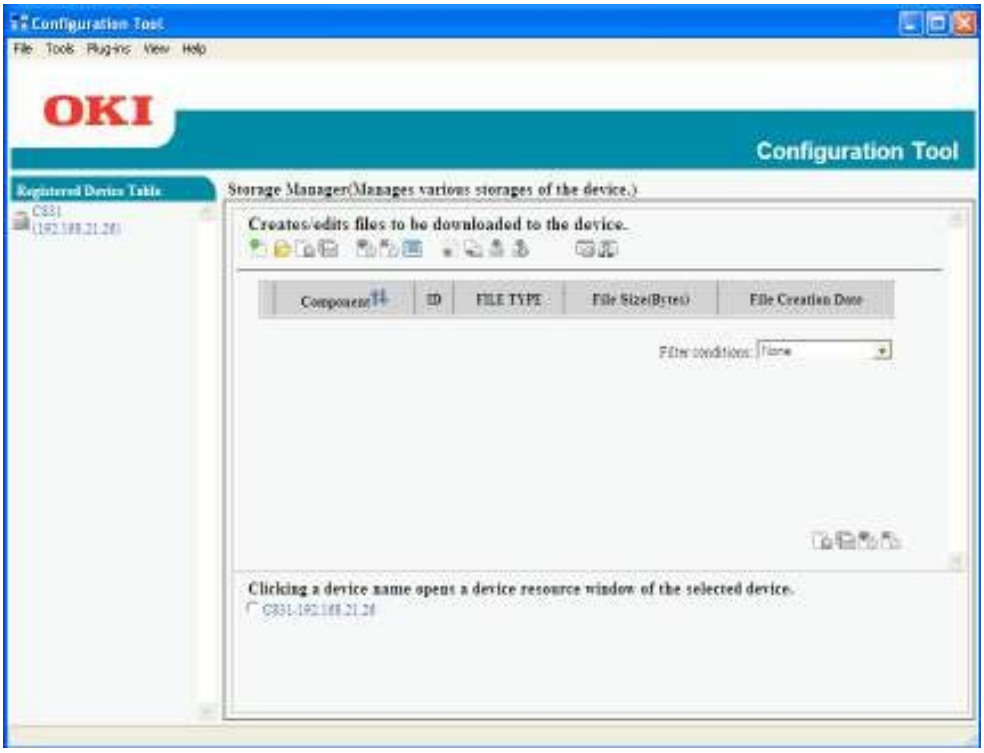
Click on Tools -> Register Device, then select and register yourprinter.

NOTE: if you have already registered your printer, go to Step 2.

Step b: Start Storage Manager.

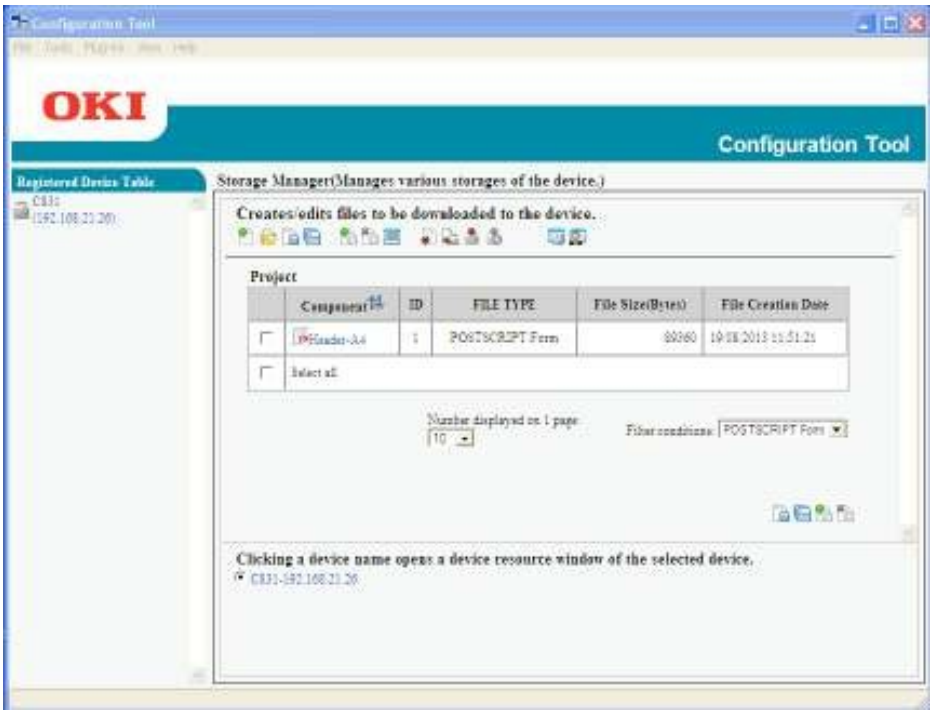
Click on Plug-ins -> Storage Manager.

Search for and select your printer at the bottom of the window.



Step c: Select "Create New Project".

Import the File(s) that you just printed.



Header-A4.hst will be automatically transformed into Header-A4form.

CAUTION!

Naming is case sensitive, Make sure naming matches exactly the scheme.
Otherwise, the form will not work.

Repeat this step, if you need to add Form in another paperformat.

Once all the wanted forms are listed in Projects, select "Send Project Files to Printer".

You will receive confirmation with this Popup:

Step 8 : DICOM Conformance Statement.

DICOM Conformance Statement

NANORIP

DICOM 3.0 Conformance Statement

Summary:

This document is the DICOM Conformance Statement of the Print Service Class Provider (SCP) software NANO DICOM RIP, of RB3L LTD.

This RB3L LTD product: NANORIP implements the necessary DICOM services to facilitate the Print (SCP) Imaging Management in the healthcare departments, managing Print imaging over a network a Windows based Printer Systems. It enables the capabilities to capture images at any networked DICOM modality and then print them anywhere they're needed in the medical facility.

Furthermore, before sending the images to be printed the NANORIP will apply image processing, using presentation parameters to improve the image presentation quality and consistency. Moreover, it will manage the printing presentation format and the Printer queue and Configuration.

Table A.1-1 provides an overview of the network services supported by the NANO DICOM RIP.

Table A.1-1 NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Print Management		
Grayscale Print Management Meta	No	Yes
Color Print Management Meta	No	Yes
Presentation LUT	No	Yes
Print Job	No	Yes
Verification	No	Yes
Store Management		
US Image Storage	No	Yes

1 Introduction

1.1 Scope and field of application

This document describes RB3L NANORIP (hereinafter referred to as “NANO DICOM RIP”) conformance to the DICOM 3.0 standard.

It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment.

The main elements describing these capabilities are the supported DICOM SOP Classes, Roles, Information Object Definitions (IOD) and Transfer Syntaxes. It should be read in conjunction with the DICOM standard and its addenda.

This statement is conformant with the recommended format as described in PS 3.2 of the DICOM standard. NANORIP acts as a SCP for the following SOP Classes:

- Basic Grayscale Print Management Meta SOP Class
- Basic Color Print Management Meta SOP Class
- Verification SOP Class
- Print Job SOP Class
- Presentation LUT SOP Class
- Basic Film Session SOP Class
- Basic Film Box SOP Class
- Basic Grayscale Image Box SOP Class
- Basic Color Image Box SOP Class
- US Image Storage SOP Class

1.2 Acronyms and abbreviations

The following acronyms and abbreviations are used in this document:

- ACR: American College of Radiology
- ANSI: American National Standards Institute
- DICOM: Digital Imaging and Communications in Medicine
- DIMSE: DICOM Message Service Element
- DIMSE-C: DICOM Message Service Element – Composite
- DIMSE-N: DICOM Message Service Element – Normalized
- NEMA: National Electrical Manufacturers Association
- PDU: Protocol Data Unit
- SCP: Service Class Provider
- SCU: Service Class User
- SOP: Service Object Pair
- TCP/IP: Transmission Control Protocol/Internet Protocol
- UID: Unique Identifier

1.2.1 Terms and Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class.
Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.

Application Context – the specification of the type of communication used between Application Entities.
Example: DICOM network protocol.

Association – a network communication channel set up between Application Entities.

Attribute – a unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010, 0020), Accession Number (0008, 0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile – the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Module – a set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.

Protocol Data Unit (PDU) – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data. **Service Class Provider (SCP)** – role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) – role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific x-ray image.
Tag – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010, 0020) [Patient ID], (07FE, 0010) [Pixel Data], (0019, 0210) [private data element]

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples:

JPEG compressed (images), little endian explicit value representation.

Unique Identifier (UID) – a globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

1.3 References

[DICOM]. Digital Imaging and Communications in Medicine

DICOM standard: NEMA PS 3.1 to 3.14 and Supplements

National Electrical Manufacturers Association (NEMA) – Publication Sales -1300 N. 17th Street, Suite 1847

Rosslyn, Va. 22209, United States of America

1.4 Intended audience

This Conformance Statement is intended for:

Potential users

System integrators of medical equipment

Software designers implementing DICOM interfaces

1.5 Note to the reader

This document is written for the people that need to understand how RB3L NANORIP will integrate into their healthcare facility.

This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product.

This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

Comparison of this Conformance Statement and the Conformance Statement of another device may show that the other device conforms to this Conformance Statement.

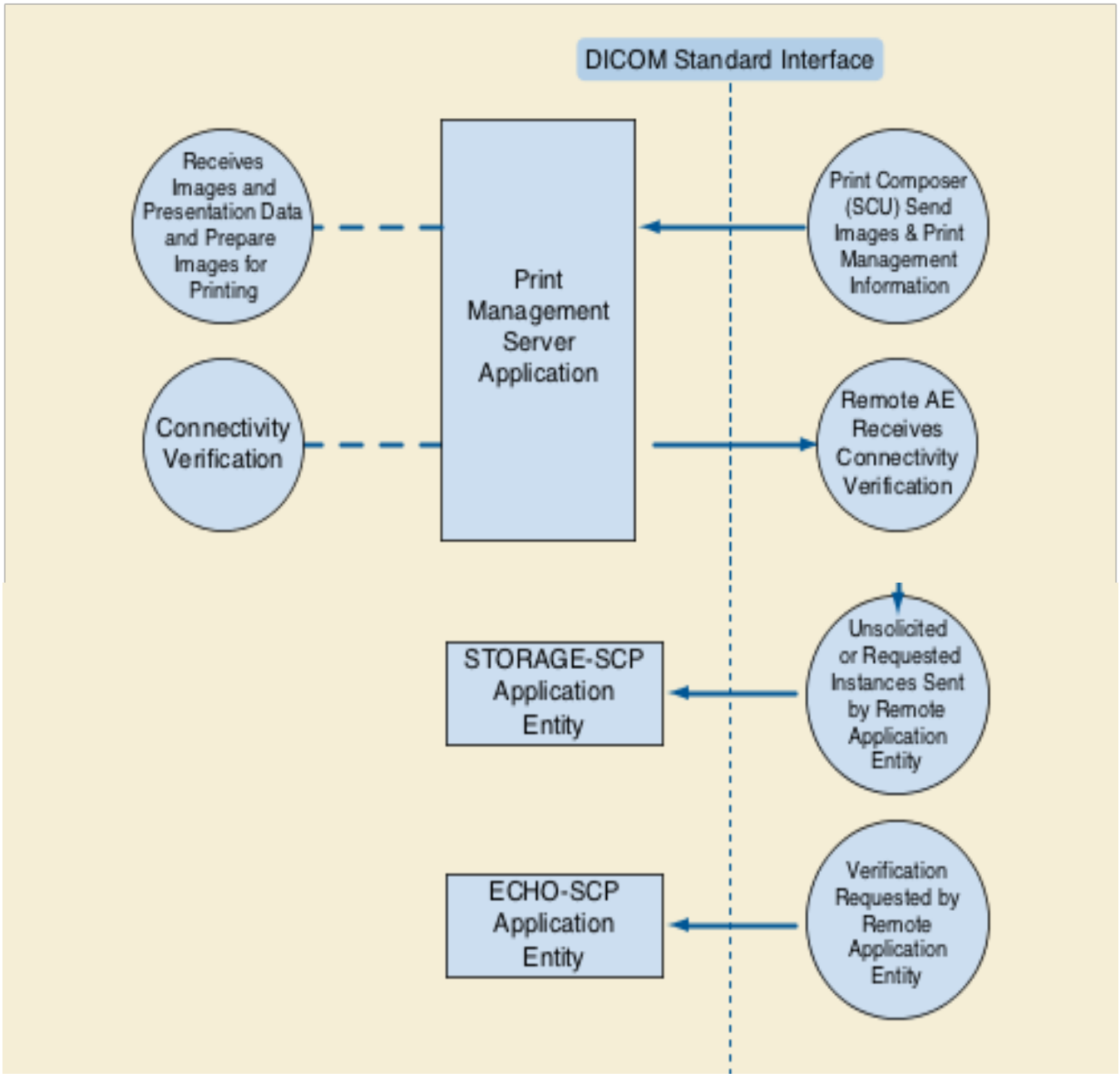
In that case, the other device may be interoperable with this product, but no guarantee is given.

DICOM only deals with communications; it is not a standard that specifies what is needed for certain applications to run on a device.

2 Implementation model

2.1 Application data flow

NANORIP is a DICOM printing solution that can receive images from DICOM modalities and render the images on paper by using Print SCU or Store SCU capabilities.



The Print Server is receiving the Images with the Presentation information, it Apply it on the images and creates a print-job within the print queue, containing one or more film pages composed from images selected by the client Print SCU. Furthermore, it also manages the Printer Status and Configuration.

2.2 Functional Definition of Print Server (SCP) Application Entity

The Print Server System acquires the images with the demographics and presentation information from the connected Print Composer (SCU) that is Grouped with a Workstation or an Archive device. Studies are temporarily stored on memory. The images are then processed and formatted and finally queued as a print job on the Printer queue. If the Printer is not operating normally (e.g. film Magazine empty), then the printer will be set to an error state and can be restarted by the user via the control panel interface.

The Print Server Management includes:

-DICOM Association and Negotiation Management

-Image Buffering

-Image Processing (Windowing level, P-LUT, GSDF, etc.)

-Image Formatting (Film sheet format)

-Printing

Furthermore, the Print Server provides in addition a Service operation of checking the networking connectivity to it’s Print SCU using the Verification SOP Class.

2.3 Functional definitions of Application Entities

2.3.1 Verification Service as SCP

NANORIP waits for another application to connect at the presentation address configured in the network settings.

When another application connects, NANORIP expects it to be a DICOM application. NANORIP will accept associations with Presentation Contexts for SOP Classes of the Verification Service Class.

2.3.2 Print services as SCP

Once started, NANORIP waits for association requests. For each accepted request, it processes on the association the received print commands compatible with the SOP Classes it supports.

Associations are released either on Print SCU request or when an error condition occurs that leads to an association abort.

2.3.3 Store services as SCP

Once started, NANORIP waits for association requests. For each request, it accept associations with Presentation Contexts for SOP Classes of the Storage Service Class, and processes to the print commands listed and viewed through the user interface.

Associations are released either on Print SCU request or when an error condition occurs that leads to an association abort.

2.4 Sequencing of real-world activities

2.4.1 Print services as SCP

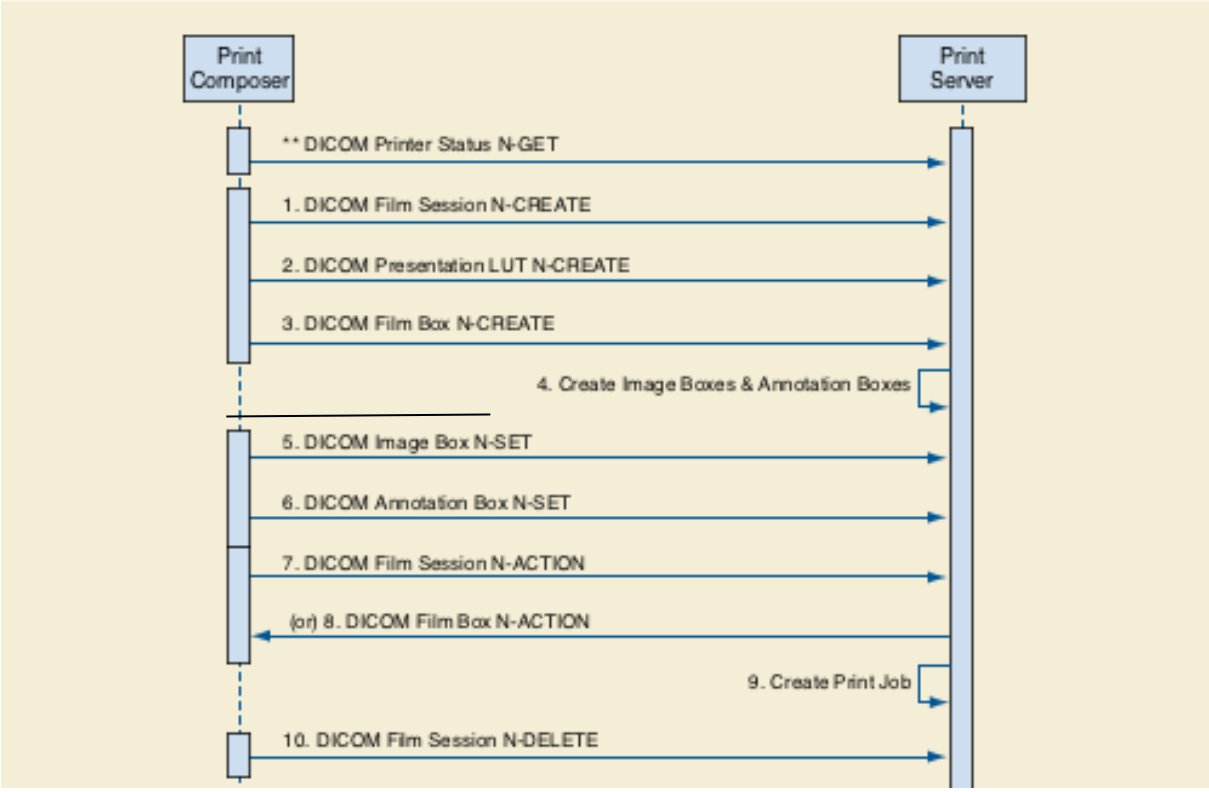


Figure 2.2.3-2. Print Server Management Sequence

The Print Server Management workflow activities in the sequence order as described in Figure 2.2.3-2 apply:

1. DICOM Film Session N-CREATE
2. DICOM Presentation LUT N-CREATE
3. DICOM Film Box N-CREATE
4. Create Image Boxes & Annotation Boxes
5. DICOM Image Box N-SET
6. DICOM Annotation Box N-SET
7. DICOM Film Session N-ACTION, A print job is created for each Film Session N-action.
8. DICOM Film Box N-ACTION, A print job is created for each Film Box N-action.
9. Create Print Job
10. DICOM Film Session N-DELETE.

2.4.2 Store services as SCP

All SCP activities are performed asynchronously in the background and not dependent on any sequencing.

3 Application Entity specifications

In its default configuration, NANORIP exists as a single Application Entity (AE) “NEWAET”. You can add several Application Entity Titles (AET), define each of those and add rules for color adjustment.

As far as the association acceptance is concerned, NANORIP does not check any matching between its AET and the called AET of the incoming DICOM association.

NANORIP provides standard conformance to the following DICOM V3.0 SOP Classes as an SCP:

SOP Class Name	UID
Verification SOP Class	1.2.840.10008.1.1
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18
Printer SOP Class	1.2.840.10008.5.1.1.16
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1
Presentation LUT SOP Class	1.2.840.10008.5.1.1.23
Storage Service Class	1.2.840.10008.4.2
Ultrasound Image Storage Class	1.2.840.10008.5.1.4.1.1.6
Ultrasound Image Storage Class	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage Class	1.2.840.10008.5.1.4.1.1.7

3.1 Association establishment policies

3.1.1 General

Before any SOP Classes can be exchanged between the SCU AE and the PMS (SCP), an association stage takes place to negotiate and exchange the capabilities of the SCU and SCP. The Store Management SCU

and SCP or the Print Management SCU and SCP establish an association by using the Association Services of the DICOM Upper Layer. During association establishment, the DICOM Store Management AE or the Print Management AE negotiates with the supported SOP classes.

Only the SCU AE shall release an association. The released association may be aborted by the SCU or the SCP. The SCU AE attempts to initiate a new association for each store or print session. This means that when no operation is done on the association, the SCU should release the association.

A DICOM entity can only send DIMSE messages to instances that are created on the same association.

The Maximum PDU Length offered by NANORIP (SCP) at association establishment time can be configured by the user, and may range between the following minimum and maximum values:

Minimum value for Maximum PDU Length: 8192 bytes
Maximum value for Maximum PDU Length: 131072 bytes

3.1.2 Number of associations

In its standard configuration, NANORIP will accept Up to 10 simultaneous delivery Associations for Print-SCP and will accept Up to 5 simultaneous delivery Associations for Store-SCP. If an attempt is made to open more than 10 simultaneous Associations for Print-SCP, the Print Server System will reject the additional Associations (A-ASSOCIATE-RJ).If an attempt is made to open more than 5 simultaneous Associations Store-SCP, the Print Server System will reject the additional Associations (A-ASSOCIATE-RJ).

Number of Associations as a SCP for PRINT-SCP

Maximum number of simultaneous Associations	10

Number of Associations as a SCP for STORAGE-SCP

Maximum number of simultaneous Associations	5

3.1.3 Asynchronous nature

The NANORIP does not support asynchronous operations.

3.2 Association initiation by real-world activity

The NANORIP never initiates an association, since it acts as a SCP from a DICOM protocol point of view.

3.3 Association acceptance policy

The NANORIP accepts DICOM associations according to the DICOM Meta SOP Classes and SOP Classes it supports. NANORIP does not perform any check on the called AET at association acceptance time.

3.3.1 Real-world activity: Print Management and Verification SCP

3.3.1.1 Associated real-world activity

The application entity waits for incoming associations. No operator action is required to receive DICOM print jobs or verification requests.

3.3.1.2 Presentation

The NANORIP accepts the following Presentation Contexts:

ACCEPTED PRESENTATION CONTEXTS FOR PRINT SERVER MANAGEMENT ACTIVITY

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Basic Grayscale Print Management Meta SOP	1.2.840.10008.5.1.1.9	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Basic Color Print Management Meta SOP	1.2.840.10008.5.1.1.18	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Presentation LUT	1.2.840.10008.5.1.1.23	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Printer	1.2.840.10008.5.1.1.16	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

ACCEPTED PRESENTATION CONTEXTS FOR STORE SERVER MANAGEMENT ACTIVITY

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Storage Service Class	1.2.840.10008.4.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Ultrasound Image Storage Class	1.2.840.10008.5.1.4.1.1.6	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Ultrasound Image Storage Class	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Secondary Capture Image Storage Class	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

3.3.1.3 SOP Specific Conformance

3.3.1.3.1 SOP Specific Conformance for Storage SOP Class

STORAGE-SCP provides standard conformance to the Storage Service Class.

No Presentation State will be applied by default.

The Mask Subtraction transformation is not supported by this implementation. It is not possible display Presentation States containing the Mask Subtraction Sequence (0028,6100).

All of the Image Storage SOP Classes listed

3.3.1.3.1.1 Presentation Context Acceptance Criterion

STORAGE-SCP will always accept any Presentation Context for the supported SOP Classes with the supported Transfer Syntaxes. More than one proposed Presentation Context will be accepted for the same Abstract Syntax if the Transfer Syntax is supported, whether or not it is the same as another Presentation Context.

3.3.1.3.1.2 Transfer Syntax Selection Policies

STORAGE-SCP prefers Implicit Transfer Syntaxes.

3.3.1.3.2 SOP Specific Conformance for Printer SOP Class

The Printer SOP Class is used to monitor the status of the printer.

The following DIMSE services are supported:

- N-GET

N-GET is used to retrieve an instance of the Printer SOP Class. The attributes of N-GET are shown in the following table:

Tag	Name	Comment
(2110,0010)	Printer Status	Returns the Printer Status
(2110,0020)	Printer Status Info	Returns the Printer Status
(2110,0030)	Printer Name	Returns the name: PRINTER Name
(0008,0070)	Manufacturer	Returns the manufacturer: RB3L Ltd
(0008,1090)	Manufacturer Model Name	Returns the model : NANO DICOM RIP
(0018,1000)	Device Serial Number	Returns the NANORIP serial number
(0018,1020)	Software Version(s)	Returns the software release
(0018,1200)	Date of Last Calibration	Returns the date of calibration
(0018,1201)	Time of Last Calibration	Returns the time of calibration

3.3.1.4 SOP Specific Conformance for Basic Film Session SOP Class

The following DIMSE services are supported:

N-CREATE

N-SET

N-ACTION

N-DELETE

Film Session SOP Class Operations for N-CREATE

N-CREATE is sent by the SCU AE to create a Basic Film Session SOP instance when an association has been established. If N-CREATE fails, an error message will be returned by the SCP AE. N-CREATE causes the Basic Film Session to be created and its attributes initialized.

The Basic Film Session SOP instances shall be created before the Film Box SOP Instances are created. NANORIP provides the following support for the attributes contained in the N-CREATE DIMSE Service of the Basic Film Session SOP Class:

Tag	Name	Value
(2000, 0010)	Number of Copies	Any integer between 1 and 99 Default 1
(2000, 0020)	Print Priority	Ignored
(2000, 0030)	Medium Type	Ignored
(2000, 0040)	Film Destination	Ignored
(2000, 0050)	Film Session Label	Ignored
(2000, 0060)	Memory Allocation	Ignored
(2100, 0160)	Owner ID	Ignored

The SCP will return one of the following status codes for FILM SESSION SOP CLASS N-CREATE RESPONSE:

Code	Status	Comment
0x0000	Success	Film session successfully created.

Film Session SOP Class Operations for N-SET

N-SET is used to update an instance of the Basic Film Session SOP Class. The following attributes may be updated:

Tag	Name
(2000,0010)	Number of Copies
(2000,0020)	Print Priority
(2000,0030)	Medium Type
(2000,0040)	Film Destination
(2000,0050)	Film Session Label
(2000,0060)	Memory Allocation
(2100,0160)	Owner ID

The SCP will return one of the following status codes for FILM SESSION SOP CLASS N-SET RESPONSE:

Code	Status	Comment
0x0000	Success	Film session has been successfully updated.

Film Session SOP Class Operations for N-ACTION

The receipt of the N-ACTION will result in submitting a print job to print all the films of the film session in the order that they were received. The Film Session N-ACTION arguments are defined in the DICOM Standard PS 3.4, table H.4-3.

The SCP will return one of the following status codes for Film Session SOP Class N-ACTION Response:

Code	Status	Comment
0x0000	Success	Film session has been successfully accepted for printing.

Film Session SOP Class Operations for N-DELETE

The Print Server Management behavior and specific status codes sent for the N-DELETE of a specific Film Session is described in the following table:

The SCP will return one of the following status codes for Film Session SOP Class N-DELETE Response:

Code	Status	Comment
0x0000	Success	The SCP has completed the operation successfully. Film session has been successfully deleted.

3.3.1.5 SOP Specific Conformance for Basic Film Box SOP Class

The following DIMSE services are supported:

N-CREATE

N-SET

N-ACTION

N-DELETE

Basic Film Box SOP Class Operations for N-CREATE

The NANORIP provides the following support for the Film Box attributes sent by the N-CREATE DIMSE

BASIC FILM BOX SOP CLASS N-CREATE REQUEST ATTRIBUTES

Attribute	Tag	Valid Range	Default Value if not sent by SCU or invalid value received
Image Display Format	(2010,0010)	STANDARD\C,R	STANDARD\1,1
Referenced Film Session Sequence	(2010,0500)	N/A	N/A
> Referenced SOP Class UID	(0008,1150)	SOP Class UID	Mandatory, no default
> Referenced SOP Instance UID	(0008,1155)	SOP Instance UID	Mandatory, no default
Referenced Image Box Sequence	(2010,0510)	N/A	N/A
> Referenced SOP Class UID	(0008,1150)	SOP Class UID	Mandatory, no default
> Referenced SOP Instance UID	(0008,1155)	SOP Instance UID	Mandatory, no default
Film Orientation	(2010,0040)	PORTRAIT LANDSCAPE	PORTRAIT
Film Size Id see Note 1	(2010,0050)	A6, A5, A4, A3 8INX10IN Letter, 11INX17IN (Tabloid)	A4

Magnification Type	(2010,0060)	BILINEAR CUBIC	BILINEAR
Max Density	(2010,0130)	0 - 300	300
Smoothing Type	(2010,0080)	NORMAL	NORMAL
Border Density See note 2	(2010,0100)	WHITE BLACK	WHITE
Empty Image Density See note 3	(2010,0110)	WHITE BLACK	WHITE
Trim	(2010,0140)	YES NO	Ignored
Reference Presentation LUT Sequence	(2050,0500)	N/A	N/A
>Referenced SOP Class UID	(0008,1150)	SOP Class UID	Mandatory if sequence is present, no default
>Referenced SOP Instance UID	(0008,1155)	SOP Instance UID	Mandatory if sequence is present, no default
Illumination	(2010,015E)	Any valid value in the unit of cd/m^2	2000, Mandatory if Presentation LUT is supported
Reflective Ambient Light	(2010,0160)	Any valid value in the unit of cd/m^2	10, Mandatory if Presentation LUT is supported

Note 1: Unknown input request size are translated to A3
Note 2: Border Density - allows the density of the areas surrounding and between images on the film to be either Black or white.
Note 3: Empty Image Density - allows the density of the areas of empty images on the film to be either Black or white.

SCP Pixel Matrix for a Pixel Size of 0.088 mm (288 ppi)

With Text as Header

Film Size	Rows	Columns
A4 (Portrait)	2276	3260
A4 (Landscape)	3260	2276
Letter (Portrait)	2344	3064
Letter (Landscape)	3064	2344
A3 (Portrait)	3260	4660
A3 (Landscape)	4660	3260
Tabloid (Portrait)	3064	4792
Tabloid (Landscape)	4792	3064
8INx10IN (Portrait)	2200	2776
8INx10IN (Landscape)	2776	2200
A5 (Portrait)	1576	2276
A5 (Landscape)	2276	1576

The SCP will return one of the following status codes for FILM BOX SOP CLASS N-CREATE RESPONSE:

Code	Status	Comment
0x0000	Success	Film Box was successfully created.

Basic Film Box SOP Class Operations for N-SET

N-SET DIMSE service allows to update the following attributes of an existing Basic Film Box SOP Instance:

Tag	Name
(2010,0010)	Image Display Format
(2010,0040)	Film Orientation
(2010,0050)	Film Size ID
(2010,0060)	Magnification Type
(2010,0080)	Smoothing Type
(2010,0100)	Border Density
(2010,0110)	Empty Image Density
(2010,0120)	Minimum Density
(2010,0130)	Maximum Density
(2010,0140)	Trim
(2010,0150)	Configuration Information
(2050,0500)	Referenced Presentation LUT Sequence
(0008,1150)	>Referenced SOP Class UID
(0008,1155)	>Referenced SOP Instance UID

The SCP will return one of the following status codes for FILM BOX SOP CLASS N-SET RESPONSE:

Code	Status	Comment
0x0000	Success	Film Box was successfully created.

Basic Film Box SOP Class Operations for N-Action

The NANORIP provides the support for submitting the print job for printing the specific Film Box. The Film BOX N-ACTION arguments are defined in the DICOM Standard PS 3.4, table H.4-8.

The SCP will return one of the following status codes for FILM BOX SOP CLASS N-ACTION Response:

Code	Status	Comment
0x0000	Success	Film Box was successfully printed.

Basic Film Box SOP Class Operations for N-DELETE

The NANORIP provides the support for deleting the last created Film Box.

The SCP will return one of the following status codes for FILM BOX SOP CLASS N-DELETE Response:

Code	Status	Comment
0x0000	Success	Film Box was successfully deleted.

4 SOP Specific Conformance for Basic Grayscale Image Box SOP Class

The following DIMSE services are supported:

- N-SET
- True Size Printing

True size printing is controlled by the DICOM tag (2020,0030) requested image size. The software calculates the size (width in MM) of the image, based on the pixel spacing and sends that value to the printer.

IMAGE BOX SOP CLASS N-SET REQUEST ATTRIBUTES

The NANORIP provides the following support for the attributes contained in the N-SET DIMSE Service of the Basic Grayscale Image Box SOP Class:

Tag	Name	Value
(2020,0010)	Image Position	1~(Rows x Columns)
(2020,0020)	Polarity	NORMAL or REVERSE
(2010,0060)	Magnification Type	BILINEAR or BICUBIC
(2010,0080)	Smoothing Type	NORMAL or SHARP
(2020,0030)	Requested image size	The width in mm. It is calculated based on pixel spacing.
(2020,0110)	Basic Grayscale Image Sequence	
(0028,0002)	>Samples Per Pixel	1
(0028,0004)	>Photometric Interpretation	MONOCHROME1 MONOCHROME2
(0028,0010)	>Rows	
(0028,0011)	>Columns	
(0028,0100)	>Bits Allocated	8
(0028,0101)	>Bits Stored	8
(0028,0102)	>High Bit	7
(0028,0103)	>Pixel Representation	
(0028,0034)	>Pixel Aspect Ratio	
(7FE0,0010)	>Pixel Data Mandatory	

The SCP will return one of the following status codes for IMAGE BOX SOP CLASS N-SET RESPONSE:

Code	Status	Comment
0x0000	Success	Image Box was successfully set.

5 SOP Specific Conformance for Basic Color Image Box SOP Class

The following DIMSE services are supported:

- N-SET

IMAGE BOX SOP CLASS N-SET REQUEST ATTRIBUTES

The NANORIP provides the following support for the attributes contained in the N-SET DIMSE Service of the Basic Color Image Box SOP Class:

Tag	Name	Value
(2020,0010)	Image Position	
(2020,0020)	Polarity	NORMAL or REVERSE
(2010,0060)	Magnification Type	BILINEAR or BICUBIC
(2010,0080)	Smoothing Type	NORMAL
(2020,0030)	Requested image size	The width in mm. It is calculated based on pixel spacing.
(2020,0110)	Basic Color Image Sequence	
(0028,0002)	>Samples Per Pixel	1
(0028,0004)	>Photometric Interpretation	RGB
(0028,0006)	>Planar Configuration	0 or 1
(0028,0010)	>Rows	
(0028,0011)	>Columns	
(0028,0100)	>Bits Allocated	8
(0028,0101)	>Bits Stored	8
(0028,0102)	>High Bit	7
(0028,0103)	>Pixel Representation	
(0028,0034)	>Pixel Aspect Ratio	
(7FE0,0010)	>Pixel Data Mandatory	

The SCP will return one of the following status codes for IMAGE BOX SOP CLASS N-SET RESPONSE:

Code	Status	Comment
0x0000	Success	Image Box was successfully set.

6 Specific Conformance for Presentation LUT Box SOP class

The NANORIP supports the Presentation LUT SOP class as SCP.

Print SCU may negotiate this support and create a Presentation LUT instance prior to the creation of Film Boxes or Image Boxes. Multiple Presentation LUT instances are supported in an association, but only one instance will be supported for each image.

The SCU shall send either Presentation LUT Sequence or the Presentation LUT Shape. These values are mutually exclusive and the action will result in an error if neither or both are present. The presence of the Presentation LUT instance overrides any data set in the Configuration Information attribute (2010,0150) of the Film Box or Image Box.

The Print Server Management System provides support for the following DIMSE Services:

- N-CREATE
- N-DELETE

Presentation LUT Box SOP class operation for N-CREATE

The Print Server Management System supports the following attributes of the N-CREATE DIMSE Service of the Presentation LUT SOP Class:

PRESENTATION LUT SOP CLASS N-CREATE REQUEST ATTRIBUTES

Attribute & Usage	Tag	Supported Values	Default Values if not sent by SCU or invalid value received
Presentation LUT Sequence	(2050,0010)		None.
>LUT Descriptor	(0028,3002)	The first value is the number of entries in the lookup table. The second value represents the first mapped value of the LUT. The third value shall be 10-16 (which represents the bit depth of each LUT entries.	First value should be the number of LUT entries. Second value should be 0. The third value default is 12.
>LUT Explanation	(0028,3003)		None.
>LUT Data	(0028,3006)		None.
Presentation LUT Shape	(2050,0020)	Enumerated values: IDENTITY, LIN OD, INVERSE	None.

The Print Server Management behavior and specific status codes sent for the N-CREATE of a specific Presentation LUT is described in the following table:

PRESENTATION LUT SOP CLASS N-CREATE RESPONSE STATUS HANDLING BEHAVIOR

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has completed successfully the creation of the Presentation LUT.

Presentation LUT Box SOP class operation for n-DELETE

When a N-DELETE DIMSE service is requested with a specific Presentation LUT SOP instance, the Print Server Management System will not delete the specified Presentation LUT SOP instance as long as there are outstanding references to it. Otherwise, it deletes the specified Presentation LUT SOP instance.

Consistent Presentation of Grayscale Images

The NANORIP supports the DICOM standard (PS 3-14) Grayscale Standard Display Function (GSDF) for Consistent Presentation of Displayed and Printed Images. The Image Consistency is achieved through the support of the Presentation LUT (transforming the image pixels value in to the Standard Presentation P-values) and then Transforming the Image pixel values from the standard Presentation (P-value) space to the Optical Density space. Calibrating the Imager Printer Device to adjust the Printer Imager characteristic curve to fit the GSDF curve. The NANORIP Service Manual describes in details the Imager Printer calibration to the DICOM GSDF curve.

7 Communication Profiles

7.1 Supported Communications Stacks

The NANORIP supports a single network interface. One of the following physical network interfaces will be available depending on installed hardware options:

SUPPORTED PHYSICAL NETWORK INTERFACES

Ethernet 1000baseT
Ethernet 100baseT
Ethernet 10baseT

7.1.1 Additional Protocols

DHCP can be used to obtain TCP/IP network configuration information (e.g. own TCP/IP address, net-mask, default gateway, DNS server, etc.).

If DHCP is not in use, TCP/IP network configuration information can be manually configured.

DNS can be used for address resolution. If DHCP is not in use, the identity of a DNS server can be configured. If a DNS server is not in use, local mapping between hostname and TCP/IP address can be manually configured.

7.1.2 IPv4 and IPv6 Support

This product supports IPv4.

7.2 TCP/IP Stack

NANORIP inherits its TCP/IP stack from the computer upon which it is executed.

7.3 Physical Media Support

NANORIP is irrelevant of the physical medium over which TCP/IP executes; it inherits this from the system upon which it is executed.

8 Extensions/Specialization/Privatization

No extensions defined.

9 Configuration

9.1 AE Title/Presentation Address Mapping

NANORIP configuration is included in the application user interface through the setup dialog.
The Field Service Engineer can configure the IP Address via the Printer Control Panel. A Default AE Titles “NEWAET” are provided.

AE TITLE CONFIGURATION TABLE

Application Entity	Default AE Title	Default TCP/IP Port
PRINTSCP	NANO	11112
STORESCP	NANO	11114

9.2 Parameters

A large number of parameters related to Print Management, Communications and general operation can be configured using the user interface.
The following table shows those configuration parameters relevant to DICOM communication. See the NANORIP Configuration Service Manual for details on general configuration capabilities.

CONFIGURATION PARAMETERS TABLE

Parameters	Configurable (Yes/No)	Default Value
General Parameters		
Max PDU Receive Size	yes	64 KB
Max PDU Send Size (If the receiver supports a smaller Max PDU Receive Size then the Max PDU Send Size will be reduced accordingly for the duration of the Association. Max PDU Receive Size information is exchanged during DICOM Association Negotiation in the Maximum Length Sub-Item of the A-ASSOCIATION-RQ and A-ASSOCIATE-AC)	No	64 KB
Time-out waiting for an acceptance or rejection response to an Association Request (Application level Timeout).	yes	180 s
Maximum number of simultaneous Associations	No	10 /5
Supported Transfer Syntaxes	No	Implicit VR Little Endian
Print Server Management		
Default Print parameters: Contrast, Brightness, Smoothing factor, etc.	Yes	Configurable
Number of times a failed print-job may be retried	No	NA
Delay between retrying failed print-jobs	No	NA

Parameters	Configurable (Yes/No)	Default Value
Printer Bit-depth Configurable: 8 , 10, 12, 16 or 24(RGB)	Yes	8
Custom Format	No	NA
Media Type: Reflective (Paper)	Yes	Paper
Media size Configurable: A6, A5, A4, A3, 8INX10IN, 8_5Inx11IN, 11Inx17IN	Yes	A4
Maximum number of printable pixel matrix per supported Media size	No	See page 44.
Maximum Pixel size	No	0.088 mm (288dpi)
Maximum number of collated films in a film session	Yes	10
Support N-EVENT-REPORT (On/Off for either Printer, Print Job or both).	No	NA
Handling of print jobs when requested Media Type and/or Film Size are not currently installed. The options are: 1. Queue the print job until the film matching the requested Media Type and/or Film Size is loaded. 2. Print on the film currently loaded in the printer.	Yes	Queue the print job until the paper matching the requested Media Size is loaded

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