

Nosil's Quick & Exact X-Ray Dental Phantom Advanced User Manual

3rd Edition



NOSIL DSc
INNOVATION Inc

PATENT PROTECTED

MADE IN CANADA



MODEL: DSP-N5





Table of Content

Instruction for Advanced User	1
Components	2
Physical Description	3
Positioning	5
Measurements on Film	6
Measurements on Digital	7
Examination of Digital Image	8
Analysis for Digital	9
Analysis for Film	11
Dose Standards	12
Image Quality Standards	13
Surevy Form Sample	14
Acceptance & Tracking	15
Standard Compliance & Tracking	17
Appendix 1	18
Appendix 2	21
Certificate Sample	28



Instruction for Advanced User

1

This dental test phantom is designed to assess the image quality produced by intraoral dental X-ray units employing either film or digital detectors. It is simple to position vis-a-vis the x-ray unit, and the information produced is easily interpreted.

It is intended to be used in the acceptance and routine testing of dental X-ray equipment, in the periodic quality control of the whole imaging process, and in system optimization. Direct comparison of the results obtained from different dental units, using different imaging systems, is facilitated through its use.

The phantom is design to be used with normal bitewing exposures between 60 and 90 kVp: the routine settings on the X-ray unit under examination are used in the testing.

The means by which this Image Quality information is obtained depends upon whether the detector used clinically is film or digital.

A single standard bitewing exposure of the phantom is all that is required to produce each quality assessment image. From this exposure of the film, it is possible to evaluate density, contrast, scatter to primary ratio, limiting resolution, and an estimate of image fog or background.

Special holders are designed for film, digital type 1 sensors, and type 2 sensors that are used for children and adults, respectively.

Digital images of the aluminum image quality plate are analyzed for tooth resolution at different contrasts in aluminum, PMMA contrast steps, and combinations of PMMA and Aluminum materials.

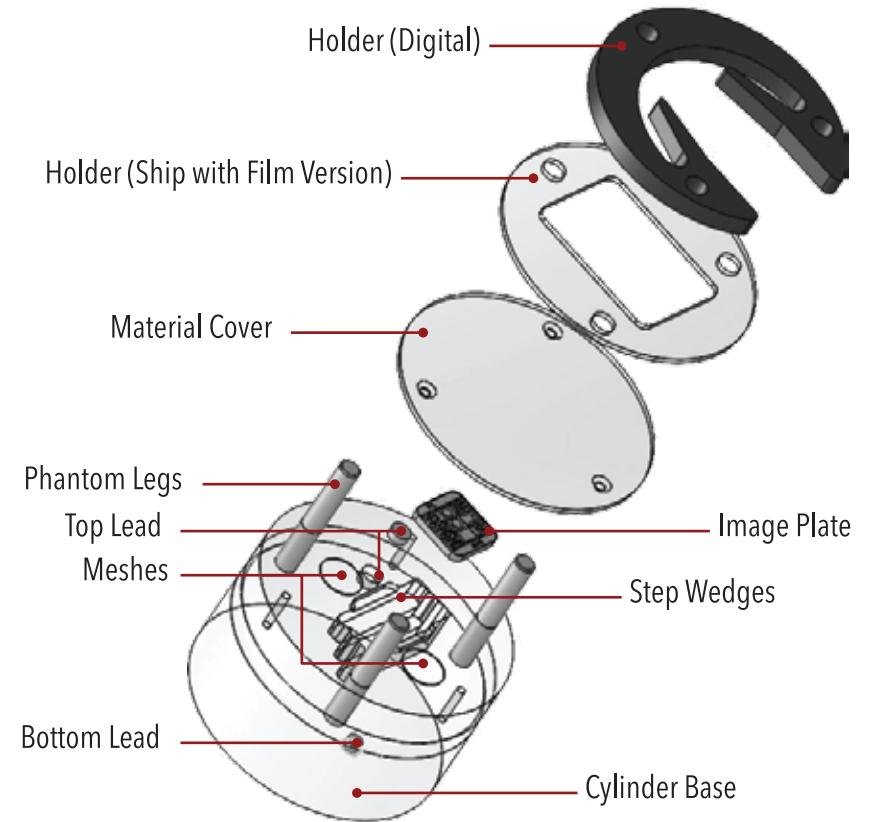
Josip Nosil

Inventor - Dr. Josip Nosil



Components

2



DO NOT disassemble the Phantom by yourself if you are not instructed by an authorized person. This Phantom is not designed for any impact or drop. Always put it back to storage container when you complete a test.

There are total **4** size of dental phantoms:

Regular - **Adult** (age 18 and up)

Pediatric - **Small** (age 5 and under)

Pediatric - **Medium** (age 6-11)

Pediatric - **Large** (age 12-17)



Physical Description

3

The dental test phantom for adult consists of a 76.5 mm diameter by 46.3 mm thick PMMA cylinder, weighing about 350g. Pediatric has various thickness, for small / medium / large size version is 19 / 28.5 / 37 mm.

The thickness of the phantom is chosen to produce an optimum density range at the detector and to simulate the normal X-ray attenuation and spectra of a bitewing X-ray exposure. Separate holders for film, and PSP, digital detectors are provided which attach to the phantom. The digital detector holder is the proprietary invention to hold sensor in place and properly position the imaging detector.

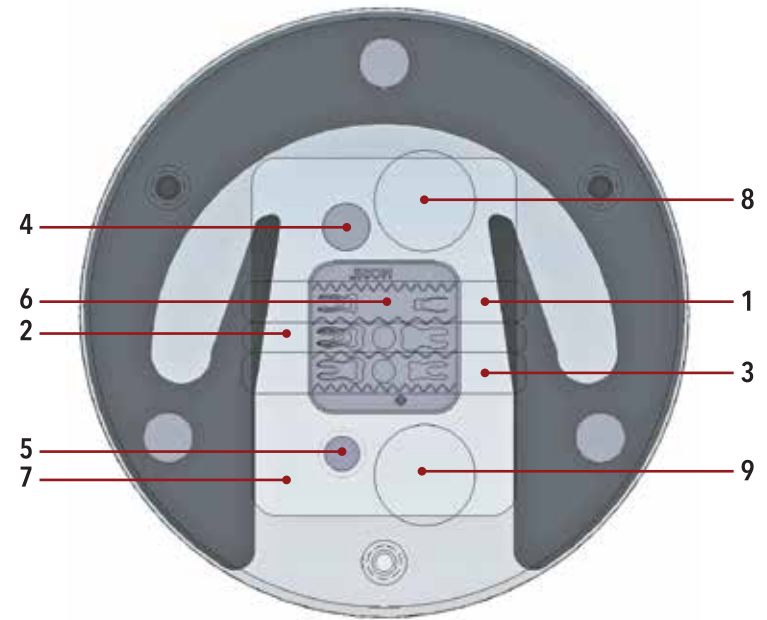
It is easy to slide in digital sensor, which is kept in required position by the pressure of the elastic plastic material. Film holder is a rectangular cut out for the placement of the film. Film is secured by the digital detector holder, which also serves the purpose to keep the film in place when the phantom is inverted. The phantom incorporates a number of embedded structures, which allow a range of tests to be performed.

Densities D on the film receptor or G on the digital receptor are measured by x-rays transmitted through step wedges (as they replace holes in previous designs with six holes, 6 mm in diameter, of different depths), and with lead and Aluminum image quality plate inserts as specified which replacing real human tooth. The previous method of using human tooth does not give consistent and repeatable results. The phantoms are consistent and reproducible.

The PMMA steps are separated and risers of 5.8 mm air (40.5 PMMA), 9.8 mm air (36.5 PMMA), 13.8 mm air (32.4 PMMA), respectively. They can be changed if different contrasts are preferred.

Three circular Aluminum steps are also added to PMMA. The steps are in the middle and are an Aluminum plate (thicknesses of 0.4, 0.5 and 0.9 mm of Aluminum).

4



The seventh density reading is for the total thickness of PMMA.

- 1. Step 5.8 mm air + 40.5 mm PMMA: D or G (5.8 mm air)
- 2. Step 9.8 mm air + 36.5 mm PMMA: D or G (9.8 mm air)
- 3. Step 13.9 mm air + 32.4 mm PMMA: D or G (13.9 mm air)
- 4. 46.0 mm PMMA + 3 mm plate Pb : D or G (PMMA, Pb at detector)
- 5. 3 mm plate lead + 46.0 mm PMMA: D or G (PMMA, Pb at collimator)
- 6. Six Al teeth (0.4, 0.5 and 0.9 mm Al) D or G (tooth1, tooth2...tooth6)
- 7. 46.3 mm PMMA: D or G (Background)
- 8. Resolution mesh 1 R(5.906 lp/mm)
- 9. Resolution mesh 2 R(7.874 lp/mm)

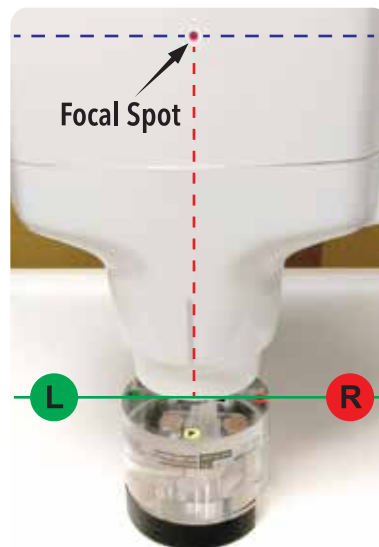
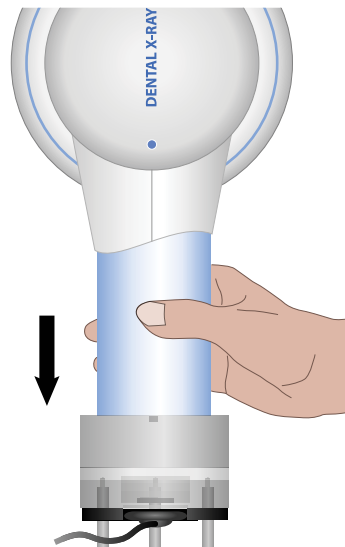
Resolution is assessed behind two copper meshes (150, and 200) specified in line pairs per inch.

			R1	R2		
Mesh lp/inch	100	120	150	200	325	400
Mesh lp/mm	3.947	4.724	5.906	7.874	12.795	15.748
Result	Fail	Poor	Fair	Good	Perfect	Excellent



Positioning

5



The dental phantom is designed for use with intraoral X-rays units with circular or rectangular collimators, and using D, E or F films, PSP or digital detectors. It is placed at the aperture of the collimator.

The X-ray unit may be inverted, or the test phantom may be placed on a flat surface as shown and the tube pointing downward, or having and x-rays coming from a side, with a similar positioning as in patient imaging.

A bitewing X-ray film (enclosed in film holder, its packet size - 32 x 42 mm) slides directly into the holder. Three holes slide in three cylindrical phantom legs, at the output surface of the phantom. If the receptor used is digital, a specially designed digital detector holder (provided) sitting on the top of the film holder is used. Using either holder, the positioning is easily reproducible without the need of identifying marks or ancillary equipment.



Measurements on Film

6

On the exposed and developed film the following measurements are made using a densitometer and magnifying glass:

The ninth density reading is for the total thickness of PMMA.

D1: Step 5.8 mm air + 40.5 mm PMMA.

D2: Step 9.8 mm air + 36.5 mm PMMA.

D3: Step 13.9 mm air + 32.4 mm PMMA.

D4: 46.0 mm PMMA + 3 mm plate Pb, (with the Pb next to the detector).

The measured density is that of base plus fog.

D5: 0.3 mm plate lead + 46.0 mm PMMA, (with the lead on the entrance surface). The measured density is that of pure scatter from the surround plus base plus fog, with no contribution from the primary radiation.

D6: Step 5.8 mm air + 40.5 mm PMMA + Al.

D7: Step 9.8 mm air + 36.5 mm PMMA + Al.

D8: Step 13.9 mm air + 32.4 mm PMMA + Al.

D9: 46.3 mm PMMA primary plus scatter plus base plus fog.

R1: Resolution mesh 1 at 5.906 lp/mm (150 lp/inch).

R2: Resolution mesh 2 at 7.874 lp/mm (200 lp/inch).

T1: Six Al teeth (0.4, 0.5 and 0.9 mm Al). Mark visible tooth elements.



Measurements on Digital

7

(Also apply on PSP (Photo Stimulated Phosphor), wired and wireless CCD)

On the exposed and developed film the following measurements are made using a computer software to analyze:

The ninth gray level reading is for the total thickness of PMMA.

G1: Step 5.8 mm air + 40.5 mm PMMA.

G2: Step 9.8 mm air + 36.5 mm PMMA.

G3: Step 13.9 mm air + 32.4 mm PMMA.

G4: 46.0 mm PMMA + 3 mm plate Pb, (with the Pb next to the detector).

The measured density is that of base plus electronic noise.

G5: 0.3 mm plate lead + 46.0 mm PMMA, (with the lead on the entrance surface). The measured density is that of pure scatter from the surround plus base plus electronic noise, with no contribution from the primary radiation.

G6: Step 5.8 mm air + 40.5 mm PMMA + Al.

G7: Step 9.8 mm air + 36.5 mm PMMA + Al.

G8: Step 13.9 mm air + 32.4 mm PMMA + Al.

G9: 46.3 mm PMMA primary plus scatter plus base plus electronic noise.

R1: Resolution mesh 1 at 5.906 lp/mm (150 lp/inch).

R2: Resolution mesh 2 at 7.874 lp/mm (200 lp/inch).

T1: Six Al teeth (0.4, 0.5 and 0.9 mm Al). Mark visible tooth elements.



Examination of Digital Image

8

The computer-displayed images of the 9 test areas are examined by a suitable computer program which determines the bit level (0-256) of the pixels in a 4x4 mm or a selected area of the image, and averages them. These gray level data can then be interpreted in a similar way as density values to those derived for film.

The software to analyze the gray level that we recommended is ImageJ. ImageJ is a public domain Java image processing program inspired by NIH Image. It is a cross platform downloadable application, on any computer with a Java 1.4 or later virtual machine. Supports Windows, Mac OS, Mac OS X and Linux. To download this application and user guide please visit ImageJ website at <http://imagej.nih.gov/ij/> for more information.

Before starting to use ImageJ, you must to know:

1. How to open your image file.
2. How to select a round shape area not an oval shape with a certain size.
3. How to open Histogram window.
4. Analyze size must remain the same (ROI of pixels).
5. How to move selected area around the image.

Spatial resolution is determined from visual and computer-scanned examination of the images of the 2 copper mesh graticules in two orthogonal directions, using a magnifying glass for film or other image processing for digital image.



Each phantom is labelled as above. Tube axis, position of the focal spot and anode, is not critical. Label helps with consistency of positioning. Letter A and C are below the Anode and Cathode side of the x-ray tube.



Analysis for Digital

9

Contrast scale: Maximum range given by G3/G9

Contrast between steps: Comparison between G3, G2, G1, and G9

Contrast between AI steps: Comparison the ratio between G6, G7, G8 by G9

lp/mm Limiting Resolution: The finest mesh that can be seen in both orthogonal directions.

Appropriateness of the technique factors used. G9 should be constantly.

Scatter to primary ratio: given by $(G5 - G4) / (G9 - G5)$

The protocol described above can be used with all dental units. The phantom is positioned at the end of the collimator. The direction of the x-ray beam is immaterial. The phantom is useful as a departmental quality assurance system where it can be employed to check techniques, the optimal operation of the X-ray units, and film processing.

This manual describes how to perform the necessary tests. It does not comment on the results of the tests or how to interpret them. The visual judgement of the limiting spatial resolution and the number of discernible lines is, by nature, very subjective.

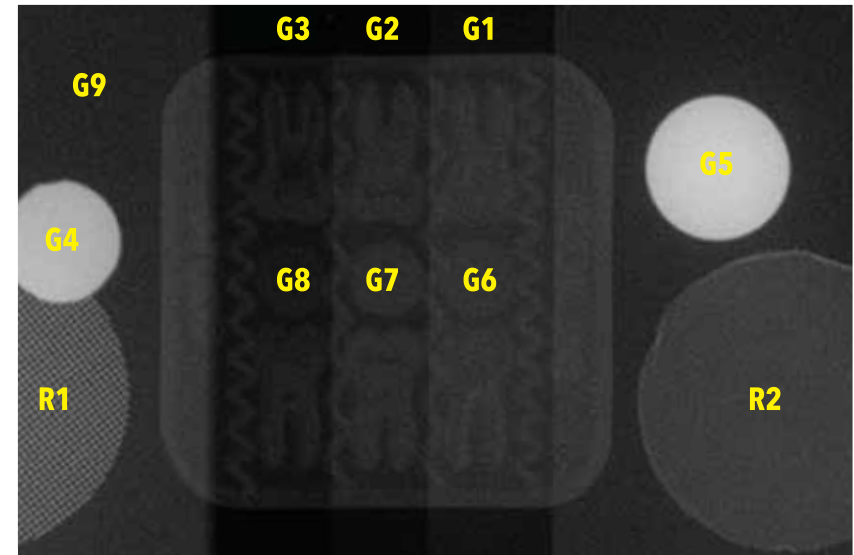
Some criteria for 'pass' and 'fail' used arise from the results of the NEXT (Nationwide Examination of X-ray Trends) of the FDA in the USA. In this program the performance of a large number of medical and dental x-ray units was examined over a period of years. It was found that, while the values of significant measured parameters (eg., Entrance Skin Exposure, Half Value Layer, High and Low Contrast Range, and Detail Resolution) varied widely, most units produced values close to a median for each parameter. A unit, which produces values differing widely from the median, is considered to have 'failed', and a recommendation is made for corrective measures.

In short, if, in examining a unit, a parameter has been measured and the result found to be widely divergent from the NEXT median value, it is reported it as a 'failure', and a recommendation is made that the unit be serviced in order to bring it into the acceptable range.

Example of Calculations

The following technique was used under ImageJ computer software, please refer page 8 to know more detail. This is not a tutorial about how to use ImageJ. We merely point out that ImageJ function is used here.

10



You must have your own digital image opened by ImageJ, it looks like above image without those yellow guiding texts.

1. Select a round shape area to set sampling size within the circle of G7.
2. Open Histogram window, click on Live.
3. Move the round shape area to analyze Mean values.
4. Starting from G1 to G9, and R1, R2, write it down on our form.
5. Write extra StdDev values from R1 and R2 only on our form.
6. If you have our Microsoft Excel sheet, calculation formula has been programmed, you could see the result right away after entered.
7. Test done.



Analysis for Film

11

Using transmission densitometer (eg. X-Rite 331) or equivalent meter to reading the value for calculation.

Contrast scale: Maximum range given by D3/D9

Contrast between steps: Comparison between D3, D2, D1, and D9

Contrast between AI steps: Comparison the ratio between D6, D7, D8 by D9.

Limiting Resolution: The finest mesh that can be seen in both orthogonal directions.

Appropriateness of the technique factors used. D9 should be close to 1.5

Scatter to primary ratio: given by $(D5 - D4) / (D9 - D5)$

Calculation of comparison is based on contrast definition:

$$\text{Contrast} = (f_t - f_b) / f_b$$

1. Use your reading meter starting from G1 to G9, and R1, R2.
2. You could print out our survey form to keep tracking your testing result by write down all readings.
3. Test done.



Dose Standards

12

(From NCRP Report No. 172, page 69 of 6.4.1.3)

NCRP recommends an achievable dose of 1.2 mGy for intraoral radiography. This is the median dose for E-F film in the Michigan survey and is higher than for digital systems.

This DRL value is intended to be one standard, regardless of the type of imaging receptor used by the dentist; whether D- or E-F speed film, or storage phosphor, charge-coupled device, complementary metal oxide semiconductor digital systems. It is recognized, and intended, that meeting this standard will most likely require dentists in the United States who use D-speed film to convert to E-F-speed film. Such a conversion requires only reducing the exposure time or milliamperage by half. The kilovolt peak and processing conditions are otherwise unaffected. This conversion carries immediate patient benefits without loss of diagnostic quality (Ludlow et al., 2001b).

It is the position of the American Dental Association that dentists should use E-F-speed film (ADA, 2006). This position is also held by NCRP (2003) and the American Academy of Oral and Maxillofacial Radiology (White et al., 2001). E- and F-speed films are also used widely in Europe and recommended by the European guidelines on radiation protection in dental imaging (EC, 2004).



Image Quality Standards

13

(From CRCPD Publication E-03-6-a, republished August 2007, page 32 and NCRP Report No. 172, page 69 of 6.4.1.3)

A number of visible intraoral high contrast meshes should at least 150 Lines/inch. No meshes are visible - Red/Fail. Only 150 mesh is visible - Yellow/Pass (lines only one circle of the meshes are visible). Both 150 and 200 meshes are visible - Green/Pass (lines are visible in both directions in both circles containing meshes).

Diagnostic Reference Levels (DRL) have been set at approximately the 75th percentile of measured phantom data. This means that the procedures performed at 75% of the institutions surveyed have exposure levels at or below the DRL. Archivable Reference Levels (ARL) represent the median of the measure distribution.

Index	DRL	ARL
G3:G9	0.72	0.81
G1:G2	0.16	0.19
G1:G9	0.40	0.47
G2:G3	0.09	0.11
G2:G9	0.60	0.67
G6:G9	0.95	0.98
G7:G9	0.85	0.92
G8:G9	0.45	0.50
Average Contrast	0.26	0.29
Min. Grey Level	13	10
Max. Grey Level	211	219
Scatter/Primary Ratio	0.36	0.29

See appendix 2 for more detail .



Surevy Form Sample

14

We have a survey form prepared for our clients, see appendix 1 for sample. It helps you collect your X-ray equipment analyze reading and calculation result. Ensure your equipments is in good condition all the time.

You can download this form in PDF or XLS format from our website. In our XLS format, it includes formula that gives you test result instantly.





Acceptance & Tracking

15

To maintain X-ray unit in good condition and quality control, please obtain the unit acceptance testing values and compare with every test you have done.

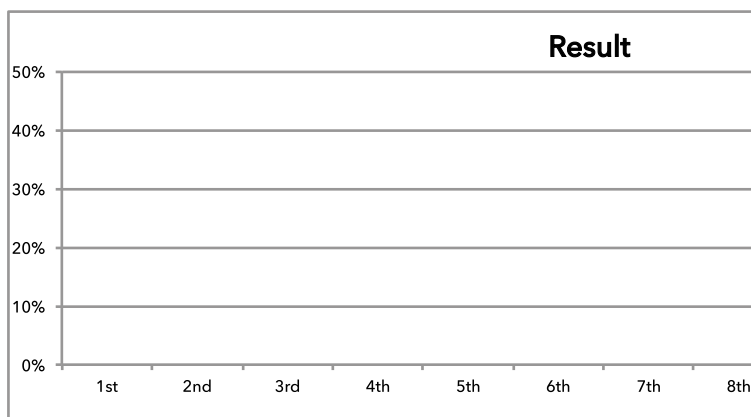
The following 3 values should be tracked. Ensure they are under the allowance range. Otherwise contact a certified technician or manufacturer to perform a service visit for repair or calibration. You could find these calculated values on the bottom of our survey form.

1. Scatter to primary ratio with error in $\pm 5\%$.

You could plot this value time to time to ensure your value is in allowance range, the template as seen in below can be found in our Microsoft Excel survey form.

Acceptance testing value
Accepted range to above $\pm 5\%$

Routine test	1st	2nd	3rd	4th	5th	6th	7th
Result							

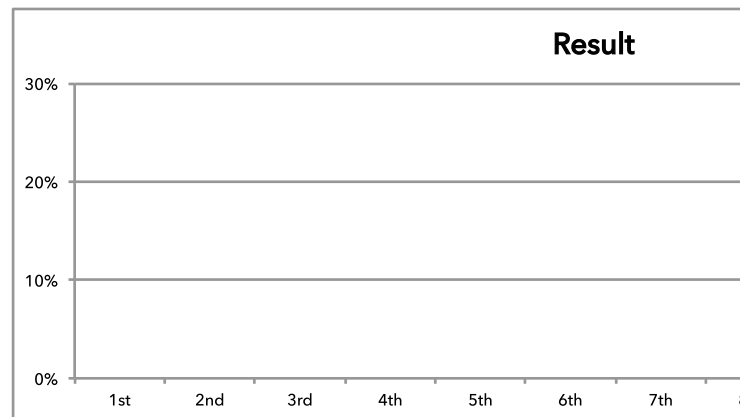


2. Average contrast with error in $\pm 10\%$.

You could plot this value time to time to ensure your value is in allowance range, the template as seen in below can be found in our Microsoft Excel survey form.

Acceptance testing value
Accepted range to above $\pm 10\%$

Routine test	1st	2nd	3rd	4th	5th	6th	7th
Result							



3. Grey level maximum error less than the specification of 256 levels.

Either one out of these 3 value has exceed allowance range, which means this unit need your attention, service may required. Before the test value back to the range, you may not using this unit.

16



Standard Compliance & Tracking

17


Analysis of dental phantom result through a week period.

Parameter	Mon	Tue	Wed	Thu	Fri
G3:G9					
G1:G2					
G1:G9					
G2:G3					
G2:G9					
G6:G9					
G7:G9					
G8:G9					
Avg. Contrast					
Min. Grey Level					
Max. Grey Level					
Scatter/Primary Ratio					



Appendix 1

18



Intraoral Dental Phantom

Medical Physics Inspection Report - Office

1 - Facility Data

Date	March 26, 2015	Facility Type	<input type="checkbox"/> Film X-Rays <input checked="" type="checkbox"/> Digital Systems	ID#	21
Licensee / Proprietor Name	Sample client				
Address	Client address				
Detector Type	<input type="checkbox"/> Film <input checked="" type="checkbox"/> CCD <input checked="" type="checkbox"/> CMOS <input type="checkbox"/> CR(PSP) <input checked="" type="checkbox"/> Pan <input type="checkbox"/> Ceph <input type="checkbox"/> CBCT				
Number of Dental Units	6	Intraoral	1	Pan.	0
		Ceph.	0	CBCT	
Office Colour	Pass				

2 - Protocols and Policies

The result of the cumulative exposure to radiation is well known and documented. As a result organizations such as the World Health Organization (WHO), the FDA in the U.S.A., Health Canada, the International Atomic Energy Agency (IAEA) on Radiation Protection in Medicine have the specific purpose of identifying and addressing issues arising in radiation protection in medicine. They have all set standards and protocols for application to the X-ray Clinics and Diagnostic Imaging Departments for some time now. However one key area is just now being recognized as requiring similar attention. The dental X-ray impact on patients and users is now recognized with standards and protocols being established and many programs are currently under development. Dental X-ray is common and applicable to all age groups including pediatric patients. What is being established in your country is a program requiring monthly radiation Quality Assurance and annual planned maintenance inspection.

Findings:
Your country has the opportunity to join keep current with trends in the World to implement monthly Quality Assurance protocols and annual planned maintenance. Such a program will support low radiation dose, consistent high image quality and diagnosis, while providing the dentists with accurate and timely information to treat their patients. It is in everyone's best interests to promote a program that has such worldwide attention and will result in patient safety and diagnostic dental protocols.

3 - Test Results

Unit Type	Siemens / Heliodont MD 1994	UID#	113	Passed	12	Failed	1	Total	13
Unit Type	Siemens / Heliodont MD 1994	UID#	114	Passed	12	Failed	1	Total	13
Unit Type	Siemens / Heliodont MD 1994	UID#	115	Passed	12	Failed	1	Total	13
Unit Type	Belmont / Belray 096 1998	UID#	186	Passed	11	Failed	2	Total	13
Unit Type	Progeny / Dental JB-70	UID#	313	Passed	11	Failed	2	Total	13
Unit Type	Progeny / Dental JB-70	UID#	314	Passed	11	Failed	2	Total	13
Unit Type	Cranex Tome Soredex	UID#	246	Passed	7	Failed	0	Total	7
Unit Type		UID#		Passed		Failed		Total	
Unit Type		UID#		Passed		Failed		Total	
Unit Type		UID#		Passed		Failed		Total	

(Brand, Description, etc) (ID Number) (Total) (Total) (Total)

4 - Evaluation of QC

Operational	Use proper and safe exposure position for all units, especially for Panoramics unit.
Digital QC	To be implemented according to new regulation.
X-ray Unit QC	Regular calibrations and maintenance to be implemented.

5 - Approval and Contact

Approved by	Josip Nosil	Authorised by	Sample person
Contact	Sample person		

Nosil DSc Innovation INC., © 2015
V3 - 2015/09/17

Phantom System and Methods for Diagnostic X-Ray Equipment
Protected by U.S. Patent No. 8,708,562 and Patent Pending

Survey form sample - Facility Data





**Intraoral Dental Phantom
Medical Physics Inspection Report - UID#113**

1 - X-Ray Unit Data

Room/Operator Name	Room 2		Inspection Date	March 26, 2015
X-Ray Unit	Siemens / Heliodont MD 1994		Sensor	Gendex GXS-700
Weekly X-Ray Exposure #	ID#	21	<input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F <input checked="" type="checkbox"/> CCD <input type="checkbox"/> CMOS <input type="checkbox"/> PSP <input type="checkbox"/> Pan <input type="checkbox"/> Ceph	
Recommended Tech.	70 kVp/	7 mA/	0.1 - 0.16 sec	
Technique Used	70 kVp/	7 mA/	0.06 sec	

2 - Unit Condition

1. Operator Distance and Safety	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
2. Performance (kV, mA, Time, HVL, etc)	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	>=5% kVp
3. Leakage Radiation	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<= 0.25 mGy/hr @ 1m
4. Image Analysis	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
5. Beam Limiting Devices (Length & Type)	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	>=20cm @ =>60 kV
6. Beam Alignment Assessment (X-ray Field Size)	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	Collimation <6.3cm
7. Patient and Public Protection (Lead Apron, Thyroid, etc)	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
8. Radiation Dose to Patient	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	1.6 mGy (1.8 for Film)
a. Dose within DRL Limits	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	1.2 mGy (1.6 for Film)
b. Dose within AD Limits	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
9. Unit Assembly Evaluation (X-ray tube is stable and balanced)	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
10. Radiation Dose to Operator (Staff)	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	Dose <= 1 μSv/yr
11. Exposure technique used as recommended	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	
12. Operator Digital QC	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	See page 2

3 - Medical Non-compliance Action Table

Risk Level	Non-Compliance	Level	Corrective Date and Signature
<input type="checkbox"/> HIGH		Fail	
<input type="checkbox"/> MEDIUM	Provide weekly number of X-ray exposures	Correct	
<input checked="" type="checkbox"/> LOW		Pass	

4 - Subsystem Image Quality Evaluation

Average Contrast	Excellent	G1:G2	Excellent	G7:G9	Pass
Min. Grey Level	Excellent	G1:G9	Pass	G8:G9	Excellent
Max. Grey Level	Pass	G2:G3	Excellent	High Resolution	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Scatter/Primary	Excellent	G2:G9	Excellent	Artifact	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
G3:G9	Excellent	G6:G9	Excellent	Total Fails	0 / 14

5 - Comments

Survey form sample - Report (1/3)



**Intraoral Dental Phantom
Medical Physics Inspection Report - UID#113**

6 - Mechanical Assembly Evaluation

Mechanical Stability	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	Comments
Electrical Stability	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	

7 - Performance Measurement Results (To be interpreted by Qualified Medical Physicist)

Calibration Equipment Used		<input checked="" type="checkbox"/> Unfors 583L (R/F Detector #1)	<input type="checkbox"/>		
Settings/Technique	kVp	70	70	70	70
	mA	7	7	7	7
	sec	0.060	0.060	1.000	0.040
	ms	/	/	/	/
	pulses/s	/	/	/	/
	Dose (mR)	71.3	71.4	121.1	46.5
Reproducibility	Dose Rate (R/min)	71.0	71.1	72.7	69.8
	kVp Accuracy	67.4	67.5	67.4	66.7
	Time (ms)	60.1	60.1	99.8	39.9
HVL @ 25cm from cone tip		(Average Adult)	(Average Adult)	(Large Adult)	(Child - baby teeth present)
		0.0mm	1.0mm	2.0mm	3.0mm

8 - Radiation Safety

<input type="checkbox"/> mR/hr	Operators Position	R Side	B Side	L Side
<input type="checkbox"/> μSv/hr	(i)	(ii)		

Fail if >7.5 μSv/hr or >0.75 mR/hr

9 - Comments on Performance

Survey form sample - Report (2/3)



**Intraoral Dental Phantom
Medical Physics Inspection Report - UID#113**

10 - Image Information

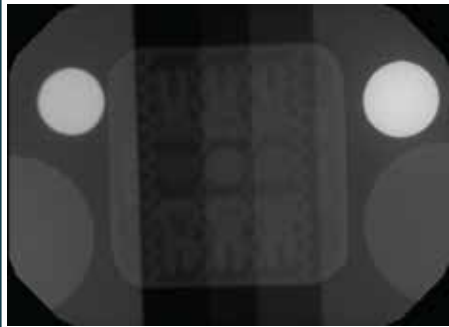
Image Format	<input type="checkbox"/> JPEG	<input checked="" type="checkbox"/> BMP	<input type="checkbox"/> DICOM	<input type="checkbox"/> GIF	<input type="checkbox"/> PNG	Dose	0.60 mCy
Sensor Size	35.9	25.8	Image Size	1842	1324	Technique Used	
Actual Size	35.53	25.54	AI Plate Size	985	985	70 kVp/	7 mA/ 0.06 sec
	<small>mm (x)</small>	<small>mm (y)</small>		<small>px (x)</small>	<small>px (y)</small>		

11 - Image J Calculations

G1	27.012	G2	12.245	G3	0.337	G4	179.792	G5	211.870
G6	59.552	G7	51.862	G8	30.839	G9	51.922	R1	77.094
R2	74.384	Maximum Visible	<input type="checkbox"/> 150 lp/inch	<input checked="" type="checkbox"/> 200 lp/inch	Image File Size	2.4MB			

12 - Calculation Results

G3:G9	0.99
G1:G2	0.28
G1:G3	0.51
G1:G9	0.48
G2:G3	0.23
G2:G9	0.76
G4:G9	1.15
G7:G9	1.00
G8:G9	0.59
R1 Dev	4.31
R2 Dev	2.68



13 - Physicist Results

Min Grey Lvl	0.337
Max Grey Lvl	211.870
Error @ Min	0.000
Error @ Max	0.172
Ave Contrast	0.514
Scatter Ratio	0.201

14 - Comments on Image Quality

Nosil DSc Innovation INC., © 2015
V3 - 2015/09/17

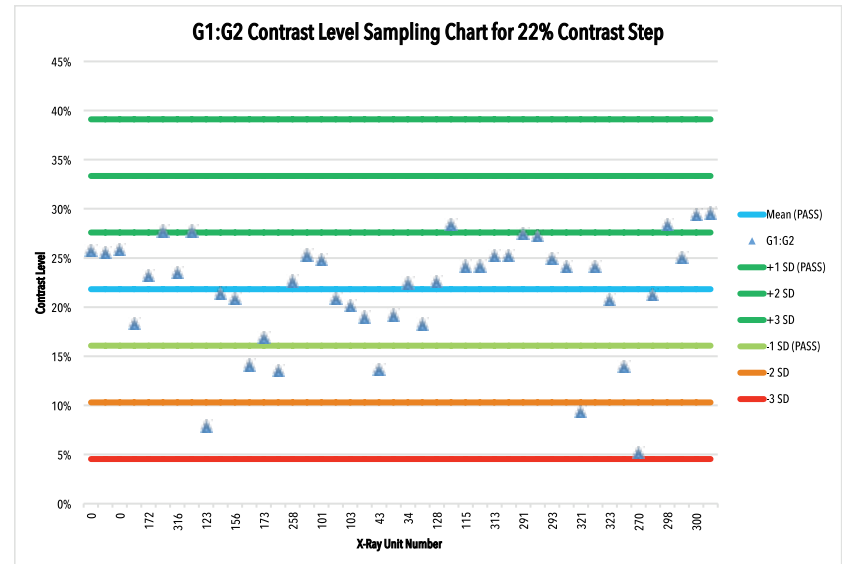
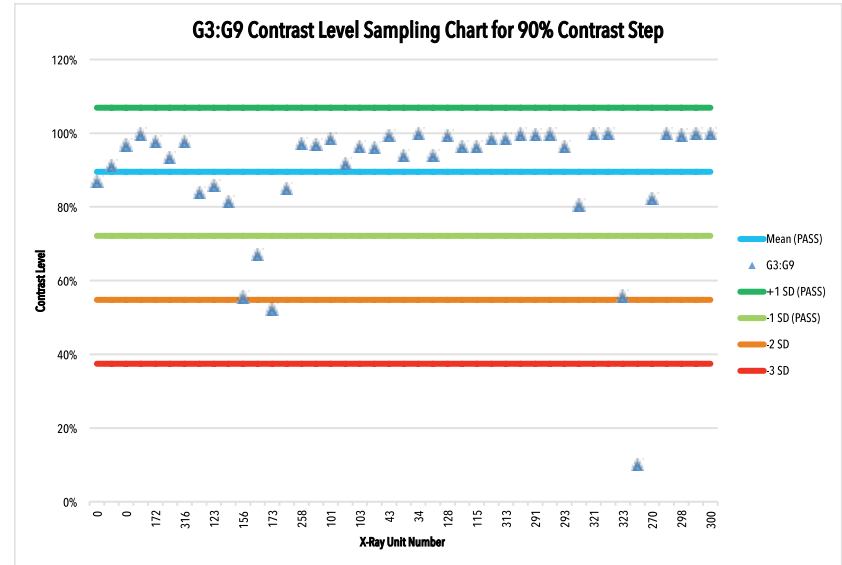
Phantom System and Methods for Diagnostic X-Ray Equipment
Protected by U.S. Patent No. 8,708,562 and Patent Pending

Survey form sample - Report (3/3)

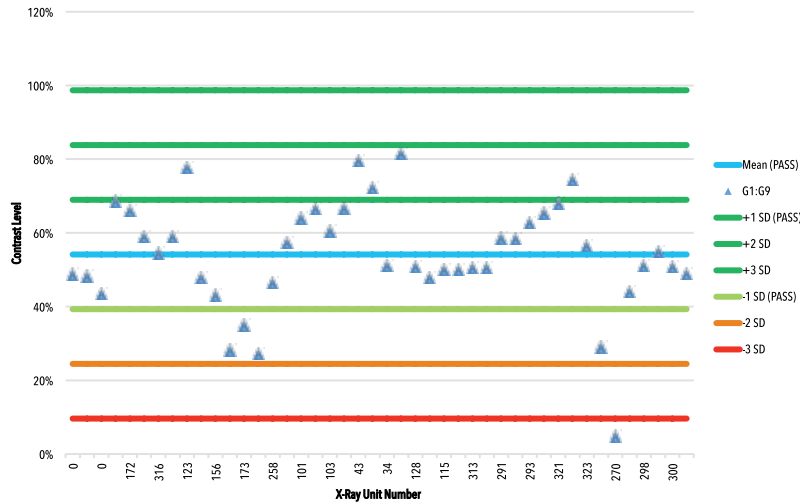


Appendix 2

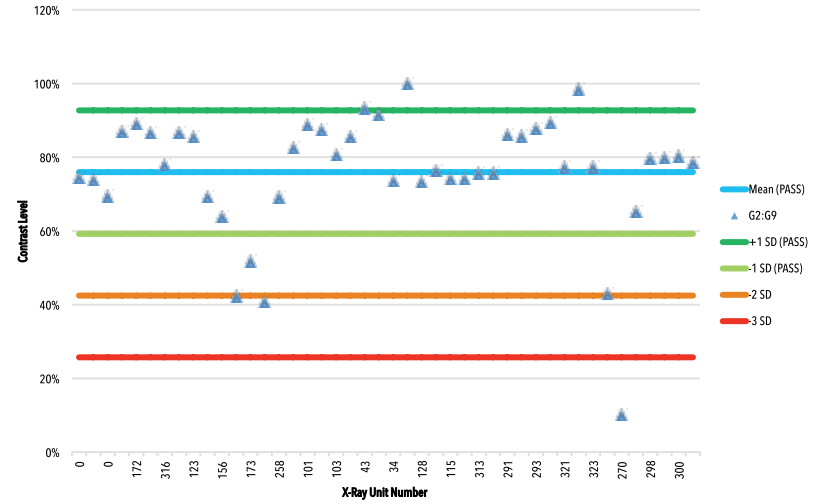
Standards calculation sampling



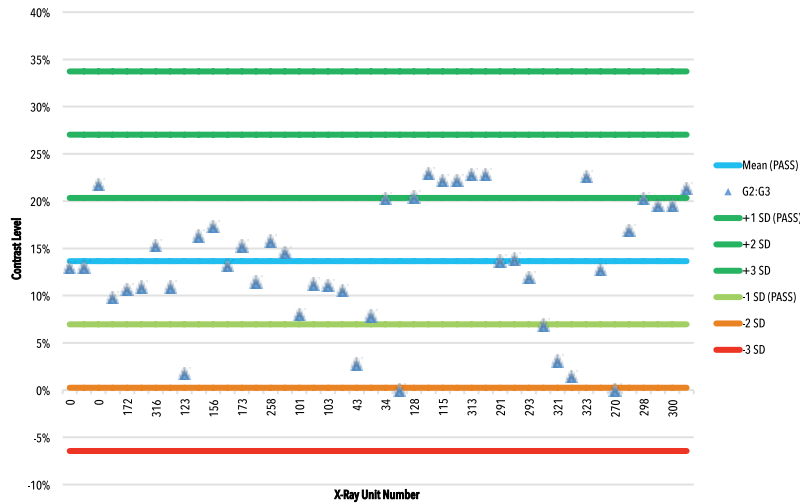
G1:G9 Contrast Level Sampling Chart for 54% Contrast Step



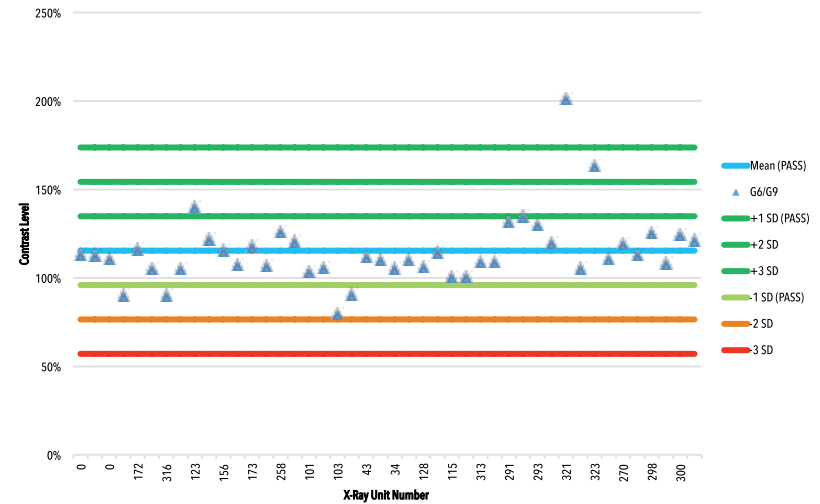
G2:G9 Contrast Level Sampling Chart for 76% Contrast Step



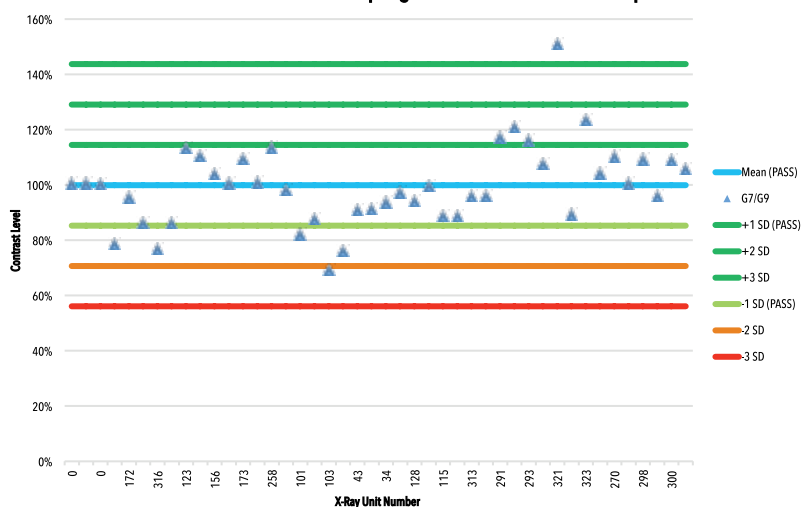
G2:G3 Contrast Level Sampling Chart for 14% Contrast Step



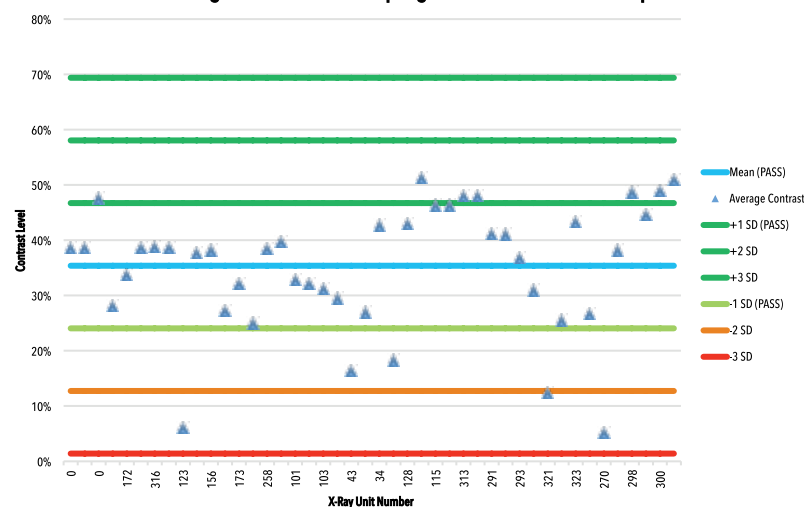
G6:G9 Contrast Level Sampling Chart for 115% Contrast Step



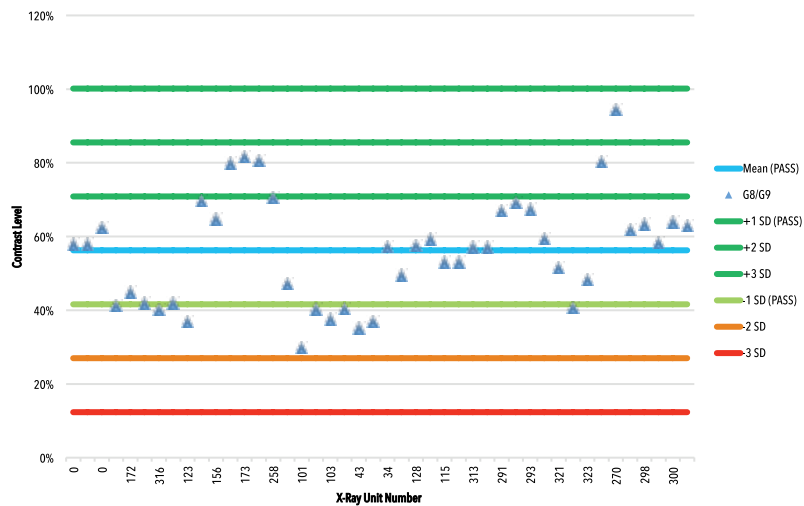
G7:G9 Contrast Level Sampling Chart for 100% Contrast Step



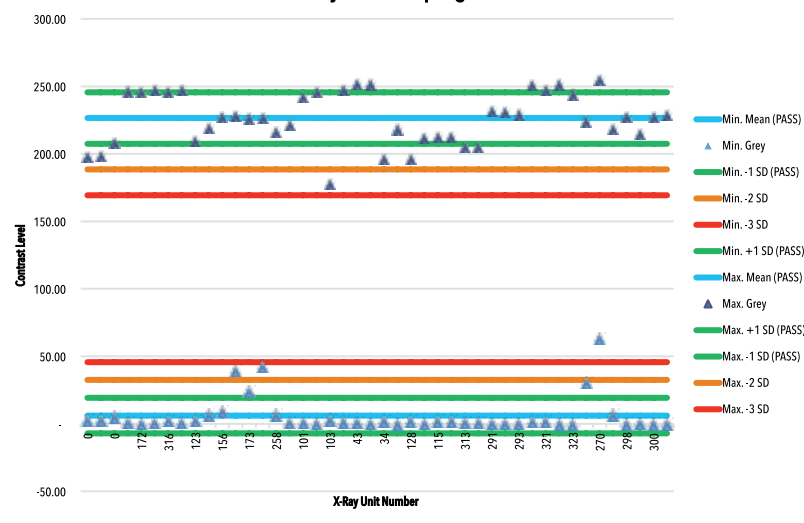
Average Contrast Level Sampling Chart for 35% Contrast Step

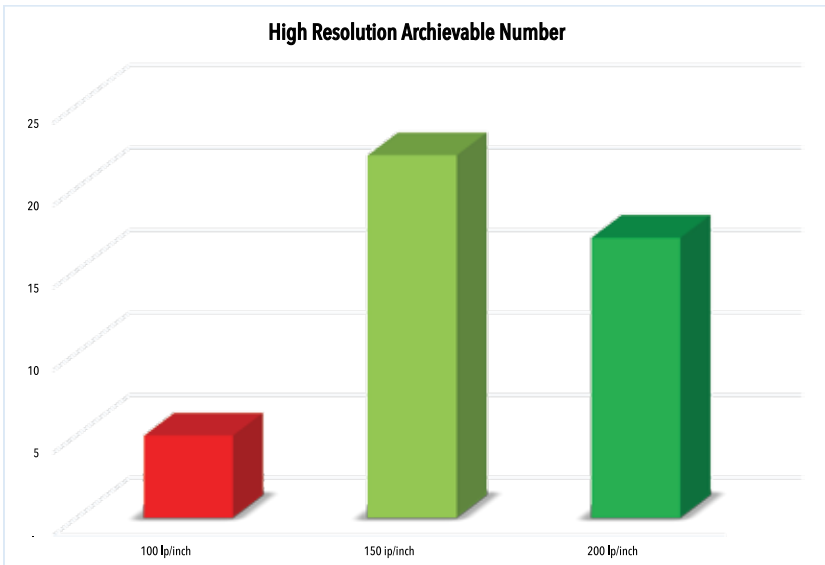
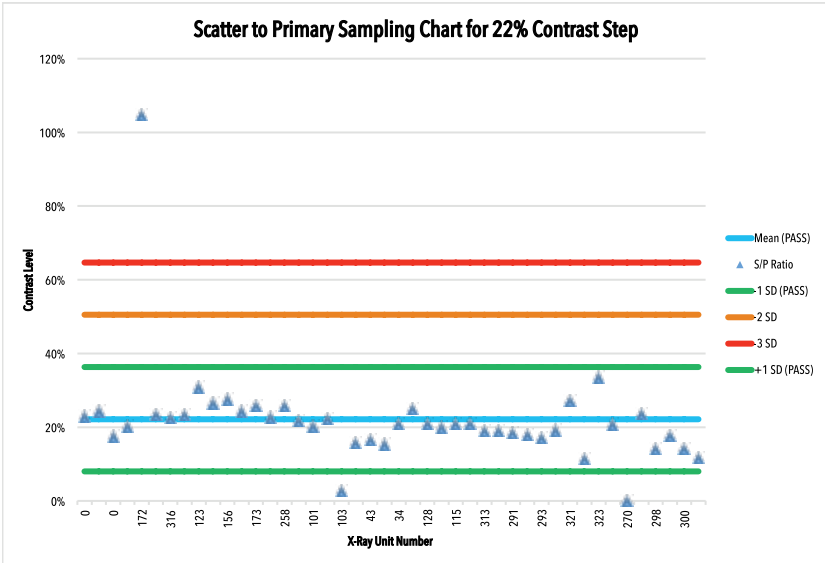


G8:G9 Contrast Level Sampling Chart for 56% Contrast Step



Grey Level Sampling Chart





Certificate Sample

If you wish to obtain the certificate as shown below, please send all your X-ray unit Phantom images to certificate@drnosil.com or certified image quality surveyer for evaluation. If image quality meets acceptable standards, you will receive a certificate as per your Phantom purchase contract.

...CERTIFICATE OF PARTICIPATION...

2016-01-04-0001-A

Presented by Nosil DSc Innovation Inc.

DENTAL X-RAY QUALITY PROGRAM

The following facility's dental x-ray units are measured and benchmarked on a regular basis

... Your Company Name ...

Valid to January 31, 2016

Certified Dental Surveyer

Date