

Diagnostic Imaging Specialists Corporation

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DISC

Diagnostic Imaging Specialists Corp

Instruction Manual for DISC QA Radchex Meter

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**KONFORMITAETSERKLAERUNG
DECLARATION OF CONFORMITY
DECLARATION DE CONFORMITE**

WE,

**DIAGNOSTIC IMAGING SPECIALISTS CORPORATION
163 ST. MALO STREET, ST. MALO, MANITOBA
CANADA R0A 1T0**

- **erklaren, dass die Produkte**
- **declare, that the products**
- **declarons, que les produits**

DISC QA Radchex System consisting of the following:

Model RCX-QA (Radiographic Cassette)

- **auf die sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt:**
- **to which this declaration relates are in conformity with the following standard:**
- **auquels se referent cette declaration sont conforme a la norme:**

EN61010-1 Safety requirements for electrical equipment for measurement control and laboratory use

Exigences de securite pour de l'equipement electronique afin de controller les mesures et pour l'utilisation du laboratoire

- **Gemass den Bestimmungen der Niederspannungsrichtlinie:**
- **following the provisions of the low voltage Directive:**
- **conformement aux dispositions de la Directive basse tension:**

73/23 EWG und 93/68 EWG

October 5, 2002

QA Radchex Measuring Instrument

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Theory of Operation

The QA Radchex meter measures the X-ray exposure at the image detector plane and calculates the following three values:

1. The manufacturer's 'exposure index value' for their reference factory plate reader.
2. CRLU (Computed Radiography Light Units): This value is directly proportional to the light produced by an exposed CR imaging plate when scanned by laser light in the scanner.
3. Relative Speed: This is the 'relative speed' compared to a 400 speed film/screen system (2000/CRLU).

Getting Started

1. To turn on the meter: Press and Release “**Power/Reset**”. LCD displays each CR manufacturer for 10 seconds.
2. To select a CR manufacturer: Press and Release “**Power/Reset**” to “toggle/scroll” through manufacturers until your manufacturer is shown. Wait 10 seconds to ‘lock in’ your manufacturer. Use “Generic” for no manufacturer. The LCD will then display “Waiting for Reset”. (*NOTE: The next time the meter is used, it will default to this manufacturer.*)
3. Check battery level. If level is “Low”, plug in for ½ hour or longer.
4. To make meter ready for exposure: Press and release “**Power/Reset**”. The LCD will display “**Ready for Exposure**”. Take an exposure and the LCD will display the three values. Pressing and releasing “**Power/Reset**” resets meter and the LCD displays “**Waiting for Reset**”.
5. To Turn off meter: Press and hold “**Power/Reset**” until LCD displays “**Power Down**”, then release “**Power/Reset**” button.
6. If meter is not used for 10 minutes, meter will turn off.

Operating Instructions

NOTE: The following procedures assumes that the X-Ray machine and Plate Reader have been calibrated and ‘calibration reference values’ have been established; to establish ‘calibration reference values’ follow the procedures below shortly after the X-Ray machine and Reader have been calibrated.

X-Ray System Calibration Consistency Testing (one exposure per bucky)

1. Center and lock the 24 x 30 cm (10" x 12") Radchex cassette in Table Bucky or Chest Bucky so that the 30 cm (12") dimension is from 'head-to-foot' and the 24 cm (10") dimension is from 'left to right'; When LCD displays '**Ready for Exposure**', close the bucky. (*Figure 1*)

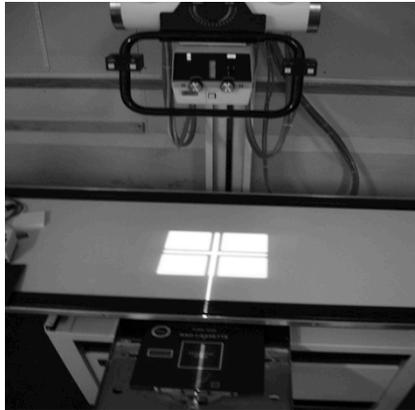


Figure 1

***NOTE:** For chest bucky, attach the 2 self adhesive 'Velcro' strips (included) to the top or rear side of the Chest Bucky. The 'copper filter' Velcro straps attach to the adhesive Velcro strips and 'hangs' the copper filter on entrance side of the Bucky.*

2. Place the 24 x 30 cm (10" x 12") copper filter on the table top or chest bucky front surface and center light/radiation field to filter and Radchex cassette; make sure the copper filter is oriented the same way as the Radchex cassette. Make certain that the radiation field exposes the entire Radchex cassette. (*See Figure 2*)

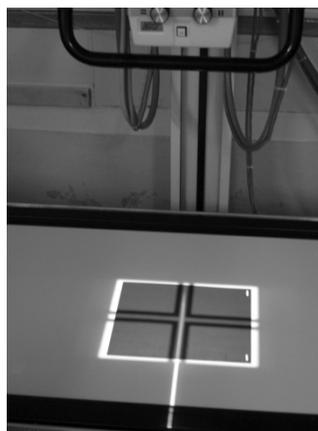


Figure 2

3. Select AEC mode on X-Ray machine; select all three chambers; and select zero density.
4. Select 80 kVp on the X-Ray machine (or as close as possible to 80kVp), (**NOTE:** Use 80 kVp for all the future tests.)
5. Take an exposure then remove the Radchex cassette from Bucky.
6. Read and record 'CRLU' value from the LCD screen onto the Data Sheet and plot value on CRLU graph.
7. Read and record mAs from the X-Ray machine onto the Data Sheet and plot value on mAs graph.
8. If the X-Ray machines' AEC calibration has not drifted, the CRLU value will not change from week-to-week; if the X-Ray tube output has not drifted, the mAs value will not change from week-to-week.

Plate Reader/Scanner Consistency Testing (two exposures)

It is recommended that a "test" imaging cassette be selected and used for this test. The same "test" cassette should always be used and not used for day-to-day imaging.

1. Place Radchex cassette on the Table Top with a 100 cm (40") tube to cassette front distance, center the light/radiation field to the Radchex cassette, and adjust the light/radiation field to about 5 cm (2") larger than the cassette. (*Figure 3*)



Figure 3

2. Reset meter and wait until LCD reads “**Ready for Exposure**”.
3. Center a 24 x 30 cm (10” x 12”) copper filter on the Radchex cassette top surface. (*Figure 4*)



Figure 4

4. Select Manual Mode on the X-Ray machine.
5. Select 80 kVp on the X-Ray machine (or as close as possible to 80 kVp).
6. Select 10 mAs on the X-Ray machine.
7. Take an exposure and read the CRLU value. If CRLU value is not 14.1 +/- 0.2, adjust mAs (coarse adjustment) and/or tube cassette distance (fine adjustment) to get 14.1 +/- 0.2 ‘CRLU reference exposure’.
8. Once the ‘CRLU reference exposure’ technique has been achieved in Step 7, replace the Radchex cassette with a freshly erased 24 x 30 cm (10” x 12”) CR ‘Test’ imaging cassette. Take an exposure using ‘reference technique’ established in Step 7.
9. Wait 10 minutes and process the ‘Imaging Plate’ in a Reader/Scanner using the appropriate ‘flat field for processing’ in image menu.
10. Read and record the exposure indicator value from plate reader/scanner on Data sheet and plot value on Reader/Scanner graph.

11. If Plate Reader/Scanner calibration has not changed, then the exposure indicator value will not change from week-to-week.

Assessing Automatic Exposure Control (AEC) and Chamber Balance

1. Select AEC mode on the X-Ray machine; 80 kVp and “zero” density Selector.
2. Center the X-Ray tube to Bucky and use the correct grid determined distance. Lock tube to Bucky.
3. Place a 24 x 30 cm (10” x 12”) copper plate on table top or chest bucky and center to bucky. (*NOTE: Place copper plate so that 30 cm (12”) dimension is from head-to-foot and the 24 cm (10”) dimension is from left-to-right.*)
4. Adjust the collimator light/radiation field to the size of the copper plate.
5. Position the Radchex cassette in bucky tray; 30 cm (12”) dimension from head-to-foot.
6. Select center chamber on AEC.
7. Before taking an exposure, press and release the “**Power/Reset**” button, wait for the LCD to display “**Ready for Exposure**”, then slide the Radchex cassette into bucky tray.
8. Take an exposure.
9. Slide the Radchex out of bucky tray and record the CRLU value.
10. Repeat steps 7 through 9 for left, right, and other chamber combinations you want to assess.
11. Chambers are balanced if CRLU values are within $\pm 10\%$ of each other.

Assessing AEC Compensation for kVp and Patient Thickness

1. Place the Radchex cassette in bucky and select AEC mode (Center chamber) on the X-Ray machine.
2. Center the desired phantom material thickness on table top or chest bucky and hold kVp constant. (**NOTE:** Use patient equivalent phantom of minimum size 24 x 24 cm that covers center AEC chamber.)
3. Take the exposures and record CRLU values for various phantom thicknesses. (It is recommended to adjust phantom thicknesses between 5 cm and 35 cm)
4. AEC is ‘thickness tracking’ if CRLU values are within $\pm 10\%$ of each other over the clinical exposure time range.
5. Select desired kVp and hold the phantom thickness constant.
6. Take the exposures and record CRLU values at various kVp’s. (It is reasonable to adjust kVp between 60 kVp and 120 kVp)
7. AEC is “kVp tracking” if CRLU values are within $\pm 10\%$ of each other over the clinical exposure time range.

Assessing Plate Reader/Scanner Calibration

1. Place the Radchex cassette on the Table Top with 100 cm (40”) tube-to-cassette distance.
2. Center light/radiation field to the Radchex cassette and adjust the light/radiation field to be slightly larger (5 cm) than the cassette; reset meter and make sure the LCD indicates “**Ready for Exposure**”.
3. Center a 24 x 30 cm (10” x 12”) copper plate on top of the Radchex cassette surface.
4. Select Manual Mode on the X-Ray machine.
5. Select 80 kVp on the X-Ray machine (or as close as possible to 80 kVp), (**NOTE:** Always use this kVp for this X-Ray machine for future tests.)

6. Select 10 mAs on the X-Ray machine.
7. Take an exposure and read the CRLU value. If CRLU value is not 14.1 ± 0.2 , adjust mAs (coarse adjustment) and/or tube-to-cassette distance (fine adjustment) to get 14.1 ± 0.2 reference value.
8. Once the 14.1 reference exposure has been achieved in Step 7, replace the Radchex cassette with a freshly erased 24 x 30 cm (10" x 12") "test" imaging cassette. Position the copper plate on the "test" imaging cassette. Take exposure using "reference technique" established in Step 7.
9. Wait 10 minutes and process the imaging plate in a plate reader/scanner using the appropriate "flat field/for processing".
10. Plate reader/scanner is calibrated if exposure indicator value shown on reader/scanner is within values shown below for your selected tolerance limits

Manufacturer	Target Value	Tolerance				
		10%	15%	20%	25%	30%
Kodak	2000	1960 to 2040	1939 to 2061	1921 to 2079	1903 to 2097	1886 to 2114
Agfa(200 speed)	2.20	2.16 to 2.24	2.14 to 2.26	2.12 to 2.28	2.10 to 2.30	2.09 to 2.31
Agfa(400 speed)	2.50	2.46 to 2.54	2.44 to 2.56	2.42 to 2.58	2.40 to 2.60	2.39 to 2.61
Fuji	145	131 to 159	123 to 167	116 to 174	109 to 181	102 to 188
Philips	145	131 to 159	123 to 167	116 to 174	109 to 181	102 to 188
Konica	145	131 to 159	123 to 167	116 to 174	109 to 181	102 to 188
ICRCo	0.00	-0.09 to 0.09	-0.14 to 0.14	-0.18 to 0.18	-0.22 to 0.22	-0.26 to 0.26

PLEASE NOTE:

The values shown in the above Table are valid if and only if:

1. The CR plates used for calibration are the same efficiency (speed) as those used for calibration assessment.
2. The "wait time" between exposure and processing is the same for calibration as for calibration assessment.
3. A well-calibrated air chamber dosimeter (including scatter) or QA Radchex is used for calibration and for calibration assessment.

Technical Specifications of the QA Radchex Meter:

X-Ray energy dependence: Simulates relative light output of Photostimulatable Phosphor Plate (PSP) within +/- 3% over kVp range of 60 kVp to 120 kVp and a patient equivalent thickness range of 5 cm to 35 cm (within specified operating rates)

Digital range: Computed Radiography Light Units: CRLU: 0 to 5000.0

Minimum CRLU Rate: 7/sec (approx 0.7 mR/sec entrance exposure rate)

Maximum CRLU Rate: 25000/sec (approx 2500 mR/sec entrance exposure rate)

Power On/Off: Manual Switch

Power Requirements: Built in NiMH rechargeable battery pack (9.6V)

Typical battery life between charging: Greater than 20 hours

Operating Environment: 15° to 35°C (59°F to 95°F)

X-ray beam filter: 10" x 12" (25cm x 30cm) Copper plate (B152-110) 1.5 mm thick.

Electronic Cassette: Dimensions: 10" x 12" x 0.5" (24cm x 30cm x 1.3cm)
Weight: 1.8 kg (3.9 lbs)

LIMITED WARRANTY

QA Radchex Meter

This product, except the use, is warranted by Diagnostic Imaging Specialists Corporation (DISC), to the original purchaser to be free from defects in material and workmanship under normal use for a period of one (1) year from the date of purchase. During the warranty period, and upon proof of purchase, the product will be repaired or replaced (with the same or similar model) at our option, without charge for either parts or labor at the DISC factory. The purchaser shall bear all shipping, packing, and insurance costs to the DISC factory. The warranty will not apply to this product if the product has been misused, abused, or altered. Without limiting the foregoing, bending or dropping of unit, broken electrical wires, visible cracking of the product components and/or enclosures are presumed to be defects resulting from misuse or abuse.

NEITHER THIS WARRANTY NOR ANY OTHER WARRANTY EXPRESS OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY, SHALL EXTEND BEYOND THE WARRANTY PERIOD. NO RESPONSIBILITY IS ASSUMED FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITING THE SAME TO MATHEMATICAL ACCURACY OR PRECISION OF THE PRODUCT. SOME PROVINCES AND OR STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS AND SOME PROVINCES AND OR STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THAT THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY.

This warranty gives the product owner specific legal rights, and the owner may also have other rights which vary from province to province or state to state.

TABLE 1
CR Manufacturer Plate Reader Values Corresponding to CR Radchex values
 (Assuming that the reader is calibrated using the manufacturers' specifications)

CRLU (CR Light Units)	Kodak® EI#	Agfa® IgM# (200 Class)	Agfa® IgM# (400 Class)	S#	iCRco® EI#	Relative Imaging Speed (2000 / CRLU)
5.00	1550	1.75	2.05	409	-1.037	400
5.25	1571	1.78	2.08	389	-0.988	381
5.51	1592	1.80	2.1	371	-0.940	363
5.79	1613	1.82	2.12	353	-0.890	345
6.08	1635	1.84	2.14	336	-0.841	329
6.38	1656	1.86	2.16	320	-0.793	313
6.70	1677	1.88	2.18	305	-0.744	299
7.04	1698	1.90	2.2	290	-0.695	284
7.39	1719	1.92	2.22	277	-0.646	271
7.76	1741	1.95	2.25	263	-0.597	258
8.14	1761	1.97	2.27	251	-0.549	246
8.55	1783	1.99	2.29	239	-0.500	234
8.98	1804	2.01	2.31	228	-0.451	223
9.43	1825	2.03	2.33	217	-0.402	212
9.90	1846	2.05	2.35	206	-0.354	202
10.39	1867	2.07	2.37	197	-0.305	192
10.91	1889	2.09	2.39	187	-0.256	183
11.46	1910	2.11	2.41	178	-0.207	175
12.03	1931	2.14	2.44	170	-0.159	166
12.63	1952	2.16	2.46	162	-0.110	158
13.27	1974	2.18	2.48	154	-0.061	151
13.93	1995	2.20	2.50	147	-0.012	144
14.63	2016	2.22	2.52	140	0.037	137

Agfa Reader Datasheet

Hospital/Clinic:

Reader Mfg: **Agfa**

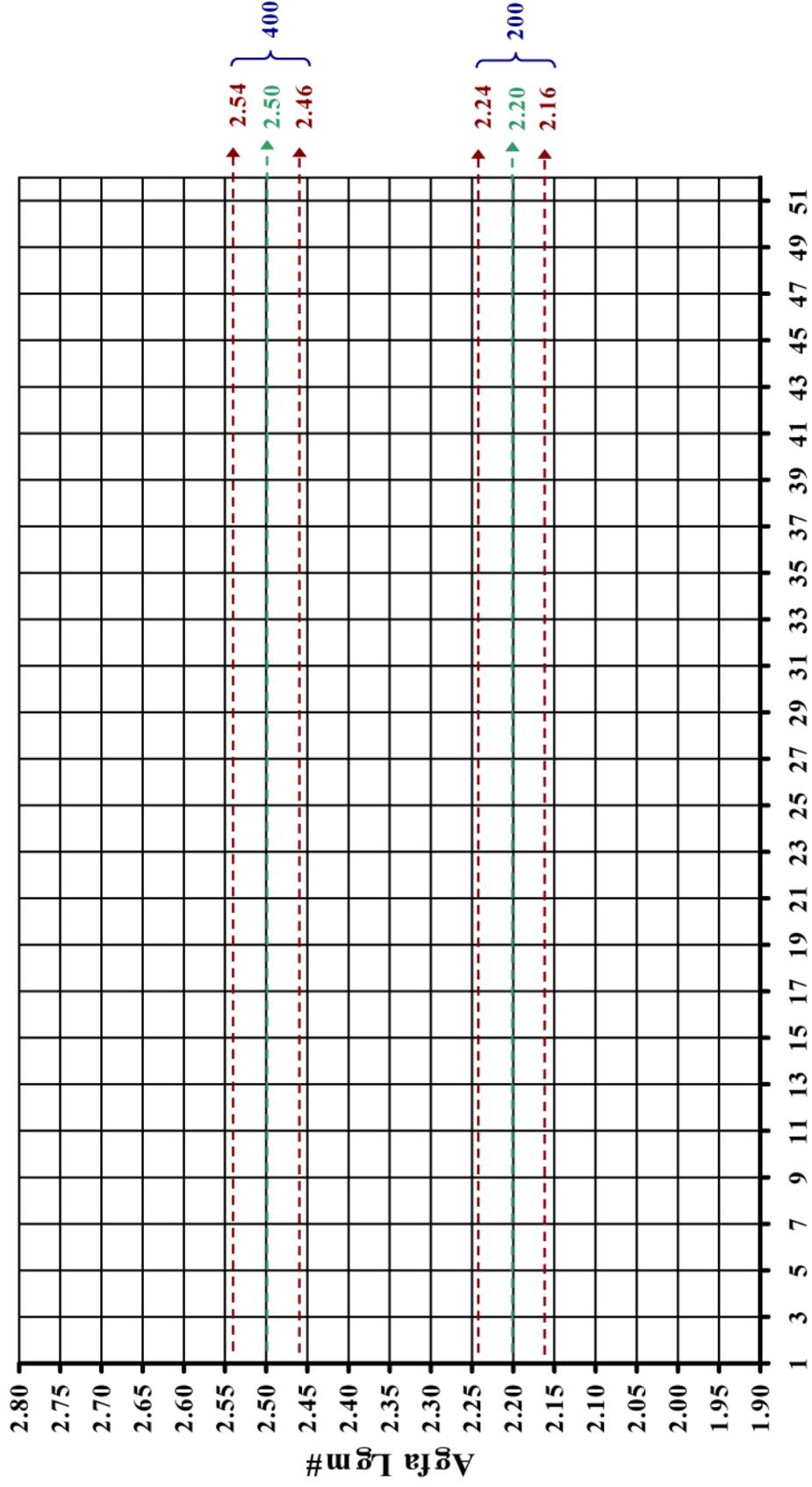
Reader ID:

Speed Class: **200**

Week #	Date	CRLU	Reader Lgm#	Week #	Date	CRLU	Reader Lgm#
1				27			
2				28			
3				29			
4				30			
5				31			
6				32			
7				33			
8				34			
9				35			
10				36			
11				37			
12				38			
13				39			
14				40			
15				41			
16				42			
17				43			
18				44			
19				45			
20				46			
21				47			
22				48			
23				49			
24				50			
25				51			
26				52			

Agfa Reader Graph(Based on a CRLU of 14.1)

Hospital/Clinic: _____
 Reader Mfg: **Agfa**
 Reader ID: _____
 Speed Class: _____



Week #

Formula to Calculate Agfa Lgm# from CRLU: $Agfa\ Lgm\# = 2.2 + \text{Log}(CRLU / 14.1) + \text{Log}(\text{Speed Class} / 200)$

Cares tream Reader Datas heet

Hospita l/Clinic:

Reader Mfg: **Carestream**

Reader ID:

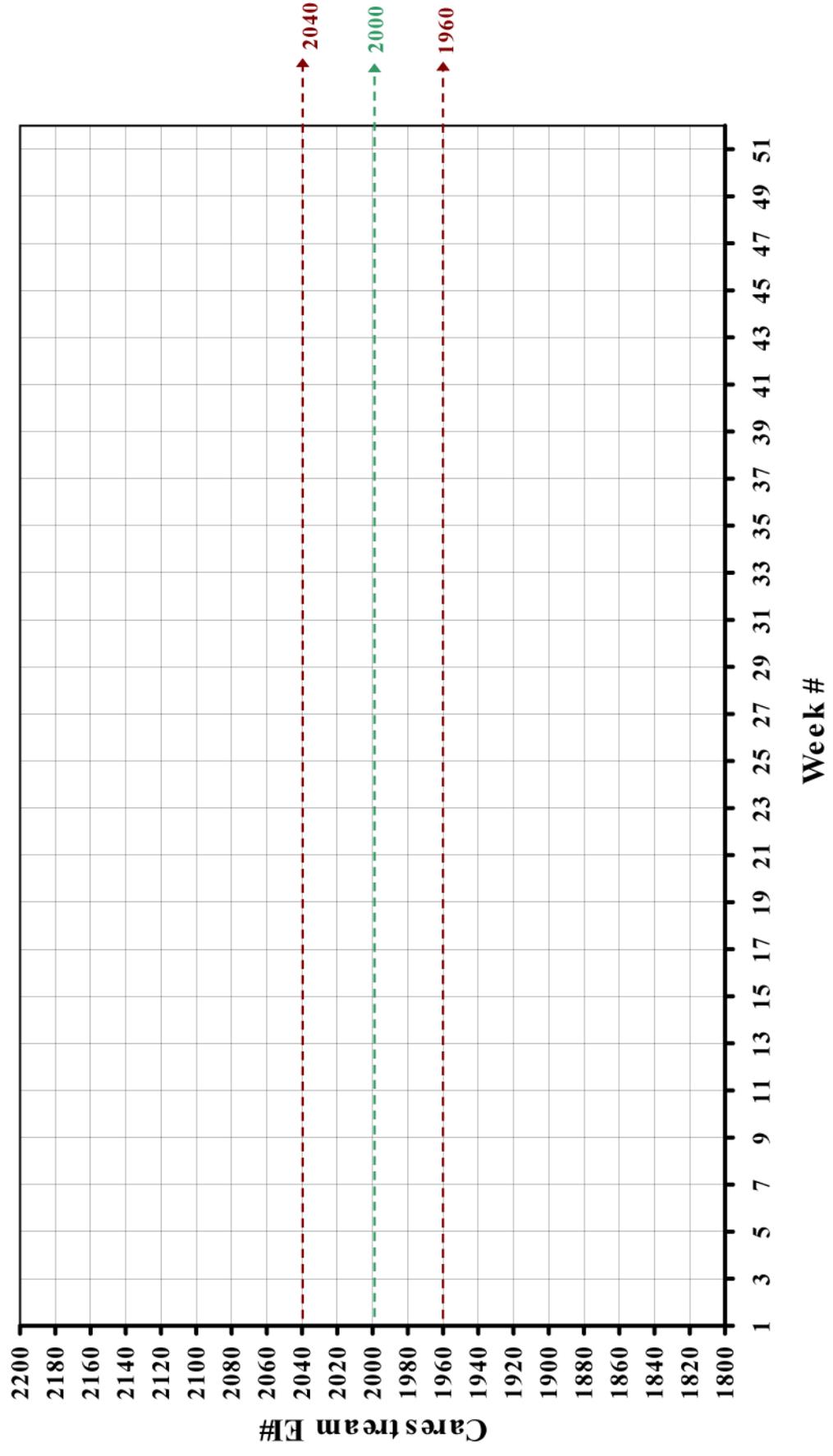
Week #	Date	CRLU	Reader EI#	Week #	Date	CRLU	Reader EI#
1				27			
2				28			
3				29			
4				30			
5				31			
6				32			
7				33			
8				34			
9				35			
10				36			
11				37			
12				38			
13				39			
14				40			
15				41			
16				42			
17				43			
18				44			
19				45			
20				46			
21				47			
22				48			
23				49			
24				50			
25				51			
26				52			

Carestream Reader Graph(Based on a CRLU of 14.1)

Hospital/Clinic: _____

Reader Mfg: Carestream

Reader ID: _____



Formula to Calculate Carestream EI# from CRLU: Carestream EI# = 2000 +(1000 x Log(CRLU/14.1))

CRLU and mAs Datasheet

Hospital/Clinic:

Room #:

Bucky ID:

Week #	Date	CRLU	mAs
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			

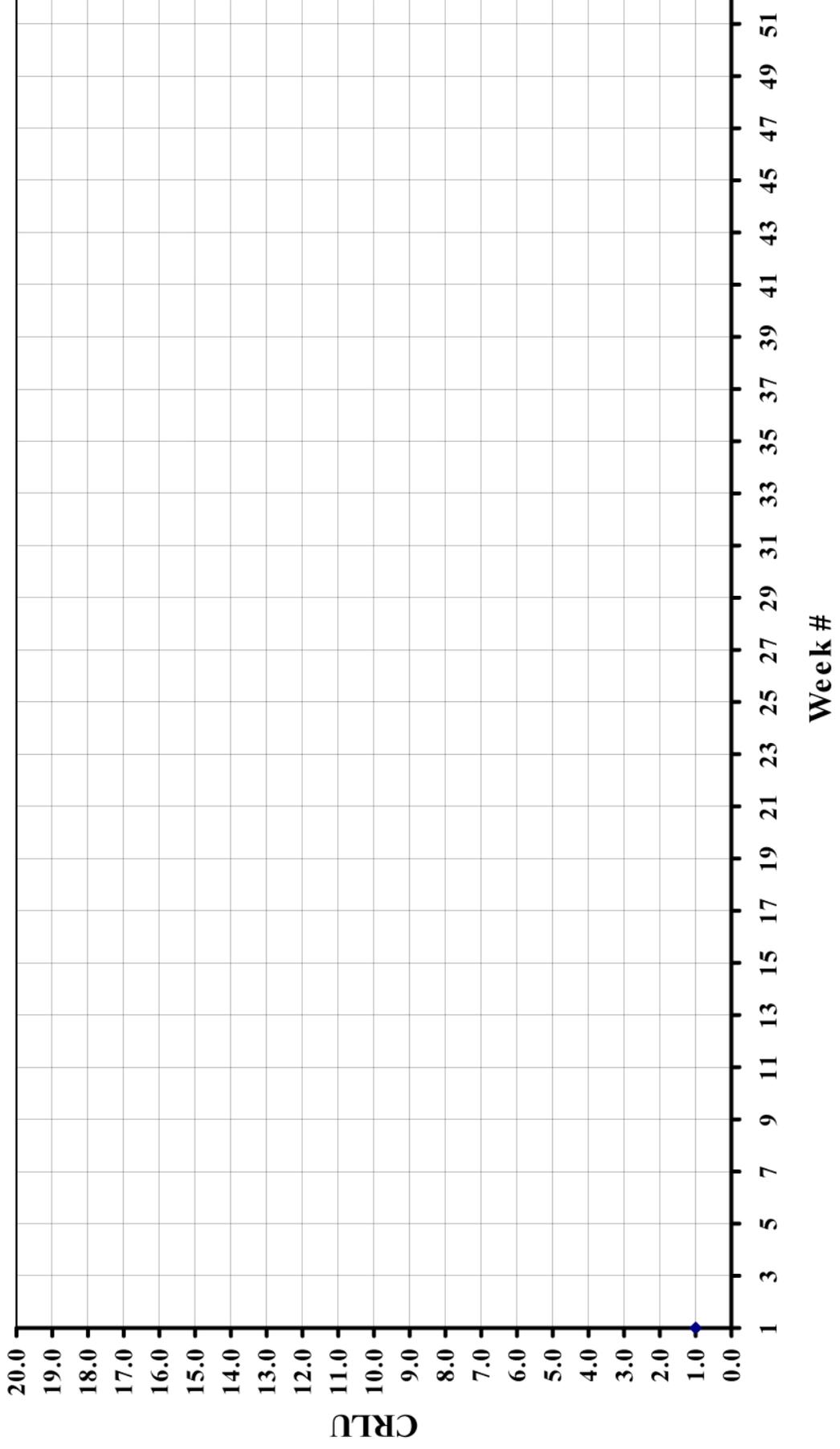
Week #	Date	CRLU	mAs
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
51			
52			

CRLU Graph

Hospital/Clinic:

Room ID:

Bucky ID:

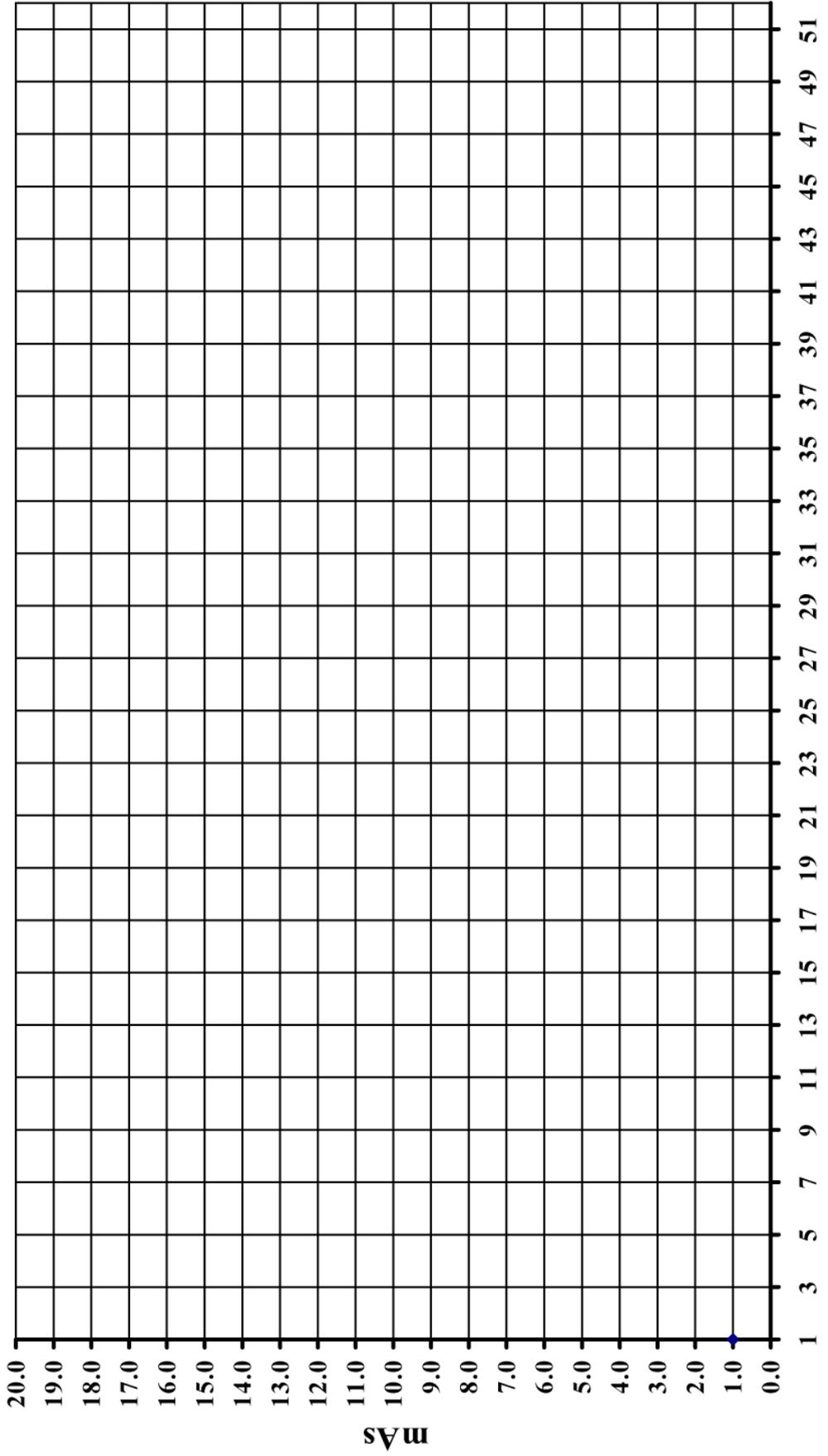


mAs Graph

Hospital/Clinic:

Room ID:

Bucky ID:



Fuji Reader Datasheet

Hospital/Clinic:

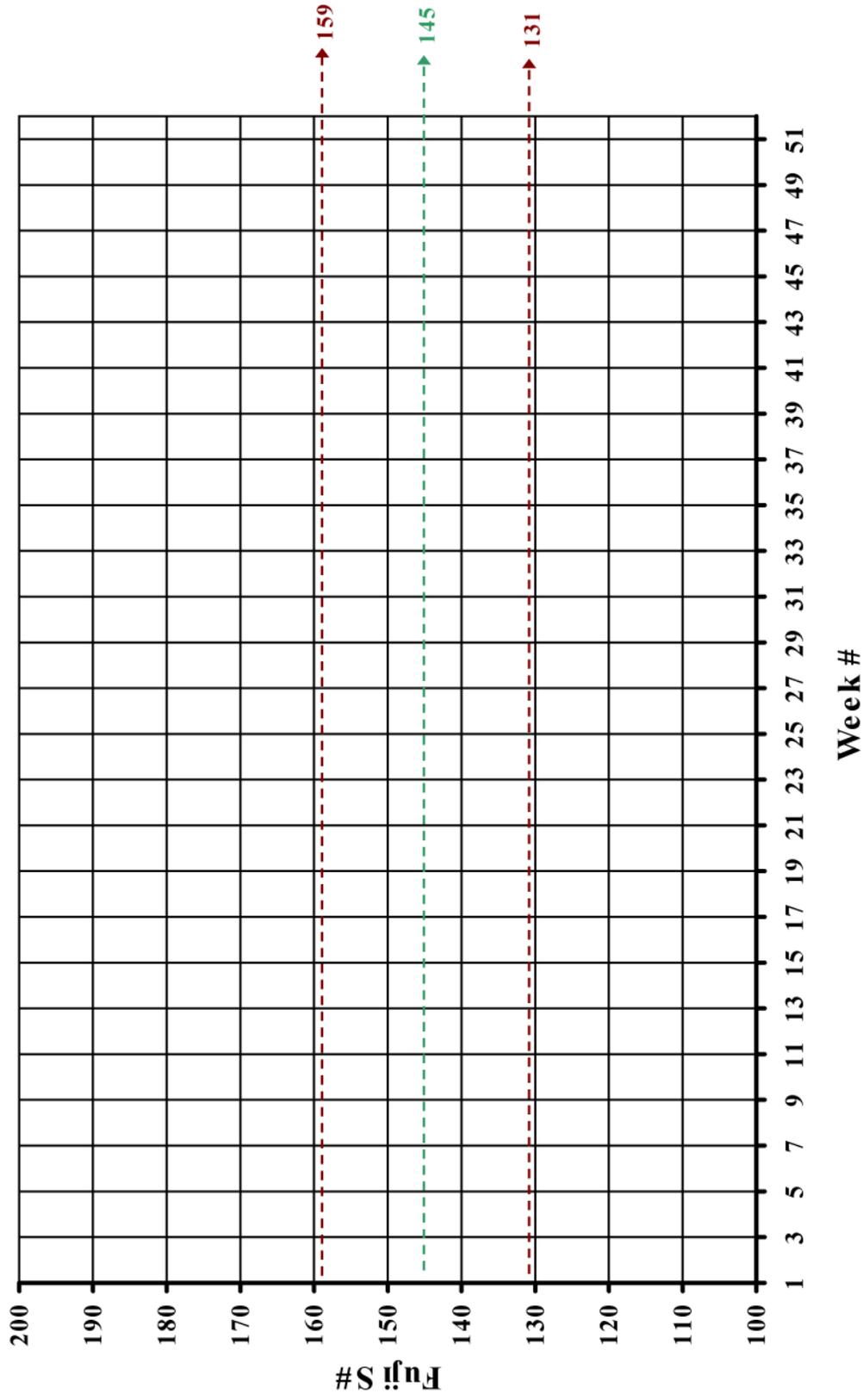
Reader Mfg: Fuji

Reader ID:

Week #	Date	CRLU	Reader S#	Week #	Date	CRLU	Reader S#
1				27			
2				28			
3				29			
4				30			
5				31			
6				32			
7				33			
8				34			
9				35			
10				36			
11				37			
12				38			
13				39			
14				40			
15				41			
16				42			
17				43			
18				44			
19				45			
20				46			
21				47			
22				48			
23				49			
24				50			
25				51			
26				52			

Fuji Reader Graph(Based on a CRLU of 14.1)

Hospital/Clinic: _____
 Reader Mfg: **Fuji**
 Reader ID: _____



Formula to Calculate Fuji S# from CRLU: $\text{Fuji S\#} = 2044 / \text{CRLU}$

iCRco Reader Datasheet

Hospital/Clinic:

Reader Mfg:

Reader ID:

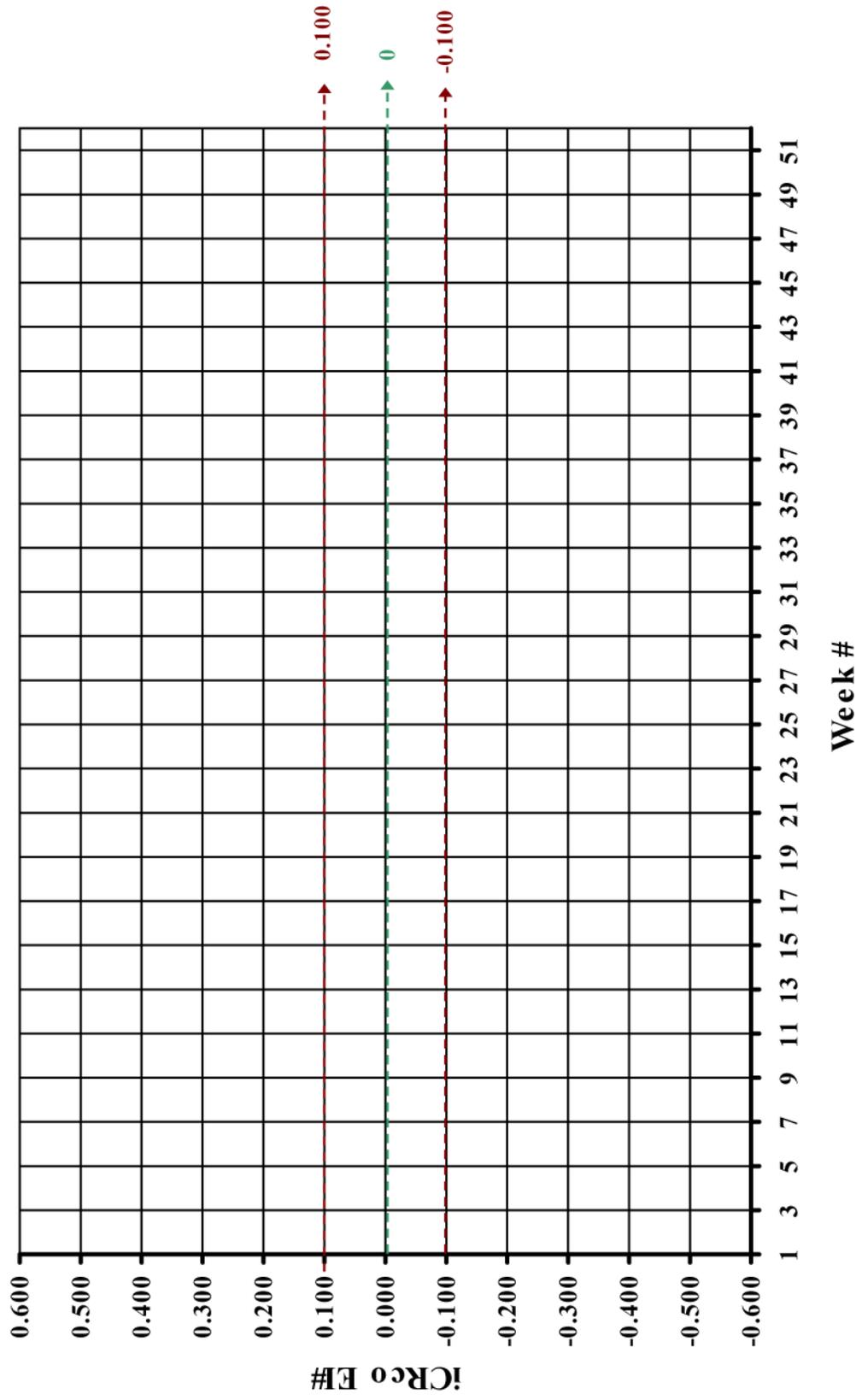
Week #	Date	CRLU	Reader E#	Week #	Date	CRLU	Reader E#
1				27			
2				28			
3				29			
4				30			
5				31			
6				32			
7				33			
8				34			
9				35			
10				36			
11				37			
12				38			
13				39			
14				40			
15				41			
16				42			
17				43			
18				44			
19				45			
20				46			
21				47			
22				48			
23				49			
24				50			
25				51			
26				52			

iCRco Reader Graph(Based on a CRLU of 14.1)

Hospital/Clinic: _____

Reader Mfg: **iCRco**

Reader ID: _____



Formula to Calculate iCRco EI# from CRLU: $iCRco EI\# = LN(CRLU / 14.1)$

Konica Reader Datasheet

Hospital/Clinic:

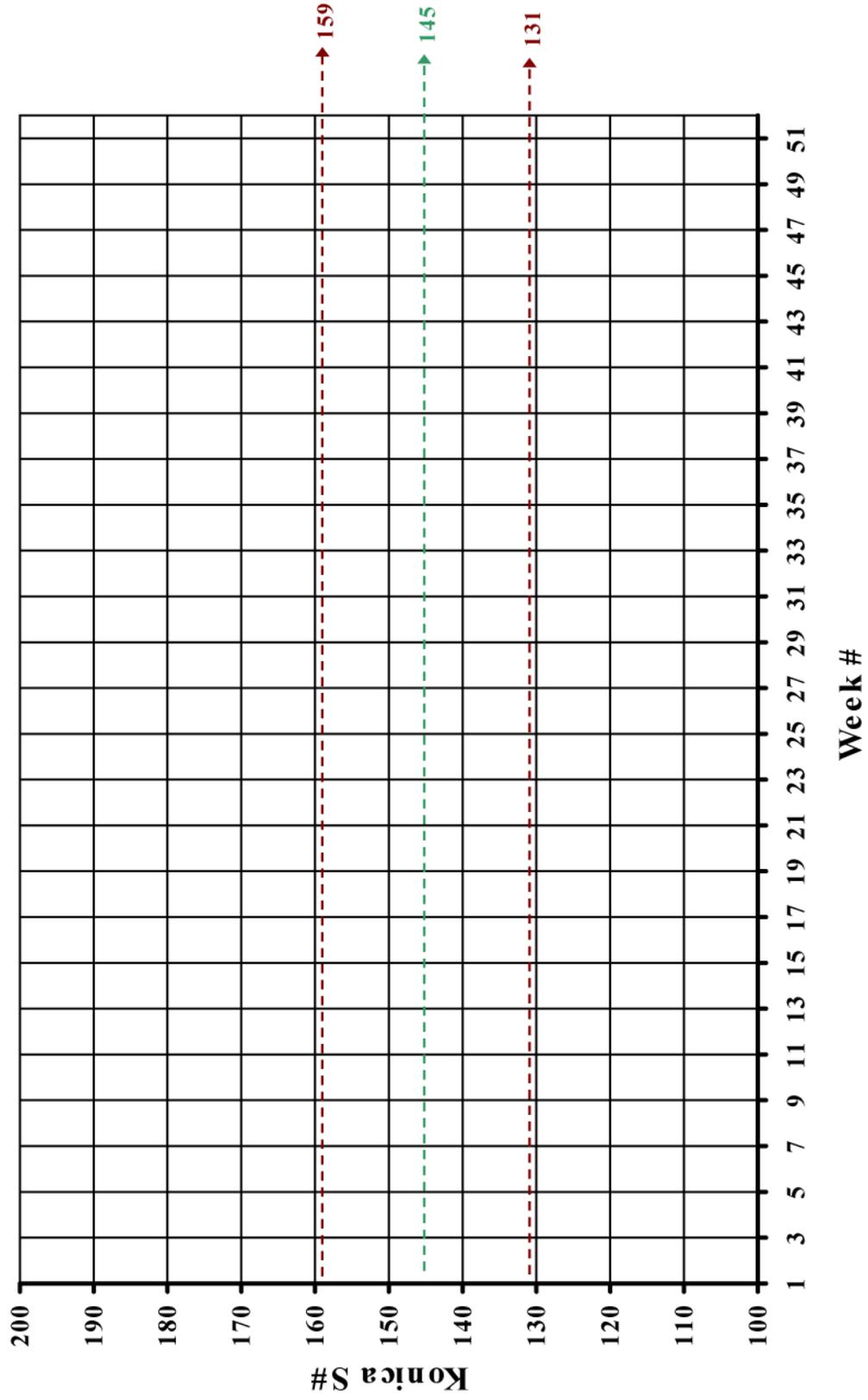
Reader Mfg: Konica

Reader ID:

Week #	Date	CRLU	Reader S#	Week #	Date	CRLU	Reader S#
1				27			
2				28			
3				29			
4				30			
5				31			
6				32			
7				33			
8				34			
9				35			
10				36			
11				37			
12				38			
13				39			
14				40			
15				41			
16				42			
17				43			
18				44			
19				45			
20				46			
21				47			
22				48			
23				49			
24				50			
25				51			
26				52			

Konica Reader Graph(Based on a CRLU of 14.1)

Hospital/Clinic:
 Reader Mfg: **Konica**
 Reader ID:



Formula to Calculate Konica S# from CRLU: $\text{Konica S\#} = 2044 / \text{CRLU}$