

**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION  
DECISION SUMMARY  
ASSAY ONLY TEMPLATE**

**A. 510(k) Number:**

k092273

**B. Purpose for Submission:**

New device

**C. Measurand:**

Ethanol (Ethyl Alcohol)

**D. Type of Test:**

Quantitative, enzymatic Alcohol Dehydrogenase

**E. Applicant:**

Radox Laboratories

**F. Proprietary and Established Names:**

Radox Ethanol Assay

Radox Ethanol Calibrator/Control Set

**G. Regulatory Information:**

<b>Product Code</b>	<b>Classification</b>	<b>Regulation Section</b>	<b>Panel</b>
DIC	Class II	21 CFR 862.3040, Alcohol test system	91-Toxicology
DLJ	Class II	21 CFR 862.3200, Clinical toxicology calibrators	91-Toxicology
LAS	Class I, reserved	21 CFR 862.3280, Clinical toxicology control material	91-Toxicology

## H. Intended Use:

1. Intended use(s):

See indications for use below

2. Indication(s) for use:

### **Randox Ethanol Assay**

The Randox Ethanol Assay is an in vitro diagnostic test for the quantitative analysis of Ethanol in human urine and serum on the Xseries analyzers, which includes the Xdaytona and the Ximola analyzers.

The measurement of ethanol is used for the diagnosis and treatment of alcohol intoxication and poisoning.

This is an in vitro diagnostic device intended for prescription use only.

### **Randox Ethanol Calibrator**

The Randox Ethanol Calibrator is intended for the calibration of the Randox Ethanol assay, which is used for the quantitative analysis of ethanol in human urine and serum on the Xseries analyzers, which includes the Xdaytona and the Ximola analyzers.

### **Randox Ethanol Control**

The Randox Ethanol Control Set is intended for the quality control of the Randox Ethanol assay, which is used for the quantitative analysis of ethanol in human urine and serum on the Xseries analyzers, which includes the Xdaytona and the Ximola analyzers.

This is an in vitro diagnostic device intended for prescription use only.

3. Special conditions for use statement(s):

This assay is for prescription use

4. Special instrument requirements:

The sponsor provided data for the RX Daytona and RX Imola analyzers

**I. Device Description:**

This assay consists of ready-to-use liquid reagents. Reagent 1 is an Ethanol Buffer which contains tris and sodium azide. Reagent 2 is an Ethanol Enzyme Reagent containing alcohol dehydrogenase, NAD, Sodium azide and stabilizers.

The calibrators and controls are ready-to-use human urine-based liquid and are sold separately.

**J. Substantial Equivalence Information:**

1. Predicate device name(s):

DRI MULTIGENT Ethanol Assay

DRI MULTIGENT Alcohol Calibrators and Controls

2. Predicate 510(k) number(s):

K923783 and k924733 respectively

3. Comparison with predicate:

Similarities		
Item	Device	Predicates
Intended Use	For the quantitative analysis of ethanol.  Calibrator Set is intended for the calibration of the Ethanol assay  Control Set is intended for the quality control of the Ethanol assay	Same
Principle of Procedure	Kinetic assay	Same
Setting of Use	For prescription use only	Same
Calibrator/Control format	Liquid Ready to Use Control Low 50 mg/dL, Control high 300 mg/dL, Level 0 calibrator 0 mg/dL and Level 1 calibrator 100 mg/dL	Same

<b>Differences</b>		
<b>Item</b>	<b>Device</b>	<b>Predicate</b>
Assay Range	Rx Daytona, Serum 8-500 mg/dl Rx Daytona, Urine 20-500 mg/dl Rx Imola, Serum 3-500 mg/dL Rx Imola, Urine 3-500 mg/dL	10 – 600 mg/dL
Matrix	Urine and Serum	Urine, Serum and Plasma
Calibrator/Control size	1 x 10 mL	1 x 5 mL

**K. Standard/Guidance Document Referenced (if applicable):**

CLSI EP5-A2: Evaluation of Precision Performance of Quantitative Measurement Methods; Approved Guideline-Second Edition (2004)

CLSI EP6-A: Evaluation of Linearity of Quantitative Measurement Procedures, A Statistical Approach: Approved Guideline (2003)

CLSI EP7-A2: Interference Testing in Clinical Chemistry; Approved Guideline (2002)

CLSI EP17-A: Protocols for Determination of Limits of Detection and Limits of Quantitation; Approved Guideline (2004)

CLSI EP9-A2: Method Comparison and Bias Estimation Using Patient Samples; Approved Guideline (2002)

**L. Test Principle:**

The RANDOX ethanol assay is a ready-to-use liquid reagent. The assay is based on the oxidation of ethyl alcohol to acetaldehyde by alcohol dehydrogenase (ADH) and NAD to NADH, resulting in an absorbance change measured spectrophotometrically at 340 nm. The concentration of ethanol alcohol is directly proportional to the ADH activity, measured at 340 nm wavelength.

**M. Performance Characteristics (if/when applicable):**

1. Analytical performance:

a. *Precision/Reproducibility:*

Reproducibility studies were conducted by spiking serum or urine to the following concentrations; 20 mg/dL, 50 mg/dL, 150 mg/dL, 300 mg/dL and 475 mg/dL. Testing was performed over 20 non-consecutive, two runs/day and two replicates /run, 2 operators and 5 calibrations on the Imola and 6 on the Daytona instruments for a total of 80 runs/concentration. The results are in the table below:

Rx Daytona

Sample Description (Concentration mg/dL)	Sample Type	N	Mean	Within Run		Total	
				SD	CV	SD	CV
20	Serum	80	18.76	1.07	5.7	3.10	16.6
	Urine	80	18.82	1.64	8.7	3.58	19.0
50	Serum	80	47.67	1.62	3.4	3.31	6.9
	Urine	79	46.04	1.62	3.5	3.16	6.9
150	Serum	79	147.21	3.31	2.2	5.39	3.7
	Urine	80	144.56	1.87	1.3	4.81	3.3
300	Serum	80	296.16	3.99	1.3	9.06	3.1
	Urine	80	299.62	3.82	1.3	9.58	3.3
475	Serum	79	478.01	3.91	0.8	13.86	2.9
	Urine	79	487.96	5.44	1.1	13.52	2.8

Rx Imola

Sample Description (Concentration ng/mL)	Sample Type	N	Mean	Within Run		Total	
				SD	CV	SD	CV
20	Serum	79	19.52	0.88	4.5	1.15	5.9
	Urine	80	19.15	0.78	4.1	1.04	5.4
50	Serum	79	47.77	2.00	4.2	2.09	4.4
	Urine	80	45.97	1.96	4.3	1.96	4.3
150	Serum	80	147.01	7.13	4.9	7.31	5.0
	Urine	80	144.40	3.71	2.6	4.49	3.1
300	Serum	79	295.88	13.28	4.5	13.30	4.5
	Urine	80	298.50	7.59	2.5	9.34	3.1
475	Serum	80	472.68	20.85	4.4	20.85	4.4
	Urine	80	482.48	3.16	0.7	11.67	2.4

b. *Linearity/assay reportable range:*

Linearity samples for serum and urine were prepared from two pools of each sample type with ethanol concentrations near the extremes of the assay range (low pool and high pool). The two pools were mixed to create 9 additional pools of intermediate concentrations. Five determinations of each pool were tested on each instrument and a linear regression analysis was performed by the method of least squares. The data provided in the tables below supports the claimed measuring range for Imola serum and urine 3-500 mg/dL and Daytona serum 8-500 mg/dL and urine 20-500 mg/dL.

	Imola Urine		Daytona Urine	
Sample	Expected ETOH mg/dL	Observed ETOH mg/dL	Expected ETOH mg/dL	Observed ETOH mg/dL
1	3	2.94	69	73.71
2	62.7	60.26	1.28	134.74
3	122.4	133.53	187	200.63
4	182.1	181.96	246	254.26
5	241.8	251.04	305	306.91
6	301.5	304.43	364	368.99
7	361.2	392.56	423	420.54
8	420.9	426.85	482	471.24
9	480.6	486.69		
Slope	1.03		0.96	
Intercept	0.82		13.75	
r	0.997		0.999	

	Imola Serum		Daytona Serum	
Sample	Expected ETOH mg/dL	Observed ETOH mg/dL	Expected ETOH mg/dL	Observed ETOH mg/dL
1	3	2.93	8	8.32
2	62.7	60.04	67.2	72.43
3	122.4	128.18	126.4	136.88
4	182.1	187.53	185.6	190.33
5	241.8	250.37	244.8	254.49
6	301.5	291.44	304	310.35
7	361.2	361.72	363.2	363.56
8	420.9	414.50	422.4	423.48
9	480.6	457.25	481.6	467.85
Slope	0.96		0.98	
Intercept	6.27		8.74	
r	0.999		0.999	

c. *Traceability, Stability, Expected values (controls, calibrators, or methods):*

Calibrator and controls are prepared by spiking ethanol (supplied by Sigma-Aldrich) into inorganic buffer. Value assignment is performed by testing new lots of calibrator and control against the master lot.

Stability of the calibrators and controls was demonstrated by real-time stability studies. Calibrators and controls come ready to use. The calibrator is stable up to the expiry date (12 months) when capped and the open vial is stable for 27 days stored at 2-8° C.

d. *Detection limit:*

The method to determine detection limit is based upon the CLSI document EP17-A3. The study assayed 60 replicates of blank and 6 low positives samples on both instruments for the LoB and LoD. The LoQ was determined by assaying 200 replicates of each of 4 additional low positive samples on both instruments. The results are presented in the Table below.

	Limit of Blank		Limit of Detection		Limit of Quantitation	
	Serum	Urine	Serum	Urine	Serum	Urine
	mg/dL		mg/dL		mg/dL	
RX Daytona	1.17	1.92	3.34	4.75	8.00	20.00
RX Imola	1.35	0.59	1.79	1.19	3.00	3.00

e. *Analytical specificity:*

The Randox ethanol assay was evaluated for interference. The interferent was spiked into serum and urine samples having ethyl alcohol concentrations of 10 and 100 mg/dL. The following substances at the tested concentration demonstrated no significant bias (defined as < 10 %).

Serum ethyl alcohol concentration	RX Daytona		RX Imola	
	10 mg/dL	100 mg/dL	10 mg/dL	100 mg/dL
Interferent	Tested Concentration (mg/dL)		Tested Concentration (mg/dL)	
Hemoglobin	62.5	1000	125	1000
Triglycerides	500	500	250	500
Intralipid	187.5	750	40	375
Total Bilirubin	60	80	20	80
Direct Bilirubin	60	80	20	80
Acetaminophen	20	20	20	20

	RX Daytona		RX Imola	
Amikacin	8	8	8	8
Ampicillin	5.3	5.3	5.3	5.3
Ascorbic Acid	6	6	6	6
Caffeine	6	6	6	6
Cardamezepine	3	3	3	3
Cloramphenicol	5	5	5	5
Clordiazepoxide	1	1	1	1
Chlorpromazine	0.2	0.2	0.2	0.2
Cholesterol	30	503	251.5	503
Cimetidine	2	2	2	2
Creatinine	30	30	30	30
Dextran	6000	6000	6000	6000
Diazepam	0.51	0.51	0.51	0.51
Digoxin	6.1	6.1	6.1	6.1
Erythromycin	6	6	6	6
Ethosuximide	25	25	25	25
Furosemide	6	6	6	6
Gentamicin	1	1	1	1
Heparin	3 U/mL	3 U/mL	3 U/mL	3 U/mL
Ibuprofen	50	50	50	50
Immunoglobulin	5000	5000	5000	5000
LDH	237,500 U/mL	237,500 U/mL	237,500 U/mL	237,500 U/mL
Lactate	901	901	901	901
Lidocaine	1.2	1.2	1.2	1.2
Lithium	2.2	2.2	2.2	2.2
Mannitol	500	500	500	500
Nicotine	0.1	0.1	0.1	0.1
Penicillin	25 u/mL	25 U/mL	25 U/mL	25 U/mL
Pentobarbital	8	8	8	8
Phenobarbital	10	10	10	10
Phenytoin	5	5	5	5
Primidone	4	4	4	4
Propoxyphene	0.16	0.16	0.16	0.16
H.S.A.	37.5	1250	100	1500
Protein-total	50	1500	100	1500
Salicylic acid	60	60	60	60
Theophylline	4	4	4	4
Urea	500	500	500	500
Uric acid	20	20	20	20
Valproic acid	50	50	50	50

	RX Daytona	RX Imola	
Urine ethyl alcohol concentration	100 mg/dL	10 mg/dL	100 mg/dL
Interferent	Tested Concentration (mg/dL)	Tested Concentration (mg/dL)	
Total Bilirubin	15	15	15
Direct Bilirubin	5	5	5
Hemoglobin	115	68.75	115
Creatinine	30	30	30
Urea	285	285	285
Glucose	2000	2000	2000
H.S.A.	500	500	500
Ascorbic acid	1000	1000	1000
Gamma globulin	500	500	500
Oxalic acid	100	100	100
Riboflavin	7.5	7.5	7.5
Sodium Chloride	6000	6000	6000
Boric acid	1000	1000	1000
Sodium azide	1000	1000	1000
Sodium Fluoride	1000	1000	1000

Cross-reactivity of structurally related compounds

Serum and Urine ethyl alcohol concentration 10 mg/dL		RX Daytona		RX Imola	
		% cross-reactivity		% cross-reactivity	
Compound	Conc. Tested (mg/dL)	Serum	Urine	Serum	Urine
1-Propanol	3000	7.18	7.39	6.74	7.15
1,2-Propandiol	3000	-0.02	0.01	0.00	-0.01
1-Butanol	3000	1.40	1.64	1.44	1.37
Acetaldehyde	3000	-0.20	-0.16	-0.15	-0.22
Acetone	3000	0.01	-0.01	-0.01	-0.01
Ethylene glycol	3000	0.05	0.05	0.05	0.04
Isopropanol	3000	0.25	0.24	0.22	0.23
Methanol	3000	0.01	-0.01	0.00	0.00

f. Assay cut-off:

Not applicable

2. Comparison studies:

a. *Method comparison with predicate device:*

Unaltered clinical 50 serum and 60 urine samples were used in the method comparison study. All the samples were measured in singlet and only one specimen per patient was obtained. Samples within the measurement range were used in the data analysis. The correlation study between the device and the predicate for urine and serum yielded the following results.

RX Daytona

Matrix	n	Slope	Intercept	r	Device range (mg/dL)	Predicate range (mg/dL)
Serum	45	0.922	0.94	0.995	8-500	10-600
Urine	42	1.001	-2.44	0.995	20-500	10-600

RX Imola

Matrix	n	Slope	Intercept	r	Device range (mg/dL)	Predicate range (mg/dL)
Serum	48	0.951	0.01	0.999	3-500	10-600
Urine	53	0.954	-2.01	0.998	3-500	10-600

b. *Matrix comparison:*

Assay is for serum and urine samples only

3. Clinical studies:

a. *Clinical Sensitivity:*

Not applicable

b. *Clinical specificity:*

Not applicable

c. Other clinical supportive data (when a. and b. are not applicable):

Not applicable

4. Clinical cut-off:

Not applicable

5. Expected values/Reference range:

Ethyl alcohol is not present in detectable concentrations in healthy adults who have not consumed ethanol.

**N. Proposed Labeling:**

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

**O. Conclusion:**

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.