510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY AND INSTRUMENT

I Background Information:

A 510(k) Number

K220451

B Applicant

Randox Laboratories Limited

C Proprietary and Established Names

Evidence MultiSTAT DOA Urine MultiPlex, Evidence MultiSTAT

D Regulatory Information

Product Code(s)	Classification	Regulation Section	Panel
DJG	Class II	21 CFR 862.3650 – Opiate Test System	TX - Clinical Toxicology
DJR	Class II	21 CFR 862.3620 – Methadone test system	TX - Clinical Toxicology
JXM	Class II	21 CFR 862.3170 – Benzodiazepine Test System	TX - Clinical Toxicology
DJC	Class II	21 CFR 862.3610 – Methamphetamine Test System	TX - Clinical Toxicology
JJE	Class I	21 CFR 862.2160 – Discrete photometric chemistry analyzer for clinical use	CH – Clinical

II Submission/Device Overview:

A Purpose for Submission:

New device

B Measurand:

Methamphetamine, Noroxycodone, Benzodiazepines, and Methadone

C Type of Test:

Chemiluminescent immunoassay

III Intended Use/Indications for Use:

A Intended Use(s):
See Indications for Use below.

B Indication(s) for Use:
The Evidence MultiSTAT DOA Urine MultiPlex is intended for use with the Evidence MultiSTAT. The Evidence MultiSTAT is an analyzer intended for the qualitative determination of parent drug molecule and metabolites of drugs in human urine at the associated cutoffs.

The Evidence MultiSTAT DOA Urine MultiPlex detects the following drugs at the following cut-offs:

Analyte	Analyte in Cut Off Material	Cut-Off
Benzodiazepines I	Oxazepam	200 ng/mL
Methamphetamine	S-(+)-Methamphetamine	500 ng/mL
Noroxycodone	Noroxycodone	100 ng/mL
Methadone	(±)-Methadone	300 ng/mL

The Evidence MultiSTAT DOA Urine MultiPlex provides only a preliminary analytical test result. A more specific alternative chemical method must be used to obtain a confirmed analytical result. Gas Chromatography/Mass Spectrometry (GC/MS) and/or Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) are the preferred confirmatory methods. Other chemical confirmation methods are available. Clinical consideration and professional judgement should be applied to any drug of abuse test result, particularly when preliminary positive results are obtained.

For in vitro diagnostic use only.

C Special Conditions for Use Statement(s):
Rx - For Prescription Use Only

D Special Instrument Requirements:

Evidence MultiSTAT

IV Device/System Characteristics:

A Device Description:

The Evidence MultiSTAT is a benchtop fully automated Biochip Array System analyzer. The Evidence MultiSTAT DOA Urine MultiPlex test kit components include a sealed urine test cartridge which contains materials for the determination of the claimed analytes at the associated cut-off.

This submission (k220451) contains the review for the Evidence MultiSTAT and following Randox Evidence MultiSTAT DOA Urine MultiPlex claimed analytes at the associated cut off concentrations: Methamphetamine at 500 ng/ml, Noroxycodone at 100 ng/ml, Oxazepam at 200 ng/ml, and Methadone at 300 ng/ml.

Submission k221550 includes the following claimed analytes and associated cut off concentrations; Phenobarbital at 200 ng/ml, Tramadol at 200 ng/ml, Phencyclidine at 25 ng/ml, Buprenorphine at 5 ng/ml, 6-Acetylmorphine at 10 ng/ml.

The Randox Evidence MultiSTAT DOA Urine MultiPlex test kit is comprised of:

- 12 x Urine Test Cartridges
- 6 x 1mL Urine Cut Off Material (lyophilized)
- 4 x 1mL Urine Positive Control Material (lyophilized)
- 2 x 10mL Reconstitution Buffer
- 1 x USB which contains batch specific update and Instructions for Use (IFU)
- 1 x Batch Barcodes

Each kit is supplied with the Evidence MultiSTAT Accessory Kit which contains:

- 12 x MultiSTAT Tip Cartridges
- 1 x Tip/Waste Cartridge
- 6 x 1000 µl Pipette Tip
- 1 x Liquid Absorber

The Reagent Composition of the test kit is comprised of:

- MultiSTAT DOA Urine MultiPlex Assay Diluent - 20 mM phosphate buffer, pH 7.2 containing protein, detergents, and preservatives. This is contained within the cartridge.

- MultiSTAT DOA Urine MultiPlex Conjugate - 20 mM Tris based buffer, pH 7.0 containing protein, preservatives, and horseradish peroxidase - labelled drug derivatives. This is contained within the cartridge.

- MultiSTAT DOA Urine MultiPlex Biochip - Solid substrate containing immobilized antibody discrete test regions. This is contained within the cartridge.

- MultiSTAT DOA Urine MultiPlex Wash Buffer - 20 mM Tris buffered saline, pH 7.4, containing surfactant and preservatives. This is contained within the cartridge.

- LUM-EV934/PX - Luminol-EV934 and Peroxide are contained within the cartridge and are mixed in a ratio of 1:1 by the analyser to give the working signal reagent

- MultiSTAT DOA Urine MultiPlex Cut Off - Lyophilised, 20 mM phosphate buffer, pH 7.2 containing stabilizers, preservatives and drug concentrations at the assay cut off values.

- MultiSTAT DOA Urine MultiPlex Positive Control - Lyophilised, 20 mM phosphate buffer, pH 7.2 containing stabilizers, preservatives, and drug concentrations at 50% higher than the cut-off values.

- MultiSTAT Reconstitution Buffer – A solution at a neutral pH containing preservatives.

B Principle of Operation:

The candidate device performs simultaneous detection of multiple analytes from a single sample. The core technology is the Randox Biochip, a solid-state device containing an array of discrete test regions containing immobilized antibodies specific to different Drugs of Abuse (DOA) compound classes. A competitive chemiluminescent immunoassay is used for the DOA assays with the drug in the specimen and drug labelled with horseradish peroxidase (HRP) being in direct competition for the antibody binding sites. Increased levels of drug in a specimen will lead to reduced binding of drug labelled with HRP and thus a reduction in chemiluminescence being emitted. The light signal generated from each of the test regions on the biochip is detected by a Charge Coupled Device (CCD) camera in the Evidence MultiSTAT analyzer which, together with the analyzer software, is used to quantify the light output and produce results. The tests employ a qualitative reporting method. Each test sample is assayed against the provided Cut Off material of known concentration, which is used to determine the classification of the samples based on the comparison of the signal output.

The immunoassay processes are performed automatically in a self-contained and sealed biochip cartridge, which holds the biochips, the reagents, wash buffer and other fluids required for the test to be conducted.

C Instrument Description Information:

1. Instrument Name:

   Evidence MultiSTAT

2. Specimen Identification:

Specimens are identified by means of a barcode which is read by the analyzer. Specimen identification can also be entered manually through the touchscreen.

3. Specimen Sampling and Handling:

   Controls, cutoff calibrators, and patient samples must be manually pipetted into specific sample wells on the cartridge, which is then inserted manually into the analyzer.

4. Calibration:

   The MultiSTAT assays employ a qualitative reporting method. Each test sample is assayed against a single Cut Off material of known concentration ('single point calibrant') which is used to determine the classification of the samples based on the comparison of the signal output between the Cut Off material and the test sample.

5. Quality Control:

   A positive control is included with each MultiSTAT cartridge and users are instructed to analyze the controls with each run.

V Substantial Equivalence Information:

A Predicate Device Name(s):
PROFILE®-V MEDTOXScan® Drugs of Abuse Test System

B Predicate 510(k) Number(s):
K091454

C Comparison with Predicate(s):

Device & Predicate Device(s):	Candidate Device K220451	K091454
Device Trade Name	Evidence MultiSTAT Urine DOA MultiPlex, Evidence MultiSTAT	PROFILE®-V MEDTOXScan® Drugs of Abuse Test System
General Device Characteristic Similarities		
Intended Use/Indications For Use	Same	For the qualitative determination of drugs of abuse in human urine
Assay Type	Same	Competitive Immunoassay
Sample Matrix	Same	Urine
General Device Characteristic Differences		

Specific Analytes	Methamphetamine, Noroxycodone, Benzodiazepines, and Methadone.	Amphetamines, Barbiturates, Benzodiazepines, Cocaine, Methadone, Methamphetamine, Opiates, Phencyclidine, THC, Oxycodone, Tricyclic Antidepressants, and Propoxyphene.

VI Standards/Guidance Documents Referenced:

IEC 60601-1-2, Edition 4 .0, 2014, Medical electrical equipment - Part 1-2: General requirements for basic safety and essential perform

CLSI EP12-A2, Edition 2. 2008. User Protocol for Evaluation of Qualitative Test Performance Approved Guideline

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:

A precision study was conducted using drug free negative urine that was spiked with the appropriate analyte at -100%, -75%, -50%, -25%, +25%, +50%, +75 %, +100%, of the cut off as well as at the cut off. The test was performed by at least two (2) operators on 4 instruments, with 40 replicates per lot. Representative data for each analyte is represented below.

Methadone

Concentration (ng/ml)	% of Cut Off	Number of determinations	Results		% Agreement
			Negative	Positive	
0	-100%	40	40	0	100
75	-75%	40	40	0	100
150	-50%	40	40	0	100
225	-25%	40	40	0	100
300	Cut Off	40	1	39	n/a
375	+ 25%	40	0	40	100
450	+50%	40	0	40	100
525	+75%	40	0	40	100
600	+100%	40	0	40	100

Benzodiazepines I

Concentration (ng/ml)	% of Cut Off	Number of determinations	Results		% Agreement
			Negative	Positive	
0	-100%	40	40	0	100
50	-75%	40	40	0	100
100	-50%	40	40	0	100
150	-25%	40	40	0	100
200	Cut Off	40	20	20	n/a
250	+ 25%	40	2	38	95
300	+50%	40	0	40	100
350	+75%	40	0	40	100
400	+100%	40	0	40	100

Methamphetamine

Concentration (ng/ml)	% of Cut Off	Number of determinations	Results		% Agreement
			Negative	Positive	
0	-100%	40	40	0	100
125	-75%	40	40	0	100
250	-50%	40	40	0	100
375	-25%	40	38	2	95
500	Cut Off	40	2	38	n/a
625	+ 25%	40	0	40	100
750	+50%	40	0	40	100
875	+75%	40	0	40	100
1000	+100%	40	0	40	100

Noroxycodone

Concentration (ng/ml)	% of Cut Off	Number of determinations	Results		% Agreement
			Negative	Positive	
0	-100%	40	40	0	100
25	-75%	40	40	0	100
50	-50%	40	40	0	100
75	-25%	40	40	0	100
100	Cut Off	40	0	40	n/a
125	+ 25%	40	0	40	100
150	+50%	40	0	40	100
175	+75%	40	0	40	100
200	+100%	40	0	40	100

2. Linearity:

Not applicable. These devices are intended for qualitative use only.

3. Analytical Specificity/Interference:

The sponsor performed a study to evaluate potential interference from various endogenous and exogenous compounds.

Using drug free negative urine two spiked samples were prepared, one at -50% of the Cut Off and one at +50% of the Cut Off. These samples were then divided into two portions where half was spiked with the interferent (test) and the other half was spiked with the same volume of matrix as a control. For each interferent there were four samples:

- Cut Off -50% spiked with Blank (Control)
- Cut Off -50% spiked with Interferent (TEST)
- Cut Off +50% spiked with Blank (Control)
- Cut Off +50% spiked with Interferent (TEST)

Results were as follows:

Methamphetamine

Compound	Test Concentration
Acetone	1000 mg/dL
Ethanol	1000 mg/dL
Glucose	3000 mg/dL
Oxalic Acid	100 mg/dL
Sodium Chloride	6000 mg/dL
Caffeine	1 mg/ml
Ascorbic Acid	1500 mg/dL
Galactose	10 mg/dL
Hemoglobin	300 mg/dL
Riboflavin	7.5 mg/dL
Acetaminophen	1 mg/ml
Ibuprofen	1 mg/ml
Creatinine	5 mg/ml
Gamma Globulin	500 mg/dL
Human Serum Albumin	500 mg/dL
Urea	3500 mg/dL
Acetylsalicylic Acid	1 mg/ml
Ranitidine	0.9 mg/ml
Promethazine HCl	500,000 ng/mL
Phenothiazine	50,000 ng/mL
Atomoxetine HCl	500,000 ng/mL
(±)-Propranolol hydrochloride	100,000 ng/mL
Trifluoperazine diHCl	125,000 ng/mL
Dopamine HCl	500,000 ng/mL
Bupropion HCI	500,000 ng/mL
Oxazepam	500,000 ng/mL

Compound	Test Concentration
Valproic acid sodium salt	500,000 ng/mL
Phenobarbital	500,000 ng/mL
(±)-Methadone HCl	500,000 ng/mL
Codeine Monohydrate	500,000 ng/mL
Sertraline HCl	125,000 ng/mL
Chlorpromazine HCl	500,000 ng/mL
Doxepin Hydrochloride	200,000 ng/mL
Benzoylecgonine Tetrahydrate	500,000 ng/mL
Morphine Sulfate Salt Pentahydrate	500,000 ng/mL
Trazodone HCl	500,000 ng/mL
Dextromethorphan hydrobromide monohydrate	500,000 ng/mL
Scopolamine Hydrobromide	250,000 ng/mL
Thioridazine	250,000 ng/mL
Brompheniramine Maleate	250,000 ng/mL
Chlorpheniramine	500,000 ng/mL
Methapyrilene	100,0000 ng/mL
Pethidine HCl (Meperidine Hydrochloride)	500,000 ng/mL
Dextropropoxyphene	500,000 ng/mL
Procainamide HCl	100,000 ng/mL
Buspirone HCl	125,000 ng/mL
Triflupromazine HCl	125,000 ng/mL
Secobarbital	100,000 ng/mL
Methaqualone	500,000 ng/mL
Phencyclidine	500,000 ng/mL
Amobarbital	500,000 ng/mL
Lorazepam	50,000 ng/mL
Fentanyl	50.000 ng/mL
Noroxycodone	50,000 ng/mL
Tramadol	50,000 ng/mL
Norbuprenorphine	50.000 ng/mL
6-Acetylmorphine	50,000 ng/mL
(-)-11-nor-9-Carboxy-Δ9-THC	50,000 ng/mL

Noroxycodone

Compound	Test Concentration
Acetone	1000 mg/dl
Ethanol	1000 mg/dl
Glucose	3000 mg/dl
Oxalic Acid	100 mg/dl
Sodium Chloride	6000 mg/dl
Caffeine	1 mg/ml
Ascorbic Acid	1500 mg/dl
Galactose	10 mg/dl
Hemoglobin	300 mg/dl
Riboflavin	7.5 mg/dl
Acetaminophen	1 mg/ml
Ibuprofen	1 mg/ml
Creatinine	5 mg/ml
Gamma Globulin	500 mg/dl
Human Serum Albumin	500 mg/dl
Urea	3500 mg/dl
Acetylsalicylic Acid	1 mg/ml
Ranitidine	0.9 mg/ml
Promethazine HCl	500,000 ng/ml
(-) Nicotine	500,000 ng/ml
(±)-Propranolol hydrochloride	250,000 ng/ml
Bupropion HCI	500,000 ng/ml
(1S,2R)-(+)-Ephedrine	500,000 ng/ml
Valproic acid sodium salt	500,000 ng/ml
(+)-Methadone Hydrochloride	500,000 ng/ml
Tyramine	500,000 ng/ml
Chlorpromazine HCl	500,000 ng/ml
Benzoylecgonine Tetrahydrate	500,000 ng/ml
Trazodone HCl	500,000 ng/ml
Brompheniramine Maleate	250,000 ng/ml
Chlorpheniramine	500,000 ng/ml
(+)-Norpropoxyphene	100,000 ng/ml
Ecgonine Methyl Ester	500,000 ng/ml
Pethidine HCl (Meperidine HCl)	500,000 ng/ml
Phenylpropanolamine	250,000 ng/mL
Phencyclidine	500,000 ng/ml
Secobarbital	100,000 ng/ml
Amobarbital	100,000 ng/ml

Benzodiazepines I

Compound	Test Concentration
Acetone	1000 mg/dl
Ethanol	1000 mg/dl
Glucose	3000 mg/dl
Oxalic Acid	100 mg/dl
Sodium Chloride	6000 mg/dl
Caffeine	1 mg/ml
Ascorbic Acid	1500 mg/dl
Galactose	10 mg/dl
Hemoglobin	300 mg/dl
Riboflavin	7.5 mg/dl
Acetaminophen	1 mg/ml
Ibuprofen	1 mg/ml
Creatinine	5 mg/ml
Gamma Globulin	500 mg/dl
Human Serum Albumin	500 mg/dl
Urea	3500 mg/dl
Acetylsalicylic Acid	1 mg/ml
Ranitidine	0.9 mg/ml
Sodium Fluoride	10 g/l
Procaine HCl	100,000 ng/ml
Furosemide	100,000 ng/ml
Sodium Azide	10 mg/ml
Boric Acid	10 mg/ml
(1S,2R)-(+)-Ephedrine	500,000 ng/ml
(1R,2R)-(-)-Pseudoephedrine	100,000 ng/ml
(1S, 2S)-(+)-Pseudoephedrine	100,000 ng/ml
(-)-alpha-Acetylmethadol HCl	100,000 ng/ml
Chloramphenicol	100,000 ng/ml
Labetalol HCl	100,000 ng/ml
Atropine Sulfate	100,000 ng/ml
(±)-Methadone Hydrochloride	500,000 ng/ml
(+) - Methamphetamine Hydrochloride	500,000 ng/ml

Bilirubin	0.15 mg/ml
Codeine Monohydrate	500,000 ng/ml
MDEA HCl	500,000 ng/ml
Quinidine	100,000 ng/ml
(-)-isoproterenol HCl	100,000 ng/ml
(-)-Cotinine	100,000 ng/ml
Cocaine Hydrochloride	500,000 ng/ml
Benzoylecgonine Tetrahydrate	500,000 ng/ml
Morphine Sulfate Salt Pentahydrate	500,000 ng/ml
(-)-11-Nor-Δ9-THC Carboxylic Acid	500,000 ng/ml
Aspartame	100,000 ng/ml
Benzilic Acid	100,000 ng/ml
Estrone	100,000 ng/ml
Chlorpheniramine	500,000 ng/ml
EDDP Perchlorate	100,000 ng/ml
Loperamide Hydrochloride	100,000 ng/ml
Pentobarbital	500,000 ng/ml
Oxycodone Hydrochloride	100,000 ng/ml
Heroin	100,000 ng/ml
Chloroquine	100,000 ng/ml
Ecgonine Methyl Ester	500,000 ng/ml
Ketamine HCl	100,000 ng/ml
(-) 11-Hydroxy-delta9-THC	100,000 ng/ml
(±)-MDMA	100,000 ng/ml
PCP	100,000 ng/ml
6MAM	100,000 ng/ml
(±)-MDA	100,000 ng/ml
Amitriptyline HCl	125,000 ng/ml
(±) MBDB	100,000 ng/ml
Cannabidiol	100,000 ng/ml
EMDP	100,000 ng/ml
Secobarbital	100,000 ng/ml
d,l-Amphetamine-D5 HCl	100,000 ng/ml
Amobarbital	100,000 ng/ml
(-)-Δ9-THC	100,000 ng/ml
Dihydrocodeine	100,000 ng/ml
Cocaethylene (Benzoylecgonine ethyl ester)	100,000 ng/ml
Perphenazine	100,000 ng/ml
Phenethylamine	100,000 ng/ml

Methadone

Compound	Test Concentration
Acetone	1000 mg/dl
Ethanol	1000 mg/dl
Glucose	3000 mg/dl
Oxalic Acid	100 mg/dl
Sodium Chloride	6000 mg/dl
Caffeine	1 mg/ml
Ascorbic Acid	1500 mg/dl
Galactose	10 mg/dl
Hemoglobin	300 mg/dl
Riboflavin	7.5 mg/dl
Acetaminophen	1 mg/ml
Ibuprofen	1 mg/ml
Creatinine	5 mg/ml
Gamma Globulin	500 mg/dl
Human Serum Albumin	500 mg/dl
Urea	3500 mg/dl
Acetylsalicylic Acid	1 mg/ml
Ranitidine	0.1 mg/ml
Salbutamol	100,000 ng/ml
Sodium Fluoride	10 g/l
(±) Metoprolol (+)Tartrate	100,000 ng/ml
Lisinopril	100,000 ng/ml
Imipramine HCl	100,000 ng/ml
(-) Nicotine	500,000 ng/ml
Quetiapine Fumarate	100,000 ng/ml
(S)- Duloxetine HCl	100,000 ng/ml
Omeprazole	100,000 ng/ml
Loratadine	100,000 ng/ml
Carbamazepine	100,000 ng/ml
Fluoxetine HCl	100,000 ng/ml
Metformin hydrochloride	100,000 ng/ml
Nortriptyline HCl	100,000 ng/ml
Sodium Azide	10 mg/ml
Boric Acid	10 mg/ml
Bupropion HCI	500,000 ng/ml
Diphenhydramine	50,000 ng/ml
Oxazepam	500,000 ng/ml
Tramadol HCl	100,000 ng/ml
(1S, 2S)-(+)-	100,000 ng/ml
Gabapentin	100,000 ng/ml

Phenobarbital	500,000 ng/ml
Cetirizine Dihychloride	100,000 ng/ml
(+) - Methamphetamine	500,000 ng/ml
Zolpidem	100,000 ng/ml
Citric Acid	8 mg/ml
Potassium Chloride	60 mg/ml
Bilirubin	0.15 mg/ml
Codeine Monohydrate	100,000 ng/ml
MDEA HCl	500,000 ng/ml
Hydromorphone HCl	100,000 ng/ml
Sertraline HCl	125,000 ng/ml
L-Thyroxine	100,000 ng/ml
Chlorpromazine HCl	100,000 ng/ml
Clomipromine	50,000 ng/ml
Desipramine	100,000 ng/ml
Benzoylecgonine	500,000 ng/ml
Morphine Sulfate Salt Pentahydrate	500,000 ng/ml
Hydrocodone	50,000 ng/ml
(-)-11-Nor-Δ9-THC Carboxylic Acid	500,000 ng/ml
Amlodipine besylate	100,000 ng/ml
Amoxicillin Trihydrate	500,000 ng/ml
Atorvastatin Calcium Salt	100,000 ng/ml
Compound Losartan	100,000 ng/ml
Chlorpheniramine	50,000 ng/ml
D-(+)-Amphetamine	500,000 ng/ml
Buprenorphine	500,000 ng/ml
Oxycodone Hydrochloride	100,000 ng/ml
Fluphenazine	100,000 ng/ml
Calcium Chloride	3 mg/ml
Sodium Phosphate	3 mg/ml
DL β-Hydroxybutyric	1 mg/ml
Uric Acid	100,000 ng/ml
Fentanyl	100,000 ng/ml
Pethidine HCl (Meperidine Hydrochloride)	25,000 ng/ml
Oxymorphone	100,000 ng/ml
(±)-MDMA	100,000 ng/ml
6MAM	100,000 ng/ml
(±)-MDA	100,000 ng/ml
Amitriptyline HCl	25,000 ng/ml

No interference was seen for any of the assays except for Ranitidine with the methadone assay. The sponsor repeated the study with lower amounts of ranitidine and found that the highest concentration that did not interfere with the methadone assay was 0.1 mg/mL.

The sponsor performed a study to determine if the specific gravity of the samples interfered with the results. The Specific Gravity of drug free negative urine aliquots was adjusted to a range from 1.000 to 1.030. For each Specific Gravity (sG) level two spiked samples were prepared, one at -50% of the Cut Off and one at +50% of the Cut Off. No positive or negative interference was seen with any of the assays at the specific gravities tested.

The sponsor also performed a study to determine if the pH of the samples interfered with the results. The pH of drug free negative urine aliquots was adjusted to a pH range of 3 to 11. For each pH level two spiked samples were prepared, one at -50% of the Cut Off and one at +50% of the Cut Off. No positive or negative interference was seen with any of the assays at the pH levels tested.

The sponsor also performed a study to determine the cross-reactivity from structurally related compounds by identifying the concentration of a compound prepared in drug free negative urine that would produce a positive response for each assay when analysed against the cut off material. The results are summarized below.

Methadone

Compound	Approximate Concentration to Read Positive (ng/ml)	Approximate % Cross Reactivity
(±)-Methadone	300	100.0
EDDP Perchlorate	Negative at 30,000 ng/ml	Not Detected
EMDP	Negative at 100,000 ng/ml	Not Detected
(-)-alpha-Acetylmethadol HCl (LAAM HCl)	Negative at 500,000 ng/mL	Not Detected
α-Noracetylmethadol (Nor-LAAM)	500,000 ng/mL	0.6
α-Methadol	30,000 ng/mL	1.0
Isomethadone	50,000 ng/mL	0.6

Benzodiazepines 1

Compound	Approximate Concentration to Read Positive (ng/ml)	Approximate % Cross Reactivity
Oxazepam	200	100.0
Alprazolam	35	571.4
Flubromazolam	50	400.0
Flualprazolam	60	333.3
Nordiazepam	110	181.8
Diazepam	150	133.3
Midazolam	190	105.3
Desalkylflurazepam	200	100.0
Flubromazepam	200	100.0
Clobazam	300	66.7
Pyrazolam	300	66.7
Bromazepam	360	55.6
α-OH-Alprazolam	400	50.0
Chlordiazepoxide	400	50.0
Temazepam	400	50.0
Delorazepam	900	22.2
Nitrazepam	900	22.2
α-OH-Flualprazolam	1,000	20.0
Flunitrazolam	1,000	20.0
Phenazepam	1,200	16.7
Lorazepam	1,250	16.0
Prazepam	22,000	0.9
Meclonazepam	2,750	7.3
Medazepam	3,000	6.7
Flunitrazepam	3,200	6.3
Diclazepam	4,000	5.0
Lormetazepam	6,000	3.3
Clonazepam	8,000	2.5

Compound	Approximate Concentration to Read Positive (ng/ml)	Approximate % Cross Reactivity
Clonazolam	15,000	1.3
α-Hydroxytriazolam	17,000	1.2
7-Aminoclonazepam	Negative at 25,000 ng/ml	Not Detected
8-Aminoclonazolam	Negative at 20,000 ng/ml	Not Detected
Etizolam	Negative at 20,000 ng/ml	Not Detected
Flurazepam	Negative at 20,000 ng/ml	Not Detected

Methamphetamine

Compound	Approximate Concentration to Read Positive (ng/ml)	Approximate % Cross Reactivity
S-(+)-Methamphetamine	500	100.0
PMMA HCl	400	125.0
(±)-MDMA	1,000	50.0
(±)-Methamphetamine	1,000	50.0
(±)-MBDB	15,000	3.3
(±)-MDEA	30,000	1.7
BDB	40,000	1.25
DL-Fenfluramine	75,000	0.7
(1S,2S)-(+)-Pseudoephedrine	120,000	0.4
Mephedrone HCl	125,000	0.4
Flephedrone	400,000	0.13
Mephentermine HCl	1,000,000	0.05
(±)-Amphetamine	Negative at 50,000ng/ml	Not Detected
R-(-)-Amphetamine	Negative at 50,000ng/ml	Not Detected
S-(+)-Amphetamine	Negative at 50,000ng/ml	Not Detected
(±)-MDA	Negative at 50,000ng/ml	Not Detected

Compound	Approximate Concentration to Read Positive (ng/ml)	Approximate % Cross Reactivity
R-(-)-Methamphetamine	Negative at 100,000ng/ml	Not Detected
Phentermine	Negative at 50,000ng/ml	Not Detected
PMA HCl	Negative at 50,000ng/ml	Not Detected
Diphenhydramine	Negative at 100,000ng/ml	Not Detected
(1R,2R)-(−)-Pseudoephedrine	Negative at 500,000ng/ml	Not Detected
(1S,2R)-(+)-Ephedrine HCl	Negative at 500,000ng/ml	Not Detected
Phenylephrine	Negative at 300,000ng/ml	Not Detected
Tyramine	Negative at 400,000ng/ml	Not Detected
Atomoxetine HCl	Negative at 500,000ng/ml	Not Detected
4-Methyl-2- Hexylamine HCl (DMAA HCl)	Negative at 500,000ng/ml	Not Detected
Dopamine HCl	Negative at 500,000ng/ml	Not Detected
Isoxsuprine HCl	Negative at 500,000ng/ml	Not Detected
Phenmetrazine HCl	Negative at 100,000ng/ml	Not Detected
Tranylcypromine HCl	Negative at 50,000ng/ml	Not Detected
Phenethylamine	Negative at 100,000ng/ml	Not Detected
Benzphetamine	Negative at 500,000ng/ml	Not Detected
Phenylpropanolamine	Negative at 100,000ng/ml	Not Detected

Noroxycodone

Compound	Approximate Concentration to Read Positive (ng/ml)	Approximate % Cross Reactivity
Noroxycodone	100	100.0
Noroxymorphone	1000	11.96
Dextromethorphan	Negative at 1,000,000 ng/mL	Not Detected
Hydrocodone	40	250.0
Oxycodone	70	142.9
Norhydrocodone	100	100.0
Norcodeine	20,000	0.5

Compound	Approximate Concentration to Read Positive (ng/ml)	Approximate % Cross Reactivity
Naloxone	50,000	0.2
6-Acetylcodeine	Negative at 10,000 ng/ml	Not Detected
6-Acetylmorphine	Negative at 50,000 ng/ml	Not Detected
Codeine	15,000	0.67
Codeine glucuronide	Negative at 100,000 ng/ml	Not detected
Desomorphine	Negative at 10,000 ng/ml	Not Detected
Dihydrocodeine	Negative at 10,000 ng/ml	Not Detected
Ethyl Morphine	Negative at 10,000 ng/ml	Not Detected
Heroin	Negative at 10,000 ng/ml	Not Detected
Hydromorphone	Negative at 15,000 ng/ml	Not Detected
Levorphanol Tartrate	Negative at 10,000 ng/ml	Not Detected
Morphine	Negative at 50,000 ng/ml	Not Detected
Morphine-3βD-Glucuronide	Negative at 10,000 ng/ml	Not Detected
Morphine-6βD-Glucuronide	Negative at 10,000 ng/ml	Not Detected
Normorphine	Negative at 10,000 ng/ml	Not Detected
Oxymorphone	Negative at 30,000 ng/ml	Not Detected
Norbuprenorphine	Negative at 100.000 ng/mL	Not Detected
Oxymorphone Glucuronide	Negative at 30,000 ng/ml	Not Detected
Thebaine	Negative at 10,000 ng/ml	Not Detected

4. Assay Reportable Range:

   Not applicable. The assays are qualitative and reported as positive or negative.

5. Traceability, Stability, Expected Values (Controls, Calibrators, or Methods):

The assays are traceable to commercially available standards.

6. Detection Limit:

   Not applicable. The assays are qualitative and reported as positive or negative.

7. Assay Cut-Off:

   See section VII.A.1 above for a description of how the device performs around the cutoffs.

8. Accuracy (Instrument):

   Not applicable

9. Carry-Over:

   All components of the assay that contact the urine sample are single use and disposable. Therefore, carryover from one sample to another is not applicable.

B Comparison Studies:

1. Method Comparison with Predicate Device:

   A method comparison study was conducted using clinical samples tested on the Randox Evidence MultiSTAT DOA Urine Multi-Plex and compared to results from a chemically specific quantitative comparator method. Results are summarized below.

Methamphetamine (n=137)

	LC/MS/MS			
MultiSTAT Result c/o = 500 ng/ml	Low Negative Less than 50% below the c/o (<250 ng/ml)	Near Cut Off Negative Between 50% below the c/o and the c/o (250 – 500 ng/ml)	Near Cut Off Positive Between 50% above the c/o and the c/o (500 – 750 ng/ml)	High Positive Greater than 50% above the c/o (>750 ng/ml)
Positive	2*	3	4	57
Negative	65	6	0	0

*these samples contained one or more of the following cross-reactants that contributed to the positive result: Pseudoephedrine and MDMA.

Noroxycodone (n=80)

	LC/MS/MS			
MultiSTAT Result c/o = 100 ng/ml	Low Negative Less than 50% below the c/o (<50 ng/ml)	Near Cut Off Negative Between 50% below the c/o and the c/o (50 – 100 ng/ml)	Near Cut Off Positive Between 50% above the c/o and the c/o (100 – 150 ng/ml)	High Positive Greater than 50% above the c/o (>150 ng/ml)
Positive	11*	5*	4	36
Negative	21	3	0	0

*these samples contained one or more of the following cross-reactants that contributed to the positive result: Codeine, Hydrocodone, Norhydrocodone, and Oxycodone.

Benzodiazepines 1 (n=133)

	LC/MS/MS			
MultiSTAT Result c/o = 200 ng/ml	Low Negative Less than 50% below the c/o (<100 ng/ml)	Near Cut Off Negative Between 50% below the c/o and the c/o (100 – 200 ng/mL)	Near Cut Off Positive Between 50% above the c/o and the c/o (200 – 300 ng/ml)	High Positive Greater than 50% above the c/o (> 300 ng/ml)
Positive	0	5*	11	34
Negative	72	10	1	0

*these samples contained one or more of the following cross-reactants that contributed to the positive result: alpha-OH- Alprazolam and Temazepam.

Methadone (n=287)

	LC/MS/MS			
MultiSTAT Result c/o = 300 ng/ml	Low Negative Less than 50% below the c/o (<150 ng/ml)	Near Cut Off Negative Between 50% below the c/o and the c/o (150 – 300 ng/ml)	Near Cut Off Positive Between 50% above the c/o and the c/o (300 – 450 ng/ml)	High Positive Greater than 50% above the c/o (>450 ng/ml)
Positive	0	2	4	40
Negative	229	12	0	0

2. Matrix Comparison:

Not applicable. Only urine samples may be used with the candidate device.

C Clinical Studies:

1. Clinical Sensitivity:

Not applicable.

2. Clinical Specificity:

Not applicable.

3. Other Clinical Supportive Data (When 1. and 2. Are Not Applicable):

Not applicable.

D Clinical Cut-Off:

Not applicable.

E Expected Values/Reference Range:

Not applicable.

F Other Supportive Instrument Performance Characteristics Data:

Not applicable.

VIII Proposed Labeling:

The labeling supports the finding of substantial equivalence for this device.

IX Conclusion:

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