510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY

I Background Information:

A 510(k) Number

K221550

B Applicant

Randox Laboratories Limited

C Proprietary and Established Names

Evidence MultiSTAT Urine DOA MultiPlex

D Regulatory Information

Product Code(s)	Classification	Regulation Section	Panel
DJG	Class II	21 CFR 862.3650 - Opiate test system	TX - Clinical Toxicology
DIS	Class II	21 CFR 862.3150 - Barbiturate Test System	TX - Clinical Toxicology
LCM	Unclassified		

II Submission/Device Overview:

A Purpose for Submission:

New device

B Measurand:

Phenobarbital, Tramadol, Phencyclidine (PCP), Buprenorphine, 6-Acetylmorphine (6-MAM)

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
Phenobarbital	Phenobarbital	200 ng/ml
Tramadol	Tramadol	200 ng/ml
Phencyclidine	Phencyclidine	25 ng/ml
Buprenorphine	Norbuprenorphine	5 ng/ml
6-Acetylmorphine	6-Acetylmorphine	10 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 (K221550) represents 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.

A sister submission (K220451) contains the review for the Evidence MultiSTAT and following Evidence MultiSTAT DOA Urine MultiPlex claimed analytes at the associated cut off concentrations; Methamphetamine at 500 ng/ml, Noroxycodone at 100 ng/ml, Benzodiazepines at 200 ng/ml, and Methadone at 300 ng/ml.

The Evidence MultiSTAT DOA Urine MultiPlex test kit will comprise 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 MutliSTAT 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 will comprise:

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.

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):	K221550	K091454
Device Trade Name	Evidence MultiSTAT DOA Urine MultiPlex	PROFILE®-V MEDTOXScan® Drugs of Abuse Test System
General Device Characteristic Similarities		
Intended Use/Indications For Use	For the qualitative determination of drugs of abuse in human urine	Same
Assay Type	Competitive Immunoassay	Same
Sample Matrix	Urine	Same
Analyte (Cutoff ng/mL)	Phencyclidine (25	Same

	ng/mL)	
General Device Characteristic Differences		
Analyte	Buprenorphine (5 ng/mL) Phenobarbital (200 ng/mL) Tramadol (200 ng/mL) 6-Acetylmorphine (10 ng/mL)	Amphetamine (500 ng/mL) Butalbital (200 ng/mL) Benzodiazepines (150 ng/mL) Cocaine (150 ng/mL) Methamphetamine (500 ng/mL) Methadone (200 ng/mL) Morphine (100 ng/mL) Oxycodone (100 ng/mL) Propoxyphene (300 ng/mL) THC Cannabinoids (50 ng/mL) TCA Tricyclic Antidepressants (300 ng/mL)
Reagent Form	Ready to Use & Lyophilized	Ready to Use

VI Standards/Guidance Documents Referenced:

CLSI EP12 – A2 – User Protocol for Evaluation of Qualitative Test Performance: Approved Guideline – Second Edition; 7-152

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 presented below:

Phenobarbital					
Percent (%) of Cut Off	Concentration (ng/ml)	Number of determinations	Results		% Agreement
			Negative	Positive	
-100%	0	40	40	0	100
-75%	50	40	40	0	100
-50%	100	40	40	0	100
-25%	150	40	38	2	95
Cut Off	200	40	6	36	N/A
+25%	250	40	0	40	100
+50%	300	40	0	40	100
+75%	350	40	0	40	100
+100%	400	40	0	40	100

Tramadol					
Percent (%) of Cut Off	Concentration (ng/ml)	Number of determinations	Results		% Agreement
			Negative	Positive	
-100%	0	40	40	0	100
-75%	50	40	40	0	100
-50%	100	40	40	0	100
-25%	150	40	37	3	92.5
Cut Off	200	40	1	39	N/A
+25%	250	40	0	40	100
+50%	300	40	0	40	100
+75%	350	40	0	40	100
+100%	400	40	0	40	100

Phencyclidine (PCP)					
Percent (%) of Cut Off	Concentration (ng/ml)	Number of determinations	Results		% Agreement
			Negative	Positive	
-100%	0	40	40	0	100
-75%	6.25	40	40	0	100
-50%	12.5	40	40	0	100
-25%	18.75	40	39	1	97.5
Cut Off	25	40	2	38	N/A
+25%	31.25	40	0	40	100
+50%	37.5	40	0	40	100
+75%	43.75	40	0	40	100
+100%	50	40	0	40	100

Buprenorphine					
Percent (%) of Cut Off	Concentration (ng/ml)	Number of determinations	Results		% Agreement
			Negative	Positive	
-100%	0	40	40	0	100
-75%	1.25	40	40	0	100

-50%	2.5	40	40	0	100
-25%	3.75	40	40	0	100
Cut Off	5	40	0	40	N/A
+25%	6.25	40	0	40	100
+50%	7.5	40	0	40	100
+75%	8.75	40	0	40	100
+100%	10	40	0	40	100

6-Acetylmorphine					
Percent (%) of Cut Off	Concentration (ng/ml)	Number of determinations	Results		% Agreement
			Negative	Positive	
-100%	0	40	40	0	100
-75%	2.5	40	40	0	100
-50%	5	40	40	0	100
-25%	7.5	40	36	4	90
Cut Off	10	40	0	40	N/A
+25%	12.5	40	0	40	100
+50%	15	40	0	40	100
+75%	17.5	40	0	40	100
+100%	20	40	0	40	100

2. Linearity:

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

3. Analytical Specificity/Interference:
   Potential interference from various compounds were tested by spiking the potentially interfering compound into drug-free urine containing the target drug concentrations at 50% below and 50% above the threshold cut off level. If interference was observed, the interferent was titrated down and the concentration at which no interference is observed quoted. The following exogenous compounds were found not to interfere with test results when tested up to the concentrations identified in the table below.

Interference: Phenobarbital Assay	
Compound	Concentration Tested
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
Oxazepam	500,000 ng/ml
Clonazepam	500,000 ng/ml
Alprazolam	500,000 ng/ml
(±)-Methadone Hydrochloride	500,000 ng/ml
(+) - Methamphetamine Hydrochloride	500,000 ng/ml
Codeine Monohydrate	500,000 ng/ml
MDEA HCl	500,000 ng/ml
Nordiazepam	500,000 ng/ml
Benzoylecgonine Tetrahydrate	500,000 ng/ml
Morphine Sulfate Salt Pentahydrate	500,000 ng/ml
Morphine-3-β-D-Glucuronide	500,000 ng/ml
(-)-11-Nor-Δ9-THC Carboxylic Acid	500,000 ng/ml
D-(+)-Amphetamine Sulfate	500,000 ng/ml
(+)-Lorazepam	500,000 ng/ml
(±)-MDMA	100,000 ng/ml
Phencyclidine	100,000 ng/ml
6-Acetylmorphine	100,000 ng/ml
(±)-MDA	100,000 ng/ml
Flunitrazepam	500,000 ng/ml
Nitrazepam	500,000 ng/ml
Temazepam	100,000 ng/ml
α Hydroxy Alprazolam	100,000 ng/ml

Interference: Tramadol Assay	
Compound	Concentration Tested
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
Salbutamol	100,000 ng/ml
Sodium Fluoride	10 g/L
(±) Metoprolo (+)Tartrate Salt	100,000 ng/ml
Lisinopril	100,000 ng/ml
Imipramine HCL	100,000 ng/ml
(-) Nicotine	500,000 ng/ml
Quetiapine Fumerate	100,000 ng/ml
(S)- Duloxetine HCL	100,000 ng/ml
Omeprazole	100,000 ng/ml
Loratadine	100,000 ng/ml
Carbamazapine	100,000 ng/ml
Fluoxetine HCl	500,000 ng/ml
Metformin hydrochloride	100,000 ng/ml
Nortriptyline HCL	100,000 ng/ml
Efavirenz	100,000 ng/ml
Sodium Azide	10 mg/ml
Ibuprofen	500,000 ng/ml
Boric Acid	10 mg/ml
Bupropion HCI	500,000 ng/ml
Diphenhydramine hydrochloride	100,000 ng/ml
Oxazepam	500,000 ng/ml
(1S, 2S)-(+)-Pseudoephedrine	100,000 ng/ml
Gabapentin	100,000 ng/ml
Ciprofloxacin	100,000 ng/ml
Cetirizine Dihychloride	100,000 ng/ml
Alimemazine Hemitartrate	100,000 ng/ml
(±)-Methadone Hydrochloride	100,000 ng/ml
(+) - Methamphetamine Hydrochloride	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	500,000 ng/ml
MDEA HCL	500,000 ng/ml

Hydromorphone HCL	100,000 ng/ml
Sertraline HCL	75,000 ng/ml
L-Thyroxine	100,000 ng/ml
Chlorpromazine HCl	10,000 ng/ml
Clomipromine Hydrochloride	50,000 ng/ml
Desipramine Hydrochloride	100,000 ng/ml
Benzoylecgonine Tetrahydrate	500,000 ng/ml
Morphine Sulfate Salt Pentahydrate	500,000 ng/ml
Hydrocodone	100,000 ng/ml
(-)-11-Nor-Δ9-THC Carboxylic Acid	500,000 ng/ml
Niflumic Acid	100,000 ng/ml
Amlodipine besylate	100,000 ng/ml
Doxylamine succinate salt	100,000 ng/ml
Amoxicillin Trihydrate	500,000 ng/ml
Atorvastatin Calcium Salt	100,000 ng/ml
Hydroxyzine Pamoate	100,000 ng/ml
Compound Losartan	100,000 ng/ml
Chlorpheniramine	100,000 ng/ml
Prochlorperazine	25,000 ng/ml
D-(+)-Amphetamine Sulfate	500,000 ng/ml
Pentobarbital	500,000 ng/ml
Buprenorphine hydrochloride	100,000 ng/ml
(+)-Lorazepam	500,000 ng/ml
Oxycodone Hydrochloride	100,000 ng/ml
Fluphenazine	100,000 ng/ml
Methapyrilene	50,000 ng/ml
Calcium Chloride	3 mg/ml
Sodium Phosphate Dibasic	3 mg/ml
DL β-Hydroxybutyric Acid	1 mg/ml
Uric Acid	100,000 ng/ml
Fentanyl	100,000 ng/ml
Pethidine HCL (Meperidine HCl)	500,000 ng/ml
Dextropropoxyphene	500,000 ng/ml
Zolpidem-6-Carboxylic Acid	10,000 ng/ml
Oxymorphone	100,000 ng/ml
(±)-MDMA	100,000 ng/ml
6-Acetylmorphine	100,000 ng/ml
(±)-MDA	100,000 ng/ml
Amitriptyline HCl	125,000 ng/ml
Verapamil HCL	500,000 ng/ml
Zolpidem Phenyl-4-Carboxylic Acid	10,000 ng/ml
Thioridazine	250,000 ng/ml
JWH-073	500,000 ng/ml

Interference: Phencyclidine Assay	
Compound	Concentration Tested
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
Imipramine HCL	25,000 ng/ml
Benzocaine	100,000 ng/ml
Erythromycin	100,000 ng/ml
Furosemide	100,000 ng/ml
Diphenhydramine HCl	5,000 ng/ml (Positive Interference)
Penicillin G	100,000 ng/ml
Atropine Sulfate	25,000 ng/ml
Quinidine	100,000 ng/ml
(-)-isoproterenol HCl	100,000 ng/ml
Lidocaine	500,000 ng/ml
Dextromethorphan hydrobromide monohydrate	25,000 ng/ml
Aspartame	100,000 ng/ml
Guaiacol Glyceryl Ether	100,000 ng/ml
Sulindac	100,000 ng/ml
Chlorpheniramine	100,000 ng/ml
Pheniramine	10,000 ng/ml
Amitriptyline HCl	50,000 ng/ml

Interference: Buprenorphine Assay	
Compound	Concentration Tested
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

Interference: 6-Acetylmorphine Assay	
Compound	Concentration Tested
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
Digoxin	500,000 ng/ml
Fluoxetine HCl	500,000 ng/ml
Diphenhydramine HCl	500,000 ng/ml
Oxazepam	500,000 ng/ml
Phenobarbital	500,000 ng/ml
(±)-Methadone Hydrochloride	500,000 ng/ml
(+) - Methamphetamine Hydrochloride	500,000 ng/ml
Chlorpromazine HCl	500,000 ng/ml

Desipramine Hydrochloride	500,000 ng/ml
Doxepin Hydrochloride	200,000 ng/ml
Benzoylecgonine Tetrahydrate	500,000 ng/ml
(-)-11-Nor-Δ9-THC Carboxylic Acid	500,000 ng/ml
Triprolidine Hydrochloride	100,000 ng/ml
Hydroxyzine	500,000 ng/ml
Brompheniramine Maleate	250,000 ng/ml
Diazepam	500,000 ng/ml
Dextropropoxyphene	500,000 ng/ml
Phencyclidine	100,000 ng/ml
Amitriptyline HCl	500,000 ng/ml
Secobarbital	100,000 ng/ml

Analytical Specificity:

To test cross-reactivity, drug metabolites and other compounds that may be present in human urine samples were tested using three (3) lots of the candidate device. The sponsor identified the concentration of each compound prepared in drug free negative urine that would produce a positive response for each assay when analyzed against the cut off material. The following is a summary of the cross-reactivity study. The individual assays are calibrated against the compounds marked with an asterisk (*).

Phenobarbital Assay Specificity	Concentration which resulted in positive (ng/ml)	Percent (%) Cross Reactivity
Phenobarbital*	200	100.0
Secobarbital	50	400.0
Butabarbital	70	285.7
Alphenal	90	222.2
Pentobarbital	90	222.2
Cyclopentobarbital	200	100.0
Amobarbital	210	95.2
Butalbital	210	95.2
Barbital	250	80.0
4-Hydroxypentobarbital	225	88.9

Tramadol Assay Specificity	Concentration which resulted in positive (ng/ml)	Percent (%) Cross Reactivity
Tramadol*	200	100.0
N-Desmethyl-cis-tramadol	1,100	18.2
O-Desmethyl-cis-tramadol	3,000	6.7
O-Desmethyl Tramadol β-D-Glucuronide	200,000	0.1
rac N-O-Didesmethyl tramadol	15,000	1.3

Ketamine	Neg @ 100,000ng/ml	Not Detected
(±)-Norketamine	Neg @ 20,000ng/ml	Not Detected
Dehydro-Norketamine	Neg @ 10,000ng/ml	Not Detected
O-Desmethylvenlafaxine	Neg @ 200,000ng/ml	Not Detected
Venlafaxine	Neg @ 100,000ng/ml	Not Detected
Naproxen	Neg @ 100,000ng/ml	Not Detected

Phencyclidine Assay Specificity	Concentration which resulted in positive (ng/ml)	Percent (%) Cross Reactivity
Phencyclidine*	25	100.0
Tenocyclidine (TCP)	125	20.0
Fentanyl	45,000	0.1
Diphenhydramine[1]	100,000 ng/ml	0.025
Dextromethorphan Hydrobromide Monohydrate	1,000,000 ng/ml	0.003
Venlafaxine	Neg @ 100,000 ng/ml	Not Detected

[1] Diphenhydramine also demonstrated positive interference at 5,000 ng/ml.

Buprenorphine Assay Specificity	Concentration which resulted in positive (ng/ml)	Percent (%) Cross Reactivity
Norbuprenorphine*	5	100.0
Buprenorphine	30	16.7
Norbuprenorphine Glucuronide	35	14.3
Buprenorphine-3 β-D-glucuronide	210	2.4
EMDP	Neg @ 100,000 ng/ml	Not Detected
Heroin	Neg @ 100,000 ng/ml	Not Detected
Levorphanol Tartrate	Neg @ 150,000 ng/ml	Not Detected

6-Acetylmorphine Assay Specificity	Concentration which resulted in positive (ng/ml)	Percent (%) Cross Reactivity
6-Acetylmorphine*	10	100.0
Heroin	1,200	0.8
6-Acetylcodeine	1,500	0.7
Levorphanol Tartrate	150,000	0.007
Codeine	Neg @ 100,000 ng/ml	Not Detected
Codeine-6-β-D- Glucuronide	Neg @ 100,000 ng/ml	Not Detected
Desomorphine	Neg @ 10,000 ng/ml	Not Detected
Dextromethorphan Hydrobromide Monohydrate	Neg @ 1,000,000 ng/ml	Not Detected
Dihydrocodeine	Neg @ 100,000 ng/ml	Not Detected
Ethyl Morphine	Neg @ 10,000 ng/ml	Not Detected
Hydrocodone	Neg @ 100,000 ng/ml	Not Detected

Hydromorphone	Neg @ 100,000 ng/ml	Not Detected
Imipramine HCL	Neg @ 200,000 ng/ml	Not Detected
Morphine	Neg @ 100,000 ng/ml	Not Detected
Morphine-3 βD-glucuronide	Neg @ 10,000 ng/ml	Not Detected
Morphine-6 βD-glucuronide	Neg @ 600,000 ng/ml	Not Detected
Naloxone	Neg @ 500,000 ng/ml	Not Detected
Nalorphine	Neg @ 200,000 ng/ml	Not Detected
Naltrexone	Neg @ 300,000 ng/ml	Not Detected
Norcodeine	Neg @ 100,000 ng/ml	Not Detected
Norhydrocodone	Neg @ 100,000 ng/ml	Not Detected
Normorphine	Neg @ 100,000 ng/ml	Not Detected
Noroxycodone	Neg @ 50,000 ng/ml	Not Detected
Noroxymorphone HCL	Neg @ 200,000 ng/ml	Not Detected
Oxycodone	Neg @ 100,000 ng/ml	Not Detected
Oxymorphone	Neg @ 100,000 ng/ml	Not Detected
Oxymorphone-3-β-D-Glucuronide	Neg @ 30,000 ng/ml	Not Detected
Pethidine HCl (Meperidine HCl)	Neg @ 200,000 ng/ml	Not Detected
Thebaine	Neg @ 10,000 ng/ml	Not Detected

Specificity of Structurally Related Compounds:

The following structurally unrelated compounds were tested and were found not to be detected when measuring any of the claimed drugs (Phenobarbital, Tramadol, Phencyclidine, Buprenorphine, 6-Acetylmorphine).

Specificity of Structurally Unrelated Compounds:

Compound	Approximate Concentration to Read Positive	Approximate Percent (%) Cross Reactivity
S(+)-Methamphetamine	Neg @ 50,000 ng/ml	Not Detected
S(+)-Amphetamine	Neg @ 50,000 ng/ml	Not Detected
Phenobarbital	Neg @ 50,000 ng/ml	Not Detected
Oxazepam	Neg @ 50,000 ng/ml	Not Detected
Lorazepam	Neg @ 50,000 ng/ml	Not Detected
(-)-11-nor-9-Carboxy- Δ9-THC	Neg @ 50,000 ng/ml	Not Detected
Benzoylecgonine	Neg @ 50,000 ng/ml	Not Detected
(+-)-Methadone	Neg @ 50,000 ng/ml	Not Detected
Morphine	Neg @ 50,000 ng/ml	Not Detected
Fentanyl	Neg @ 50,000 ng/ml	Not Detected
Noroxycodone	Neg @ 50,000 ng/ml	Not Detected
Tramadol	Neg @ 50,000 ng/ml	Not Detected
6-Acetylmorphine	Neg @ 50,000 ng/ml	Not Detected
PCP	Neg @ 50,000 ng/ml	Not Detected

Specific gravity and pH:
The effect of specific gravity for each analyte was evaluated by testing positive (50% above cutoff) and negative samples (50% below cutoff) at specific gravities ranging from 1.000 to 1.030. No interference was observed for all specific gravities tested.

The sponsor performed a study to evaluate whether low or high pH causes negative or positive interference with the candidate device. Samples containing the claimed drugs at concentrations corresponding to -50% and +50% of the cutoff were adjusted to pH levels ranging from 3.0 to 11.0. Aside from 6-Acetylmorphine at pH 11, none of the pH levels tested caused a positive result at -50% of the cutoff or a negative result at +50% of the cutoff, as described below:

Assay	pH Assessed that Does Not Interfere				
	pH 3	pH 5	pH 7	pH 9	pH 11
Phenobarbital	No effect	No effect	No effect	No effect	No effect
Tramadol	No effect	No effect	No effect	No effect	No effect
Phencyclidine	No effect	No effect	No effect	No effect	No effect
Buprenorphine	No effect	No effect	No effect	No effect	No effect
6-Acetylmorphine	No effect	No effect	No effect	No effect	Interference Observed

Effect of pH: **6-Acetylmorphine**					
Compound	Value	-50% Cut Off (5.0ng/mL)		+50% Cut Off (15.0ng/mL)	
		Result	Interference?	Result	Interference?
pH	10	Negative	No	Positive	No
	11	Negative	No	Negative	Yes

4. Assay Reportable Range:

   Not applicable.

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

   The assays are traceable to commercially available standards.

6. Detection Limit:

   Not applicable.

7. Assay Cut-Off:

   Not applicable.

B Comparison Studies:

1. Method Comparison with Predicate Device:

A method comparison study was conducted using 878 clinical samples obtained from one (1) site and tested on the candidate device and compared to results from a LC-MS/MS quantitative comparator method. Phenobarbital results were compared to results from a GC/MS quantitative comparator method. Results are summarized below.

Analyte	N	Cut-Off (ng/ml)	Evidence MultSTAT Urine MultiPlex Result	Reference Method Results by GC/MS or LC-MS/MS Value			
				Low Negative Less than 50% below the Cut Off	Near Cut Off Negative Between 50% below the Cut Off	Near Cut Off Positive Between 50% above the Cut Off	High Positive Greater than 50% above the Cut Off
Phenobarbital	111	200	Positive	0	7	21	40
			Negative	41	2	0	0
Tramadol	287	200	Positive	0	3	6	41
			Negative	235	2	0	0
Phencyclidine (PCP)	132	25	Positive	2*	6	11	46
			Negative	64	3	0	0
Buprenorphine	108	5	Positive	0	0	4	40
			Negative	49	12	3	0
6-Acetylmorphine (6-MAM)	240	10	Positive	0	3	5	45
			Negative	185	2	0	0

Discordant Sample Results:
* - These samples contained diphenhydramine at levels shown to cause positive interference.

2. Matrix Comparison:

Not applicable.

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.

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.