

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

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

k122064

**B. Purpose for Submission:**

New device

**C. Measurand:**

Buprenorphine

**D. Type of Test:**

Qualitative immunoassay

**E. Applicant:**

Tianjin New Bay Bioresearch Co., Ltd.

**F. Proprietary and Established Names:**

ForSure One Step Buprenorphine Drug Cup Test Device

**G. Regulatory Information:**

Product Code	Classification	Regulation Section	Panel
DJG	II	862.3650 Opiate test system	91, Toxicology

**H. Intended Use:**

1. Intended use(s):

See indication for use below

2. Indication(s) for use:

The ForSure One Step Buprenorphine Drug Cup Test Device is an immunochromatographic assay for the qualitative determination of buprenorphine in human urine at cutoff level of 10 ng/mL. The test is intended for prescription and over-the-counter use.

The buprenorphine assay will yield preliminary positive results when buprenorphine is ingested at or above therapeutic doses. There are no uniformly recognized drug levels for buprenorphine in urine. The ForSure One Step Buprenorphine Drug Cup Test Device shows the drug was or was not present at the cutoff level. The assay provides only a preliminary analytical test result. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. Gas Chromatography/Mass Spectrometry (GC/MS) or Liquid Chromatography/Mass Spectrometry (LC/MS) are the preferred confirmatory methods. Clinical consideration and professional judgment should be applied to any drugs of abuse test result, particularly when preliminary positive results are indicated.

3. Special conditions for use statement(s):

For prescription and over the counter use.

4. Special instrument requirements:

Not applicable, as the devices are visually-read single-use devices.

**I. Device Description:**

The device is for use with human urine. The ForSure One Step Buprenorphine Drug Cup Test Device is a single-test test strip. The ForSure One Step Buprenorphine Drug Cup Test Device contains a test cup, test strip, and package insert (instructions for use).

**J. Substantial Equivalence Information:**

1. Predicate device name(s):

ForSure One Step Buprenorphine Test Strip Device

2. Predicate K number(s):

k042990

3. Comparison with predicate:

Item	Candidate Device	Predicate
Intended use	ForSure OTC Buprenorphine One Step Immunochromatographic Drug Cup Qualitative test. The assay provides a simple and rapid analytical screening procedure to detect Buprenorphine and its metabolite drugs in human urine for prescription and OTC use.	Same except for prescription use only
Analyte	Buprenorphine	Same
Matrix	Urine	Same
Cutoff	10 ng/mL	Same
Assay time	5 minutes	Same
Storage	Below 28°C until expiration	Same
Chemistry formulation and Antibody used in the device	Using monoclonal/polyclonal antibody for the colloidal gold conjugate, Drug-Bovine Serum albumin conjugate for the test line of the membrane	Same
Test Format	Cup (Dip Method)	Test strip (Droplet method)

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

None were referenced

**L. Test Principle:**

The ForSure One Step Buprenorphine Drug Cup Test Device is based on lateral flow immunochromatographic technology. Buprenorphine in urine sample competes with the colloidal gold labeled monoclonal antibody-conjugates for binding to Buprenorphine protein conjugates on the test zone area. In the absence of drug in the sample, the Buprenorphine-protein conjugate binds to labeled antibody and produces a magenta band in the test zone area, i.e., a negative result. If drug is present in the sample, labeled antibody does not binds to the Buprenorphine-protein conjugate and produces no magenta band in the test zone area, i.e., a positive result. The absence or presence of the line is determined visually by the operator.

The device also has an internal process control which indicates that adequate volume of sample has been added and that the immunochromatographic device is intact. A

goat anti-mouse antibody is employed in the control line system.

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

1. Analytical performance:

a. *Precision/Reproducibility:*

Precision studies were performed using drug-free urine spiked to the following concentrations: cutoff, +/-25%, +/-50%, +/-75% and 200% of the cutoff. Also, negative urine was tested. The samples were aliquots, randomized and blinded. Within-run reproducibility testing was conducted using one lot tested by one operator in one run for a total of 30 determinations. The between-run reproducibility testing was conducted using 3 lots tested by three operators over 20 days. A total of 30 determinations were made at each concentration for each lot. Sample concentrations were confirmed by GC/MS. The results are displayed in the table below:

Within-run

Conc.		
	Neg	Pos
Negative	30	0
-75%	30	0
-50%	30	0
-25%	26	4
Cutoff	0	30
25%	0	30
50%	0	30
75%	0	30
200%	0	30

Between-run

Conc.	Lot 1		Lot 2		Lot 3	
	Neg	Pos	Neg	Pos	Neg	Pos
Negative	30	0	30	0	30	0
-75%	30	0	30	0	30	0
-50%	30	0	30	0	30	0
-25%	27	3	26	4	30	0
Cutoff	0	30	0	30	1	29
25%	0	30	0	30	0	30
50%	0	30	0	30	0	30
75%	0	30	0	30	0	30
200%	0	30	0	30	0	30

*b. Linearity/assay reportable range:*

Not applicable, the device is intended for qualitative use

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

This device has internal process controls. A colored line appearing in the control region confirms sufficient sample volume and adequate membrane wicking. Users are informed that the test is invalid if a line fails to appear in the control region.

Control standards are not supplied with this device; however labeling states it is good laboratory practice to confirm the test procedure and to verify proper test performance. Users should follow all applicable guidelines for testing QC materials.

*Stability:*

Accelerated studies have been conducted. Protocols and acceptance criteria were described and found to be acceptable. The manufacturer claims the following expiration date:

When stored at 2–30 °C product is stable until expiration date which is 24 months.

Real time studies have been conducted and are on-going.

*d. Detection limit:*

See Precision/Reproducibility section in M1.a above.

*e. Analytical specificity:*

Cross-reactivity was established by spiking structurally related compounds into drug-free urine. Results are expressed as a minimum concentration of metabolite or compound required to produce a response approximately equivalent to the cutoff concentration of the assay. The percent cross-reactivity of those compounds are presented below:

Substances	Concentration (ng/mL)	% Cross-reactivity
Buprenorphine- $\beta$ -D-Glucuronide	2.5	400%
Buprenorphine	10	100%
Nalorphine	1000	1%
Norbuprenorphine	15,000	0.06%
Norbuprenorphine-3- $\beta$ -D-Glucuronide	15,000	0.06%
Codeine	12,500	0.08%

Structurally un-related:

This study was performed by spiking structurally unrelated at a concentration of 100  $\mu$ g/mL compounds and endogenous substances at various concentrations into urine samples containing drug at  $\pm$ 25% of the respective drug cutoff concentrations. The following compounds showed no interference when tested at the  $\pm$ 25% drug concentration:

Unrelated substances

Acetaminophen	Histamine	Lansoprazol
Acetylsalicylic Acid	2-Ethylidene-1,5-dimethyl-3,3-diphenylpyrrolidine	Oxazepam
Amikacin	Hydromorphone	Oxycodone
Amitriptyline	Hydrochlorothiazide	Oxymorphone
Ampicillin	Imipramine	Phendimetrazine
Arterenol	Indomethacin	Penicillin G
Aspartame	Levorphanol	Phenobarbital
Benzoic Acid	Ketoprofen	d-Propoxyphene
Benzoylcegonine HCL	D9-THC	l-Propanol
Caffeine	11-Nor-D9-THC-9-COOH	Phencyclidine
Chlorpheniramine	Methylphenidate	Phenobarbital
Chlorpromazine HCL	Methadone	Phentermine
Cimetidine	Methaqualone	Phenylpropanoamine
Deoxyephedrine	Morphine	l-Phenylephrine
Dextromethorphan	Histamine	Quinine
Diazepam	Morphine-3-Glucuronide	Sodium Salicylate
Diethylpropion	6-Monoacetylmorphine	Tryptophan
5,5-Dihydrocodeine	Nalorphine	Tetracycline
Doxylamine	Naloxone	Tetrahydrozoline
Ecgonine HCL	Naltrexone	Theophylline
Ecgonine Methyl Ester	Noroxycodone	Thioridazine
Heroin	Noroxymorphone	Trifluoperazine

Endogenous substances

Acetone (1000 mg/dL)	Urea (2000 mg/dL)
Ascorbate (300 mg/dL)	Ethanol (1000 mg/dL)
Creatinine (500 mg/dL)	DL-thyroxine (12 mg/dL)
Globulin (500 mg/dL)	Digoxin (15 mg/dL)
Glucose (1500 mg/dL)	Apomorphine (10 mg/dL)
Hemoglobin (300 mg/dL)	Tetracycline (20 mg/dL)
NaCl (6000 mg/dL)	D-glucuronic Acid (20 mg/dL)
Oxalic (50 mg/dL)	Uric Acid (23 mg/dL)
HAS (500 mg/dL)	Ampicillin (20 mg/dL)

Evaluation of Specific Gravity and pH on test results:

To evaluate the effect of pH value on the test results, urine samples at +/-25% of the cutoff value were used. Each sample was adjusted to pH levels at 4.0, 4.5, 5.0, 6.0, 7.0, 8.0 and 9.0. Each test sample was tested in duplicate.

To evaluate the effect of specific gravity, urine samples at +/-25% of the cut-off values were spiked to obtain specific gravities of 1.003, 1.005, 1.010, 1.015, 1.020, 1.025, and 1.030. Each test sample was tested in duplicate.

The testing results demonstrate that varying pH's and specific gravities do not affect urine testing results around the analyte cut-off.

*f. Assay cut-off:*

Characterization of how the device performs analytically around the claimed cutoff concentration appears in the precision section, M1.a, above.

2. Comparison studies:

*a. Method comparison with predicate device:*

An internal study was conducted using 133 unaltered clinical samples tested on the cup device and compared to the GC/MS. Results are displayed below:

Buprenorphine		Negative	Negative (<50% cutoff concentration by GC/MS)	Near cutoff negative (-50% to the cutoff concentration)	Near cutoff positive (cutoff to 50%)	High Positive (>50% cutoff)
	Positive	0	0	0	14	35
	Negative	72	7	5	0	0

A lay user study was performed at three intended user sites with 104 lay persons. Participants in the study (53 females and 51 males) tested the buprenorphine samples. They had diverse educational backgrounds and ranged in age from 18 to 70. Urine samples were prepared at the following concentrations; negative, +/-50%, +/-25% of the cutoff and at the cutoff by spiking drug(s) into drug free-pooled urine specimens. The concentrations of the samples were confirmed by GC/MS. Each sample was aliquoted into individual containers and blind-labeled.

Each participant was provided with the package insert, 1 blind labeled sample and a device. The results are summarized below.

Drug	Concentration	Number of samples	OTC user		% Agreement With GC/MS
			Negative	Positive	
Buprenorphine	Negative	104	104	0	100%
	-50%	104	103	1	99%
	-25%	104	93	11	89.4%
	cutoff	104	3	101	97.1%
	+25%	104	0	104	100%
	+5%	104	0	104	100%
	+75%	104	0	104	100%

*b. Matrix comparison:*

Not applicable. The assay is intended for only one sample matrix, urine

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:

Not applicable

**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.