

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

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

**k041685**

**B. Purpose for Submission:**

New product

**C. Analyte:**

Amphetamine, Barbiturates, Benzodiazepines, Cocaine, Marijuana, Methylenedioxymethamphetamine, Opiates, Oxycodone, Phencyclidine, Propoxyphene, and Tricyclic Antidepressants

**D. Type of Test:**

Qualitative lateral flow immunochromatographic test

**E. Applicant:**

ACON Laboratories, Inc.

**F. Proprietary and Established Names:**

ACON multi-CLIN Drug Screen Test Device

**G. Regulatory Information:**

1. Regulation section:

21 CFR §862.3100: Test System, Amphetamine

21 CFR §862.3150: Test System, Barbiturate

21 CFR §862.3170: Enzyme Immunoassay, Benzodiazepine

21 CFR §862.3250: Enzyme Immunoassay, Cocaine and Cocaine Metabolites

21 CFR §862.3870: Enzyme Immunoassay, Cannabinoids

21 CFR §862.3610: Test System, Methamphetamine

21 CFR §862.3650: Enzyme Immunoassay, Opiates (Oxycodone)

Unclassified : Enzyme Immunoassay, Phencyclidine

21 CFR §862.3700: Enzyme Immunoassay, Propoxyphene

21 CFR §862.3910: Tricyclic Antidepressant Drugs Test System

2. Classification:

Class II

3. Product Code:

DKZ, DIS, JXM, DIO, LDJ, LAF, DJG, LCM, JXN, LFG

4. Panel:

Toxicology (91)

**H. Intended Use:**1. Intended use(s):

This device is used in the diagnosis and treatment of drug use or overdose.

2. Indication(s) for use:

The ACON multi-CLIN Drug Screen Test Device is a rapid chromatographic immunoassay for the qualitative and simultaneous detection of Amphetamine, Barbiturates, Benzodiazepines, Cocaine, Marijuana, Methylenedioxymethamphetamine, Opiates, Oxycodone, Phencyclidine, Propoxyphene, and Tricyclic Antidepressants in urine. The designated cut-off concentrations for these drugs are as follows: Amphetamine 1000 ng/mL, Barbiturates 300 ng/mL, Benzodiazepines 300 ng/mL, Cocaine 300 ng/mL, Marijuana 50 ng/mL, Methylenedioxymethamphetamine 500 ng/mL, Opiates 300 ng/mL, Oxycodone 100 ng/mL, Phencyclidine 25 ng/mL, Proxyphene 300 ng/mL and Tricyclic Antidepressants 1000 ng/mL. They are intended for healthcare professionals including professionals at point-of-care sites.

This assay provides only a preliminary analytical test result. A more specific alternate chemical method must be used in order to obtain a confirmed analytical result. Gas chromatography/mass spectrometry (GC/MS) is the preferred confirmatory method.

Clinical consideration and professional judgment should be applied to any drug of abuse test result, particularly when preliminary positive test results are used.

3. Special condition for use statement(s):

The ACON multi-CLIN Drug Screen Test provides only a preliminary analytical test result. A more specific alternative chemical method, such as GC/MS, must be used to obtain a confirmed analytical result. Clinical consideration and professional judgment should be applied to any drug of abuse test result, particularly when preliminary positive results are obtained.

4. Special instrument Requirements:

Not applicable, as the device is a visually-read single-use device.

**I. Device Description:**

The device is a single-use visually read cassette device. It has a plastic housing that contains the test strip. A plastic sample dispenser is also provided. Several drops of urine are added to start the test which employs traditional immunochromatographic technology. Three to four drug tests and controls appear on each of four strips in the cassette.

**J. Substantial Equivalence Information:**1. Predicate device name(s):

ACON One-Step Multi-drug Multi-line Screen Test: Amphetamines, Cocaine, Methamphetamine, Opiates, Marijuana, and PCP  
 ACON One-Step Multi-drug Multi-line Screen Test: Barbiturates, Benzodiazepines, Methadone, MDMA, Opiates, and Tricyclic Antidepressants  
 ACON OXY One-Step Oxycodone Test Device  
 ACON One-Step Propoxyphene Test Device

2. Predicate K number(s):
3. k020313, k023946, k033047, k040445 Comparison with predicate:  
 The device is similar to or the same as to the previously cleared predicate(s) in the following ways: manufacturer, test principles, indication for use, cut-off concentration(s), used in a professional and point-of-care setting, sample matrix, endpoint, and test time.

The essential difference between the device and the predicate(s) is the test format; the new test contains 11 drug assays on four immunochromatographic strips while the predicate(s) were individual tests on each strip or cartridge.

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

The sponsor did not reference any standards in the submission.

**L. Test Principle:**

The device employs lateral flow immunochromatographic technology and is based on the principle of competitive binding. Drugs, if present in concentrations below the cutoff level, will not saturate the binding sites of antibody-coated particles in the device. The antibody-coated particles will then be captured by immobilized drug-specific conjugate and a colored line will appear in the test line region. A red line will not form if the sample contains drug in excess of the cutoff level because the drug will saturate all the binding sites of the drug-specific antibody. Each strip in the device contains both a negative and a positive procedural control. Formation of a red line in the negative control line region indicates that the proper volume of urine has been added and membrane wicking has occurred. The continued presence of a blue line in the positive control region could indicate that the immunochemical reaction did not occur. If either control does not work the test is invalid and should be repeated.

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

1. Analytical performance:
  - a. **Precision/Reproducibility:**  
See section 1.d below.
  - b. **Linearity/assay reportable range:**  
Not applicable. The assay is intended for qualitative use.
  - c. **Traceability, Stability, Expected values (controls, calibrators, or method):**  
This device has internal process controls. A red line appearing in the negative control region confirms sufficient sample volume, adequate

membrane wicking, and that the correct technique has been used. Users are informed not to interpret the test if a line forms in the positive control region or if no line forms in the negative control region.

Control standards are not supplied with this device; however 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.

**d. Detection limit:**

The sponsor tested the device to determine if its analytical specificity was at or around the same designated cut-off concentrations as those of the individual predicate strips. These cutoffs are based on the recommendation of the Substance Abuse and Mental Health Services Administration (SAMHSA). Drug free urine and drug urine samples at -65% cut-off, -50% cutoff, -25% cut-off, +25% cut-off, and +50% cutoff were tested with three lots of ACON multi-CLIN Drug Screen Test Device as well as three lots of ACON Single Drug Test Strips according to package inserts. Each lot was tested thirty times. The average percent correct read is described in the table below:

**Cut-Off Concentration Testing: Average Correct Result**

Drug Tested	Drug-free Urine	-65% Cut-Off	-50% Cut-Off	-25% Cut-Off	+25% Cut-Off	+50% Cut-Off
Amphetamines	100%	100%	100%	72.2	91.1	100%
Barbiturates	100%	100%	100%	67.8	94.4	100%
Benzodiazepines	100%	100%	100%	70.0	91.1	100%
Cocaine/Metabolites	100%	100%	100%	72.2	92.2	100%
Marijuana (THC)	100%	100%	100%	74.4	83.3	100%
MDMA	100%	100%	100%	67.8	91.1	100%
Opiates	100%	100%	100%	67.8	92.2	100%
Oxycodone	100%	100%	100%	70.0	88.9	100%
Phencyclidine	100%	100%	100%	66.7	93.3	100%
Propoxyphene	100%	100%	100%	68.9	91.1	100%
Tricyclic Antidepressants	100%	100%	100%	75.6	94.4	100%

**e. Analytical specificity:**

The drugs tested for by this device, their known metabolites, and related compounds were spiked into drug-free urine at a concentration of 1000 ng/mL, then serially diluted and tested with the ACON multi-CLIN Drug Screen Test Device until the

concentrations which yielded a negative result were obtained. The following table lists the lowest concentration which yields a positive result for the compound being tested when read at five minutes. Cross-reactivity was calculated by dividing the concentration at which the compound yielded a positive result by the designated cut-off concentration.

**ACON multi-CLIN Drug Test: Cross-reactivity of Compounds**

Compound	Conc (ng/mL)	% Cross Reactivity	Compound	Conc (ng/mL)	% Cross Reactivity
<b>AMPHETAMINES</b>			<b>METHYLENEDIOXYMETHAMPHETAMINE (MDMA)</b>		
d-Amphetamine	1,000	100	3,4-MDMA	500	100
d,l-Amphetamine	3000	33	l-Methamphetamine	100,000	0.5
l-Amphetamine	50,000	2	3,4-MDA	3000	17
p-OH-Amphetamine	3125	32	3,4-MDMA	300	167
3,4-MDA	2000	50	<b>OPIATES</b>		
Phentermine	3000	33	Morphine	300	100
<b>BARBITURATES</b>			Codeine	300	100
Secobarbital	300	100	Ethylmorphine	6250	5
Amobarbital	300	100	Hydrocodone	50,000	0.6
Alphenal	150	200	Hydromorphone	3125	10
Aprobarbital	200	150	Levorphanol	1500	20
Butabarbital	75	400	6-Monoacetylmorphine	400	75
Butalbital	2500	12	Morphine-3-β-d-glucuronide	1000	30
Butethanol	100	300	Norcodeine	6250	5
Cyclobarbital	400	75	Normorphone	100,000	0.3
Cyclopentobarbital	600	50	Oxycodone	30,000	1
Pentobarbital	300	100	Oxymorphone	100,000	0.3
Phenobarbital	100	300	Thebaine	6250	5
<b>BENZODIAZEPINES</b>			<b>OXYCODONE</b>		
Oxazepam	300	100	Oxycodone	100	100
Alprazolam	196	153	6-Acetylcodeine	100,000	0.1
Alprazolam, -OH	1262	24	Codeine	25,000	0.4
Bromazepam	1562	19	Dihydrocodeine	12,500	0.8
Chlordiazepoxide	1562	19	Ethylmorphine	25,000	0.4
Clobazam	98	306	Hydrocodone	6250	2
Clonazepam	781	38	Hydromorphone	12,500	0.8
Chlorazepate	195	154	Levorphanol	100,000	0.1
Delorazepam	1562	19	6-Monoacetylmorphine	100,000	0.1
Desalkylflurazepam	390	77	Morphine	100,000	0.1
Diazepam	195	154	Morphine-3-β-d-glucuronide	100,000	0.1
Estazolam	2500	12	Norcodeine	100,000	0.1
Flunitrazepam	390	77	Normorphone	100,000	0.1
(±) Lorazepam	1562	19	Oxymorphone	780	13
RS-Lorazepam glucuronide	156	192	Procaine	100,000	0.1
Midazolam	12,500	2	Thebaine	25,000	0.4
Nitrazepam	98	306	<b>PHENCYCLIDINE</b>		
Norchlordiazepoxide	195	154	Phencyclidine	25	100

Compound	Conc (ng/mL)	% Cross Reactivity	Compound	Conc (ng/mL)	% Cross Reactivity
Nordiazepam	390	77	4-Hydroxyphencyclidine	12,500	0.2
Temazepam	98	306	PROPOXYPHENE		
Triazolam	2500	12	d-Propoxyphene	300	100
<b>COCAINE</b>			Norpropoxyphene	300	100
Benzoylcegonine	300	100	<b>TRICYCLIC ANTIDEPRESSANTS</b>		
Cocaine	780	38	Nortriptyline	1000	100
Cocaethylene	12,500	2	Amitriptyline	1500	67
Ecgonine	32,000	0.9	Clomipramine	12,500	8
<b>MARIJUANA</b>			Cyclobenzaprine	6250	16
11-nor- $\Delta^9$ -THC-9-COOH	50	100	Desipramine	200	500
Cannabinol	20,000	0.25	Imipramine	400	250
$\Delta^8$ -THC	15,000	0.33	Maprotiline	2000	50
$-\Delta^9$ -THC	15,000	0.33	Nordoxepine	1000	100
			Perphenazine	50,000	2
			Promazine	1500	67
			Promethazine	25,000	4
			Trimipramine maleate	3000	33

Almost 200 compounds were tested for possible interference with the ACON multi-CLIN Drug Screen Test in drug-free urine, in a urine pool spiked with -65% of the cutoff levels of the drugs of abuse, and in a urine pool spiked with +50% of the cutoff levels of the drugs of abuse. The compounds tested for possible interference are listed in the package insert; no compound caused an incorrect test result in any of the three urine pools when tested at 1000 ng/mL.

The pH of an aliquoted negative urine pool was adjusted to a range of 5 to 9 in 1 pH unit increments; four of the five aliquots were spiked with a drug to -65%, -50%, +25%, and +50% of the cutoff concentration. The spiked, pH-adjusted urine was tested in duplicate. Altering the pH of the urine sample did not affect the accuracy of any of the test results.

Fifteen (15) urine samples of specific gravity ranging from 1.004 to 1.034 were aliquoted into five samples each; one sample remained neat while the other four aliquots were spiked with each drug to the concentration of -65%, -50%, +25%, and +50% of the cutoff respectively. Each sample was tested in duplicate. Variations in specific gravity did not affect the accuracy of any of the test results

*f. Assay cut-off:*

The identified cutoff concentrations are those recommended by the Substance Abuse and Mental Health Services Administration (SAMHSA); these cutoffs are listed above. The test will yield a

positive result when a given drug exceeds this concentration in the urine sample. Analytical performance of the device around the cutoff is described in Section 1.M.d above.

2. Comparison studies:

*a. Method comparison with predicate device:*

Urine samples were collected from presumed non-user volunteers and known positive specimens were obtained from several clinical laboratories. Drug positive samples were confirmed by GC/MS or HPLC. The percentage of samples  $\pm 25\%$  of the cutoff (as determined by GC/MS) varied by drug: AMP 7.6%, BAR 2.9%, BZO 2.6%, COC 7.7%, THC 5.1%, MDMA 2.8%, OPI 3.8%, OXY 2%, PCP 3.1%, PPX 1.6%, TCA 6.2%. Specimens were coded, randomized, and blinded for side-by-side comparisons between ACON multi-CLIN Drug Screen Test and ACON Single Drug Test Strips. The results are shown in the tables below:

**Comparison of ACON multi-CLIN to ACON One Step Tests**

		ACON Single Test							
		AMP		BAR		BZO		COC	
		pos	neg	pos	neg	pos	neg	pos	neg
ACON multi-CLIN	Positive	140	0	103	0	122	1	132	4
	Negative	3	307	0	307	0	302	0	308
Total		143	307	103	307	122	303	132	312
% Agreement with ACON Single Test		98	100	100	100	100	99.7	100	98.7
% Overall Agreement		99		100		99		99	

		ACON Single Test							
		THC		MDMA		OPI		OXY	
		pos	neg	pos	neg	pos	neg	pos	neg
ACON multi-CLIN	Positive	132	0	91	1	149	0	141	2
	Negative	9	307	0	301	0	300	0	307
Total		141	307	91	302	149	300	141	309
% Agreement with ACON Single Test		94	100	100	99.7	100	100	100	99.4
% Overall Agreement		98		99		100		99	

		ACON Single Test					
		PCP		PPX		TCA	
		pos	neg	pos	neg	pos	neg
ACON multi-CLIN	Positive	89	0	135	0	54	0
	Negative	0	301	0	305	0	316

	Total	89	301	135	305	54	316
% Agreement with ACON Single Test		100	100	100	100	100	100
% Overall Agreement		100		100		100	

Samples were analyzed by GC/MS and compared to the ACON multi-CLIN test. Samples were considered positive if they were above the cutoff level listed in Section H.2. Results are described in the tables below:

### Comparison of ACON multi-CLIN to GC/MS

		GC/MS							
		AMP		BAR		BZO		COC	
		pos	neg	pos	neg	pos	neg	pos	neg
ACON multi-CLIN	Positive	134	6	99	4	139	2	119	17
	Negative	2	308	2	305	1	308	0	308
Total		136	314	101	309	140	310	119	325
% Agreement with GC/MS		98.5	98.1	98	99	99.3	99.4	100	95
% Overall Agreement		98		99		99		96	

		GC/MS							
		THC		MDMA		OPI		OXY	
		pos	neg	pos	neg	pos	neg	pos	neg
ACON multi-CLIN	Positive	116	16	88	4	140	9	140	3
	Negative	5	311	0	301	0	300	1	306
Total		121	327	88	305	140	309	141	309
% Agreement with GC/MS		95.9	95.1	100	98.7	100	97.1	99.3	99
% Overall Agreement		95		99		98		99	

		GC/MS					
		PCP		PPX		TCA	
		pos	neg	pos	neg	pos	neg
ACON multi-CLIN	Positive	85	4	145	0	32	22
	Negative	1	300	1	304	0	316
Total		86	304	146	304	32	338
% Agreement with GC/MS		98.8	98.7	99.3	100	100	93.5
% Overall Agreement		99		99		94	

**b. Matrix comparison:**

Not applicable; this device is only for use with urine samples

**3. Clinical studies:**

**a. Clinical sensitivity:**

Not applicable. Clinical studies are not typically submitted for this device type.

***b. Clinical specificity:***

Not applicable. Clinical studies are not typically submitted for this device type.

***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. Conclusion:**

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