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

A. 510(k) Number:

k121065

B. Purpose for Submission:

New device

C. Measurand:

Amphetamine, Benzodiazepines, Cocaine, Marijuana, Morphine, Phencyclidine, MDMA (Ecstasy)

D. Type of Test:

Qualitative lateral flow chromatographic immunoassay

E. Applicant:

Polymed Therapeutics, Inc

F. Proprietary and Established Names:

Polymed Therapeutics Fastep Dipstick Drugs of Abuse Screen Device and Polymed Therapeutics Fastep Dipcard Drugs of Abuse Screen Device

G. Regulatory Information:

Product Code	Classification	Regulation section	Panel
DKZ	Class II	862.3100	Toxicology (91)
JXM		862.3170	
DIO		862.3250	
LDJ		862.3870	
DJC		862.3610	
LCM		unclassified	
DNK		862.3640	

H. Intended Use:

1. Intended use(s):

   Refer to Indications for Use

2. Indication(s) for use:

   Polymed Therapeutics Fastep Dipstick Drugs of Abuse Screen Device and Polymed Therapeutics Fastep Dipcard Drugs of Abuse Screen Device are rapid chromatographic immunoassays for the qualitative and simultaneous detection of one to seven of the following drugs in a variety of combinations in human urine. The cutoff concentrations and direct calibrator for these drugs are as follows:

Analyte	**Abbreviation**	**Direct Calibrator**	**Cutoff (ng/mL)**
Amphetamine	AMP	Amphetamine	1000
Benzodiazepines	BZO	Oxazepam	300
Cocaine	COC	Benzoylecgonine	300
Marijuana	THC	11-nor-Δ9-THC9-COOH	50
Morphine	MOR	Morphine	2000
Phencyclidine	PCP	Phencyclidine	25
Ecstasy	MDMA	3,4-Methylenediioxy-MET	500

   For prescription use in central laboratories only. This 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 method.

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

3. Special conditions for use statement(s):

   For prescription use in central laboratories only

4. Special instrument requirements:

   Not applicable; this is a visually read single use device

I. Device Description:

The devices incorporate a one-step, colloidal gold based immunochromatographic strip for the rapid, qualitative detection of Marijuana, Cocaine, Phencyclidine, Morphine, Amphetamine, Benzodiazepines, and MDMA (Ecstasy) in human urine. The Dipstick device consists of a single strip, and the Dipcard device consists of one or more strips held by a card.

J. Substantial Equivalence Information:

1. Predicate device name(s):

   ACON One Step Drug Screen Tests

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

Amphetamine	k011673
Benzodiazepine	k012300
Cocaine	k010841
THC	k003557
Morphine 2000	k011353
PCP	k011730
MDMA	k022589

3. Comparison with predicate:

Similarities		
Item	Device	Predicate
Intended Use	Qualitative detection of amphetamine, benzodiazepines, cocaine, THC, morphine, PCP, and MDMA	Same
Sample Type	Urine	Same
Methodology	Qualitative lateral flow chromatographic immunoassay	Same
Cutoff (ng/mL)	Amphetamine 1000 Benzodiazepines 300 Cocaine 300 THC 50 Morphine 2000 2000 PCP 25 MDMA 500	Same
Read Time Window	5 – 10 minutes	Same
Storage	2 – 30° C	Same

Differences		
Item	Device	Predicate
Intended Users	Prescription use in central laboratories only	Point of care use

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

None referenced.

L. Test Principle:

The Fastep Dipstick and Dipcard Drugs of Abuse Screen Devices are one-step immunoassays in which chemically labeled drugs (drug-protein conjugates) compete for limited antibody binding sites with drugs that may be present in urine. The single and multi-test device contains one or more than one test strips in the cassette or dip card. The drug-protein conjugates are pre-coated on the test band of the membrane and the drug antibody-colloidal gold conjugate pads are placed at one end of the membrane. In the absence of drugs in the urine, the solution of the colored antibody-colloidal gold conjugates move along with the sample solution upward chromatographically by capillary action across the membrane to the immobilized drug-protein conjugate zones on the test band region. The colored antibody-gold conjugates then attach to the drug-protein conjugates to form visible lines as the antibodies complex with the drug conjugates. Therefore, the formation of the visible precipitant in the test band occurs when the test urine is negative for the drug. When drug is present in the urine, the drug/metabolite antigen competes with drug-protein conjugates on the test band region for the limited antibody on the colored drug antibody-colloidal gold conjugate pad. When a sufficient concentration of the drug is present, it will fill the limited antibody binding sites. This will prevent attachment of the colored antibody (drug-protein conjugate)-colloidal gold conjugate to the drug-protein conjugate zone on the test band region. Therefore, absence of the color band on the test region indicates a positive result. A control band with a different antigen/antibody reaction is added to the immunochromatographic membrane strip at the control region (C) to indicate that the test has performed properly.

M. Performance Characteristics (if/when applicable):

1. <u>Analytical performance:</u>

   a. Precision/Reproducibility:

   Precision for each test format was evaluated in a study conducted with three operators collecting the data in three runs per day over 17 days. This resulted in a total of 51 results per operator per each concentration for each of the seven analytes. Results are summarized below:

	Concentration Tested	**Operator1/ Lot One**	**Operator 2/ Lot Two**	**Operator 3/ Lot Three**
		Neg/Pos	**Neg/Pos**	**Neg/Pos**
AMP Dipstick Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0

	Concentration Tested	Operator1/ Lot One	Operator 2/ Lot Two	Operator 3/ Lot Three
		Neg/Pos	Neg/Pos	Neg/Pos
	-25%	40/11	43/8	41/10
	Cutoff	20/31	19/32	20/31
	+25%	11/40	11/40	9/42
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51
BZO Dipstick Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	41/10	41/10	41/10
	Cutoff	20/31	17/34	18/33
	+25%	8/43	8/43	11/40
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51
COC Dipstick Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	40/11	41/10	41/10
	Cutoff	21/30	19/32	20/31
	+25%	9/42	9/42	8/43
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51
MOR Dipstick Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	39/12	42/9	40/11
	Cutoff	21/30	22/29	17/34
	+25%	9/42	8/43	11/40
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51

PCP Dispstick Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	41/10	39/12	42/9
	Cutoff	19/32	18/33	19/32
	+25%	11/40	11/40	11/40
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51
THC Dipstick Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	40/11	39/12	42/9
	Cutoff	19/32	20/31	19/32
	+25%	8/43	6/45	8/43
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51
MDMA Dipstick Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	41/10	41/10	41/10
	Cutoff	19/32	21/30	21/30
	+25%	8/43	5/46	9/42
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51
AMP Dipcard Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	40/11	40/11	40/11
	Cutoff	19/32	20/30	18/33
	+25%	9/42	11/40	9/42
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51

BZO Dipcard Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	42/9	42/9	39/12
	Cutoff	20/31	20/31	21/30
	+25%	10/41	7/44	10/41
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51
COC Dipcard Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	42/9	41/10	41/10
	Cutoff	18/33	19/32	19/32
	+25%	11/40	8/43	10/41
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51
MOR Dipcard Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	41/10	42/9	42/9
	Cutoff	20/31	21/30	17/34
	+25%	10/41	10/41	11/40
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51
PCP Dipcard Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	42/9	39/12	40/11
	Cutoff	20/31	20/31	20/31
	+25%	8/43	10/41	8/43
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51

THC Dipcard Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	41/10	40/11	42/9
	Cutoff	20/31	20/31	19/32
	+25%	8/43	10/41	8/43
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51
MDMA Dipcard Format	-100%	51/0	51/0	51/0
	-75%	51/0	51/0	51/0
	-50%	51/0	51/0	51/0
	-25%	41/10	41/10	41/10
	Cutoff	20/31	18/33	19/32
	+25%	9/42	11/40	10/41
	+50%	0/51	0/51	0/51
	+75%	0/51	0/51	0/51
	+100%	0/51	0/51	0/51

b. *Linearity/assay reportable range:*

Not applicable. The assays produce qualitative results only.

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

These devices have 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.

Labeling states that control materials 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.

Stability:

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

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

d. *Detection limit:*

Analytical performance of the device around the cutoff is characterized in section a (precision/reproducibility) above.

e. Analytical specificity:

Cross-reactivity was evaluated by spiking various concentrations of similarly structured drug compounds into drug-free urine. By analyzing various concentration of each compound the sponsor determined the concentration of the drug that produced a response approximately equivalent to the cutoff concentration of the assay. Results of those studies appear in the tables below:

Amphetamine Drug Compound	Response equivalent to cutoff in ng/mL	% Cross-reactivity
d-amphetamine	1000	100
l-amphetamine	>100, 000	<1
d-methamphetamine	>100, 000	<1
l-methamphetamine	>100, 000	<1
3,4-Methylenedioxyamphetamine (MDA)	1250	80
D,L 3,4-Methylenedioxymethamphetamine (MDMA)	>100,000	<1
3,4-Methylenedioxyethylamphetamine(MDEA)	>100, 000	<1
Phentermine	1250	80
Tyramine	>100,000	<1
Paramethoxyamphetamine (PMA)	625	160

Benzodiazepines Drug Compound	Response equivalent to cutoff in ng/mL	% Cross-reactivity
Oxazepam	300	100
Alprazolam	125	240
Bromazepam	625	48
Chlordiazepoxide	2500	12
Clobazam	63	476
Clonazepam	2500	12
Clorazepate	3330	9
Desalkflurazepam	250	120
Diazepam	250	120
Estazolam	5000	6
Fentanyl	>100,000	<0.3

Benzodiazepines Drug Compound	Response equivalent to cutoff in ng/mL	% Cross-reactivity
Flunitrazepam	375	80
Flurazepam	>100,000	<0.3
Lorazepam	1250	24
Lormetazepam	1250	24
Medazepam	>100,000	<0.3
Midazolam	>100,000	<0.3
Nitrazepam	>25,000	<1.2
Nordiazepam	500	60
Norchlordiazepoxide	250	120
Prazepam	>100,000	<0.3
Temazepam	63	476
Triazolam	5000	6

Cocaine Drug Compound	Response equivalent to cutoff in ng/mL	% Cross-reactivity
Benzoylecogonine	300	100
Cocaine	1000	30
Ecgonine	100000	<0.3
Ecgonine Methyl Ester	>100,000	<0.3

THC Drug Compound	Response equivalent to cutoff in ng/mL	% Cross-reactivity
11-Hydroxy-Δ^9-Tetrahydrocannabinol	50	100
11-Nor-Δ^9-Tetrahydrocannabinol carboxylic acid	50	100
Δ^8-Tetrahydrocannabinol	15000	0.33
Δ^9 –Tetrahydrocannabinol	15000	0.33
Cannabinol	20000	0.25
Cannabidiol	>100,000	<0.05

Morphine Drug Compound	Response equivalent to cutoff in ng/mL	% Cross-reactivity
Morphine	2,000	100
Acetylcodeine	1,563	128
Buprenorphine	25,000	8
Codeine	500	400
Diacetyl Morphin (Heroin)	1,250	160
Dihydrocodeine	1,563	128
Ethylmorphine	800	250
Nalorphine Hydrochloride	>100,000	<2
Hydromorphone	25,000	8
Hydrocodone	50,000	4
Oxymorphone	>10,000	<20
Oxycodone	>20,000	<10
Merperidine	>100,000	<2
6-Monoacetylmorphine	1250	160
Morphine-3-glucuronid	12,500	16
Rifampicine	>100,000	<2
Thebaine	50,000	4

PCP Drug Compound	Response equivalent to cutoff in ng/mL	% Cross-reactivity
Phencyclidine	25	100
Hydrocodone	12500	0.2
Hydromorphone	6250	0.4
4-hydroxyphencyclidine	75	33

MDMA Drug Compound	Response equivalent to cutoff in ng/mL	% Cross-reactivity
D,L 3,4-Methylenedioxymethamphetamine (MDMA)	500	100
d-amphetamine	>100,000	<0.5
l-amphetamine	>100,000	<0.5
d-methamphetamine	>100,000	<0.5
l-methamphetamine	>100,000	<0.5
3,4-Methylenedioxyethylamphetamine(MDEA)	156	320

MDMA Drug Compound	Response equivalent to cutoff in ng/mL	% Cross-reactivity
3,4-Methylenedioxyamphetamine (MDA)	2500	20
Paramethoxyamphetamine (PMA)	50000	1
Paramethoxymethamphetamine (PMMA)	100,000	0.5

The following structurally unrelated compounds were evaluated at +50% and -50% of the cutoff for each analyte, and did not cause any negative or positive interference when tested at the concentrations listed below.

Compound	**Concentration (µg/mL)**
Acetaminophen	100
Acetone	200
Albumin	50,000
Amitriptyline	100
Ampicillin	100
Aspartame	100
Aspirin	100
Benzocaine	100
Bilirubin	150
Caffeine	100
Chloroquine	100
Chlorpheniramine	100
Creatine	100
Dextromethorphan	100
Dextrorphan tartrate	100
4-Dimethyllaminoantiyrine	100
Dopamine	100
(+/-)-Ephedrine	100
(-)-Ephedrine	100
Erythromycin	100
Ethanol	1000
Furosemide	100
Glucose	1200
Guaiacol Glyceryl Ether	100
Hemoglobin	200,000
Ibuprofen	100
Imipramine	100
Isoproterenol	100
Lidocaine	100
Methadone	100

Compound	Concentration (µg/mL)
(+)-Naproxen	100
Oxalic Acid	100
Penicillin-G	100
Pheniramine	100
Phenothiazine	100
b-Phenylethyl-amine	100
Procaine	100
Protonix	100
Pseudoephedrine	100
Ranitidine	100
Quinidine	100
Sertraline	100
Tyramine	100
Vitamin C (Ascorbic Acid)	100

Evaluation of specific gravity and pH on test results:

To evaluate the effect of pH value on the test results, urine controls at 0%, 75%, 125% and 300% of the cutoff value were used. Each control level was adjusted by either NaOH or HCl solution to pH levels at 3.0, 5.0, 6.5, 7.5, and 8.5. Each test sample was tested in duplicate.

To evaluate the effect of specific gravity, urine controls at +/-25% and +/-50% of the cut-off values were spiked or diluted to obtain specific gravities in the following four ranges: 1.000 – 1.015, 1.016 – 1.025, 1.026 – 1.03, and > 1.03. Each test sample was tested in duplicate.

The testing results demonstrate that the pH and specific gravity ranges tested do not affect results around each analyte cut-off.

f. Assay cut-off:

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

2. Comparison studies:

a. Method comparison with predicate device:

Method comparison studies for each test format were performed in house by trained operators. Samples were blinded and randomized before being given to the operators. The percent agreement with GC-MS ranged from a low of 85% to a high of 100%. Results are summarized below:

Amphetamine Multi-Strip Dip (MSD) (Dipcard) and Single Strip (SS) (Dipstick)

		Drug-Free Urine	< -50% of the cutoff	-50% of the cutoff to the cutoff	Cutoff to +50% of the cutoff	> +50% of the cutoff
MSD	positive	0	0	2	4	49
	negative	35	0	8	2	0
SS	positive	0	0	3	5	49
	negative	35	0	7	1	0

Agreement among negatives: 94% Agreement among positives: 97%

Discordant Results - Amphetamine

PolyMed Dipcard Result	PolyMed Dipstick Result	GC-MS Concentration (ng/mL)	Cutoff (ng/mL)
POS	POS	813	1000
	POS	839	
POS	POS	861	
NEG		1124	
NEG	NEG	1205	

Benzodiazepines Multi-Strip Dip (MSD) (DipCard) and Single Strip (SS) (Dipstick)

		Drug-Free Urine	< -50% of the cutoff	-50% of the cutoff to the cutoff	Cutoff to +50% of the cutoff	> +50% of the cutoff
MSD	positive	0	0	0	2	38
	negative	35	0	5	2	0
SS	positive	0	0	0	2	38
	negative	35	0	5	2	0

Agreement among negatives: 100% Agreement among positives: 95%

Discordant Results - Benzodiazepines

PolyMed Dipcard Result	PolyMed Dipstick Result	GC-MS Concentration (ng/mL)	Cutoff (ng/mL)
NEG	NEG	367	300
NEG	NEG	384	

Cocaine Multi-Strip Dip (MSD) (Dipcard) and Single Strip (SS) (Dipstick)

		Drug-Free Urine	< -50% of the cutoff	-50% of the cutoff to the cutoff	Cutoff to +50% of the cutoff	> +50% of the cutoff
MSD	positive	0	0	6	7	35
	negative	35	0	7	0	0
SS	positive	0	0	8	7	35
	negative	35	0	5	0	0

Agreement among negatives: 85% Agreement among positives: 100%

Discordant Results - Cocaine

PolyMed Dipcard Result	PolyMed Dipstick Result	GC-MS Concentration (ng/mL)	Cutoff (ng/mL)
POS	POS	171	300
POS	POS	178	
POS	POS	194	
POS	POS	214	
	POS	229	
	POS	231	
POS	POS	239	
POS	POS	248	

THC Multi-Strip Dip (MSD) (Dipcard) and Single Strip (SS) (Dipstick)

		Drug-Free Urine	< -50% of the cutoff	-50% of the cutoff to the cutoff	Cutoff to +50% of the cutoff	> +50% of the cutoff
MSD	positive	0	0	4	6	39
	negative	35	0	8	0	0
SS	positive	0	0	2	5	39
	negative	35	0	10	1	0

Agreement among negatives: 94% Agreement among positives: 99%

Discordant Results - THC

PolyMed Dipcard Result	PolyMed Dipstick Result	GC-MS Concentration (ng/mL)	Cutoff (ng/mL)
POS		25	50
POS	POS	26	
POS	POS	27	
POS		30	
	NEG	70	

Morphine Multi-Strip Dip (MSD) (Dipcard) and Single Strip (SS) (Dipstick)

		Drug-Free Urine	< -50% of the cutoff	-50% of the cutoff to the cutoff	Cutoff to +50% of the cutoff	> +50% of the cutoff
MSD	positive	0	0	0	4	41
	negative	35	0	7	0	0
SS	positive	0	0	0	4	41
	negative	35	0	7	0	0

Agreement among negatives: 100% Agreement among positives: 100%

Phencyclidine Multi-Strip Dip (MSD) (Dipcard) and Single Strip (SS) (Dipstick)

		Drug-Free Urine	< -50% of the cutoff	-50% of the cutoff to the cutoff	Cutoff to +50% of the cutoff	> +50% of the cutoff
MSD	positive	0	0	3	5	45
	negative	39	0	6	0	0
SS	positive	0	0	3	5	45
	negative	39	0	6	0	0

Agreement among negatives: 94% Agreement among positives: 100%

Discordant Results - Phencyclidine

PolyMed Dipcard Result	PolyMed Dipstick Result	GC-MS Concentration (ng/mL)	Cutoff (ng/mL)
POS	POS	15	25
POS	POS	21	
POS	POS	21.5	

MDMA Multi-Strip Dip (MSD) (Dipcard) and Single Strip (SS) (Dipstick)

		Drug-Free Urine	< -50% of the cutoff	-50% of the cutoff to the cutoff	Cutoff to +50% of the cutoff	> +50% of the cutoff
MSD	positive	0	0	0	3	39
	negative	35	1	4	1	0
SS	positive	0	0	0	3	39
	negative	35	1	4	1	0

Agreement among negatives: 100% Agreement among positives: 98%

Discordant Results – MDMA

PolyMed Dipcard Result	PolyMed Dipstick Result	GC-MS Concentration (ng/mL)	Cutoff (ng/mL)
NEG	NEG	677	500

b. Matrix comparison:

Not applicable. Urine is the only matrix that may be used with this device.

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):

The sponsor performed a reading time study to validate the recommended read time. The protocol and acceptance criteria were described and found to be acceptable. The labeling instructs users that negative results may be read as early as 3 minutes after sample is added. Positive results may be read from 5 – 10 minutes.

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.