

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

A. 510(k) Number:

k052269

B. Purpose for Submission:

For removal of a limitation to use of ciprofloxacin to the BD Phoenix™ gram-negative ID/AST panels

C. Measurand:

Ciprofloxacin 0.25 - 4 µg/mL

D. Type of Test:

Antimicrobial Susceptibility Test (AST) (Qualitative) colorimetric oxidation-reduction, growth-based

E. Applicant:

Becton, Dickinson & Company

F. Proprietary and Established Names:

BD Phoenix™ Automated Microbiology System – Ciprofloxacin 0.25 – 4 µg/mL

G. Regulatory Information:

1. Regulation section:
21 CFR 866.1645 Fully Automated Short-Term Incubation Cycle Antimicrobial Susceptibility System
2. Classification:
II
3. Product code:
LON System, Test, Automated, Antimicrobial Susceptibility, Short Incubation
4. Panel:
83 Microbiology

H. Intended Use:

1. Intended use(s):
The BD Phoenix™ GN Panel:
The BD Phoenix™ Automated Microbiology System is intended for the *in vitro* rapid identification (ID) and quantitative determination of antimicrobial

susceptibility by minimal inhibitory concentration (MIC) of gram-negative aerobic and facultative anaerobic bacteria belonging to the family *Enterobacteriaceae* and non – *Enterobacteriaceae*.

BD Phoenix™ Automated Microbiology System:

The BD Phoenix™ Automated Microbiology System is intended for *in vitro* quantitative determination of antimicrobial susceptibility by minimal inhibitory concentration of gram-negative aerobic and facultative anaerobic bacteria belonging to the family *Enterobacteriaceae* and non – *Enterobacteriaceae* and gram-positive bacteria belonging to the genera *Staphylococcus* and *Enterococcus*.

2. Indication(s) for use:

This submission is for the removal of limitations for *Enterobacter cloacae* and *Serratia* species to the drug, ciprofloxacin on the gram negative panels and a change in the concentration from 0.125 – 4 µg/mL to 0.25 - 4 µg/mL.

3. Special conditions for use statement(s):

For prescription use only

Results for *S. maltophilia* have been excluded in the BD Phoenix™ therefore no results will be reported. An alternate method should be performed when this combination is identified.

4. Special instrument requirements:

Not Applicable

I. Device Description:

The BD Phoenix™ Automated Microbiology System includes instrumentation and software, sealed and self-inoculating molded polystyrene trays with 136 micro-wells containing dried reagents, and specific inoculum broth formulations for ID and AST Indicator. The organism to be tested must be a pure culture and be preliminarily identified as gram positive or gram negative. Colonies are then suspended in broth, and equated to a 0.5 McFarland with the recommendation to use the BD CrystalSpec™ Nephelometer. A further dilution is made into an AST broth, which contains an AST indicator, prior to inoculating the panel. The AST broth is a cation-adjusted formulation of Mueller-Hinton broth containing 0.01% Tween 80. After adding the indicator solution to the AST inoculum the color is blue and after inoculation and incubation goes to pink to colorless as reduction in the panel well proceeds. Inoculated panels are barcode scanned and loaded into the BD Phoenix™ Automated Microbiology System instrument where the panels are continuously incubated at 35⁰C. The AST has a final inoculum of 5 x 10⁵ CFU/ml. The instrument incubates, reads and records the results of the biochemical substrates and antimicrobial agents and interprets the reactions to give an ID of the isolate and MIC value and category interpretation of the antimicrobial agents. Organisms growing in the presence of a given antimicrobial agent reduce the indicator, signaling

organism growth and resistance to the antimicrobial agent. Organisms killed or inhibited by a given antimicrobial do not cause reduction of the indicator and therefore do not produce a color change. Additional interpretation is done using software driven “EXPERT” System using rules derived from the NCCLS documentation.

Readings are taken every 20 minutes with an ID result available between 2-12 hours and an AST result available between 4-16 hours. This is only an autoread result; there are no manual readings possible.

J. Substantial Equivalence Information:

1. Predicate device name(s):
VITEK® System
2. Predicate 510(k) number(s):
N50510
3. Comparison with predicate:

Similarities		
Item	Device	Predicate
1. Intended Use	Intended for the <i>in vitro</i> rapid identification (ID) and quantitative determination of antimicrobial susceptibility by minimal inhibitory concentration (MIC) of most bacteria.	Same
2. Isolates	Isolated colonies from culture used	Isolated colonies from culture used
3. Result Reported	Report results as minimum inhibitory concentration (MIC) and categorical interpretation (SIR)	Report results as minimum inhibitory concentration (MIC) and categorical interpretation (SIR)
4. Incubation Time	<16 hours	<16 hours
5. Type of Test	Automated	Automated

Differences		
Item	Device	Predicate
1. Results achieved	Results are determined from serial twofold dilutions of antimicrobial agents	Results are determined from extrapolation of doubling dilutions

Differences		
Item	Device	Predicate
2. Sample Preparation	Inoculum density equated to 0.5 McFarland standard	Inoculum density equated to 1.0 McFarland standard
3. Technology	Automated growth based enhanced by use of a redox indicator (colorimetric oxidation-reduction) to detect organism growth.	Automated growth based with detection using an attenuation of light measured by an optical scanner.

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

“Class II Special Controls Guidance Document: Antimicrobial Susceptibility Test Systems; Guidance for Industry and FDA”; CLSI M7 (M100-S15) “Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; Approved Standard.”

L. Test Principle:

The system employs conventional, colorimetric, fluorogenic and chromogenic substrates to identify the genus and species of the isolate. The AST portion of the BD Phoenix™ Automated Microbiology System is a broth based microdilution method that utilizes a redox indicator (colorimetric oxidation-reduction) to enhance detection of organism growth. The MIC is determined by comparing growth in wells containing serial two-fold dilutions of an antibiotic to the growth in “growth control wells” which contains no antibiotic.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

a. *Precision/Reproducibility:*

Ten isolates were evaluated for site to site and inter site reproducibility and demonstrated >95% reproducibility. The ten isolate study described in the guidance document was followed, (10 organisms tested 3 times on 3 days at 3 sites).

b. *Linearity/assay reportable range:*

Not applicable

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

The FDA and CLSI recommended QC isolates, *E. coli* ATCC 25922 and *P. aeruginosa* ATCC 27853 were tested on every test occasion with the reference method and the BD Phoenix™. The reference method QC results were in range for every day tested. The BD Phoenix™ was tested a sufficient number of times to demonstrate that the system can produce QC results in the

CLSI recommended ranges. The BD Phoenix™ and reference method had the same mode for *E. coli* ATCC 25922 but had a different mode with *P. aeruginosa* ATCC 27853 where BD Phoenix™ was one dilution higher than the reference method but still in the acceptable range.

Quality Control Table

ORGANISM	conc. (µg/mL)	Reference		BD Phoenix™	
<i>E. coli</i> ATCC 25922 Expected Range: ≤0.25 µg/mL	≤0.25	369		385	1
<i>P. aeruginosa</i> ATCC 27853 Expected Range : ≤1 µg/mL	≤0.25	299		3	
	0.5	68		361	
	1	1		19	

Inoculum density control: The organism suspension density of the ID broth was equivalent to a 0.5 McFarland standard using the BBL™ CrystalSpec™ Nephelometer which was verified each day of testing. Internal data was used to demonstrate that the use of the BBL™ CrystalSpec™ Nephelometer would produce reproducible results. Five different instruments were used.

d. *Detection limit:*
Not Applicable

e. *Analytical specificity:*
Not Applicable

f. *Assay cut-off:*
Not Applicable

2. Comparison studies:

a. *Method comparison with predicate device:*

The CLSI recommended broth dilution reference panel was prepared according to the CLSI recommendation. In order to remove the limitations for *Enterobacter cloacae* and *Serratia species*, clinical testing was performed at six sites. The testing included both fresh clinical isolates and stock isolates along with a challenge set with known results. The test device had a growth rate of >95%. A comparison was provided to the reference method with the following agreement.

Summary Table

	EA Tot	EA N	EA %	Eval EA Tot	Eval EA N	Eval EA %	CA N	CA %	#R	min	maj	vmj
Clinical	2739	2706	98.8	345	331	95.9	2610	95.3	636	118	7	4
Challenge	97	96	99.0	13	13	100.0	90	92.8	14	7	0	0
Combined	2836	2802	98.8	358	344	96.1	2700	95.2	650	125	7	4

EA-Essential Agreement
CA-Category Agreement
R-resistant isolates

maj-major discrepancies
vmj-very major discrepancies
min- minor discrepancies

Essential agreement (EA) is when the BD Phoenix™ panels agree with the reference test panel results exactly or within one doubling dilution of the reference method. Category agreement (CA) is when the BD Phoenix™ panel result interpretation agrees exactly with the reference panel result interpretation. Evaluable EA is when the MIC result is on scale for both the BD Phoenix™ and the reference and have on-scale EA.

There appears to be a trend where the test device is slightly more resistant than the reference device as reflected in one of the QC studies and the Accuracy studies however results are still within essential agreement.

- b. *Matrix comparison:*
Not Applicable
- 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:
Enterobacteriaceae ≤1(S), 2 (I), ≥4
Pseudomonas aeruginosa and other non-*Enterobacteriaceae* ≤1(S), 2(I), ≥4(R)

N. Proposed Labeling:

The Interpretative criteria, QC isolates and the expected ranges are the same as recommended by the FDA and CLSI. All values will be included in the package insert.

O. Conclusion:

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