

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

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

k082852

**B. Purpose for Submission:**

Addition of Nitrofurantoin to the BD Phoenix™ Automated Microbiology System

**C. Measurand:**

Nitrofurantoin 4 – 128 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 – Nitrofurantoin (4 – 128 µg/mL)

**G. Regulatory Information:**

1. Regulation section:

21 CFR 866.1645 Fully Automated Short-Term Incubation Cycle Antimicrobial Susceptibility System

2. Classification:

Class II

3. Product code:

LON System, Test, Automated, Antimicrobial Susceptibility, Short Incubation

4. Panel:

Microbiology

**H. Intended Use:**

1. Intended use(s):

The BD Phoenix™ Automated Microbiology System is intended for the *in vitro* rapid identification (ID) of gram positive bacteria from pure culture belonging to the genera *Staphylococcus*, *Enterococcus*, other gram positive *cocci* and gram positive bacilli. The BD Phoenix™ Automated Microbiology System is also intended for the quantitative determination of antimicrobial susceptibility by minimal inhibitory concentration (MIC) of most gram positive bacterial isolates from pure culture belonging to the genera *Staphylococcus* and *Enterococcus*.

2. Indication(s) for use:

This premarket notification is indicated for the addition of the antimicrobial agent nitrofurantoin at concentrations of 4 – 128µg/mL to Gram-positive ID/AST or AST only Phoenix panels for testing *S. aureus*, *Enterococci* (e.g. *E. faecalis*) with activity against Coagulase-negative *staphylococci* (including *S. epidermidis* and *S. saprophyticus*).

3. Special conditions for use statement(s):

Prescription use

Results of *E. faecium* with nitrofurantoin 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 turns to blue. After inoculation and incubation, the color changes to pink then 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 35°C. The AST has a final inoculum of  $5 \times 10^5$  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 a software driven “EXPERT” System using rules derived from the CLSI documentation.

Readings are taken every 20 minutes with an AST result available between 4-16 hours. This is only an autoread result; no manual readings are possible with this system.

#### **J. Substantial Equivalence Information:**

1. Predicate device name(s):

Vitek® System

2. Predicate K number(s):

N50510

3. Comparison with predicate:

Similarities		
Item	Device	Predicate
Intended use	Intended for the rapid identification (ID) and <i>in vitro</i> antimicrobial susceptibility testing of isolates from pure culture of most aerobic and facultative anaerobic Gram-negative and Gram-positive bacteria of human origin.	Intended for the determination of <i>in vitro</i> susceptibility to antimicrobial agents for rapidly growing, aerobic and/or facultative anaerobic Gram-negative and Gram-positive bacteria.
Inoculum	Isolated colonies from culture	Isolated colonies from culture
Incubation Time	< 16 hours	<16 hours
Result Reported	Report results as	Report results as

Similarities		
Item	Device	Predicate
	minimum inhibitory concentration (MIC) and categorical interpretation (SIR)	minimum inhibitory concentration (MIC) and categorical interpretation (SIR)
Technology	Automated	Automated

Differences		
Item	Device	Predicate
Results Achieved	Serial twofold dilutions of antimicrobial	Extrapolation of doubling dilutions

**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-S18) “Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; Approved Standard.”

**L. Test Principle:**

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 gram positive isolates were evaluated for site to site and inter site reproducibility demonstrating >95% reproducibility. The ten isolate study described in the guidance document was used (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 Quality Control (QC) isolates, S.

*aureus* ATCC 25922 and *E. faecalis* ATCC 29212 were tested on every test occasion with the reference method and the BD Phoenix™. There appears to be no difference between the modes of the BD Phoenix™ and the reference method. 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 recommended ranges.

Quality Control Table

<b>ORGANISM</b>	<b>Conc (ug/mL)</b>	<b>Reference</b>	<b>BD Phoenix™</b>
<i>E. faecalis</i> ATCC 29212 Expected Range: 4 – 16 µg/mL	<=4	3	
	8	80	60
	16		25
<i>S. aureus</i> ATCC 29213 Expected Range: 8 – 32 µg/mL	8	13	3
	16	71	83

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 broth dilution reference panel was prepared according to the CLSI recommendation and used to compare with the BD Phoenix™ results. Clinical testing was performed at several 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 >90%. A comparison was provided to the reference method with the following agreement.

**Gram Positive (GP) Accuracy Summary Clinical and Challenge**

	EA Tot	EA N	EA %	Eval EA Tot	Eval EA N	Eval EA %	CA N	CA %	#R	min	maj	vmj
<b>Clinical</b>	<b>848</b>	<b>837</b>	<b>98.7</b>	<b>804</b>	<b>802</b>	<b>99.8</b>	<b>848</b>	<b>100</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Challenge</b>	<b>131</b>	<b>127</b>	<b>96.9</b>	<b>131</b>	<b>127</b>	<b>96.9</b>	<b>131</b>	<b>100</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Combined</b>	<b>979</b>	<b>964</b>	<b>98.5</b>	<b>935</b>	<b>929</b>	<b>99.4</b>	<b>979</b>	<b>100</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

**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.

*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:

*Staphylococcus* species ≤32(S), 64 (I), ≥128 (R)

*Enterococcus* species ≤32(S), 64 (I), ≥128 (R)

**N. Proposed Labeling:**

The labeling is sufficient and satisfies the requirements of 21 CFR Part 809.10.

**O. Conclusion:**

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