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

A. 510(k) Number:
   k031699
B. Analyte:
   Trimethoprim-sulfamethoxazole (0.5/9.5-16/304 ug/ml) AST
C. Type of Test:
   Quantitative – broth based, colorimetric oxidation reduction detection
D. Applicant:
   BD Diagnostic Systems
E. Proprietary and Established Names:
   BD Phoenix™ Automated Microbiology System
F. Regulatory Information:
   1. Regulation section:
      CFR 866.1645 Short Term Antimicrobial Susceptibility Test System
   2. Classification:
      Class II
   3. Product Code:
      LON Automated short incubation AST system
   4. Panel:
      83 Microbiology
G. Intended Use:
   1. Intended use(s):
      The BD Phoenix™ Automated Microbiology System is intended for in vitro quantitative determination of antimicrobial susceptibility by minimal inhibitory concentration (MIC) of most Gram-negative aerobic and facultative anaerobic bacteria isolates from pure culture for *Enterobacteriaceae* and Non-*Enterobacteriaceae* and most Gram-positive bacteria isolates from pure culture belonging to the genera *Staphylococcus* and *Enterococcus*.

   2. Indication(s) for use:
      This submission is for the addition of Trimethoprim-sulfamethoxazole at concentrations of 0.5/9.5-16/304 ug/ml to gram negative ID/AST or AST BD Phoenix™ panels.
   3. Special condition for use statement(s):
      Serratia marcescens will be suppressed from reporting in the Phoenix™ system
   4. Special instrument Requirements:

H. Device Description:
The Phoenix 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 35^0C. The AST has a final inoculum of 5×10^5 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 antimicrobic agent reduce the indicator, signaling organism growth and resistance to the antimicrobic agent. Organisms killed or inhibited by a given antimicrobic 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 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

I.   Substantial Equivalence Information:
1. Predicate device name(s):
   Vitek® System
2. Predicate K number(s):
   N50510
3. Comparison with predicate:

Similarities		
Item	**Device**	**Predicate**
specimen	Isolated colonies from culture used	Isolated colonies from culture used
Inoculum	Inoculum density to 0.5 McFarland standard	Inoculum density to 0.5 McFarland standard
Incubation	<16 hours	< 16 hours
panels	Dried antibiotics at different concentrations	Dried antibiotics at different concentrations
Differences		
Item	**Device**	**Predicate**
results	Qualitative based on a single concentration	Qualitative based on extrapolation of a single concentration.

J. Standard/Guidance Document Referenced (if applicable):
"Class II Special Controls Guidance Document: Antimicrobial Susceptibility Test (AST) Systems; Guidance for Industry and FDA"

K. 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 Phoenix™ 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 contain no antibiotic.

L. Performance Characteristics (if/when applicable):
  1. Analytical performance:
     a. *Precision/Reproducibility:*
        Inter-site and intra-site reproducibility studies were performed using 21 isolates tested 3 times at each of the three sites for an overall reproducibility of >95%.
     b. *Linearity/assay reportable range:*
        Not applicable
     c. *Traceability (controls, calibrators, or method):*
        NCCLS recommended Quality Control strains were tested with expected results 99.6% of the time. The Phoenix results demonstrate that the system can produce QC results in the recommended range.

Organism	Concentration ug/ml	Reference results	Phoenix™ results
E. coli ATCC 25922 (range ≤ 0.5/9.5 ug/ml)	≤ 0.5/9.5	384	386
	1		
	2		
	4		
	8		
	16		1
	>16	1	
P aeruginosa ATCC 27853 (range 8/152-32/608)	≤ 0.5		
	1		
	2		
	4		3
	8/152	41	104
	16	98	230
	>16	244	

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.

   d. *Detection limit:*
      Not applicable
   e. *Analytical specificity:*
      Not applicable
   f. *Assay cut-off:*
      Not applicable

2. <u>Comparison studies:</u>
   a. *Method comparison with predicate device:*

The NCCLS recommended broth reference panel prepared according to the NCCLS recommendation was used to compare the Phoenix™ results. Clinical testing was performed at four sites. The testing included both fresh clinical isolates and stock isolates along with a challenge set with known results. There was a 0.1% no growth rate in the study. A comparison of Enterobacteriaceae (with the exception of *S. marcescens* which will not be reported) to the reference method was provided with the following agreement:

	total	EA	% EA	Total evalu-able	EA of evalu-able	% EA	CA	% CA	#R	min	maj	vmj
Clinical	2022	1942	96	93	45	48.4	1979	97.9	484	NA	27	16
Challenge	86	86	100	3	3	100	86	100	21	NA	0	0
Combined	2108	2028	96.2	96	48	50	2065	98	505	NA	27	16

EA-Essential Agreement   **maj**-major discrepancies
CA-Category Agreement   **vmj**-very major discrepancies
R-resistant isolates   **min-** minor discrepancies
NA There are no minor errors because there is no intermediate category.

Evaluable results are those that fall within the test range of the reference method and could also be on-scale with the new device if within the plus/minus one well variability. EA is when there is agreement between the reference method and the Phoenix™ within plus or minus one serial two-fold dilution of antibiotic. CA is when the interpretation of the reference method agrees exactly with the interpretation of the Phoenix™ result. Eight of the category errors are within EA but since there is no intermediate range they are either vmj (4) or maj(4).

   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):*

4. Clinical cut-off:

5. Expected values/Reference range:
    ≤ 2/38 (S), ≥ 4/76 (R)

M. Conclusion:

Data analysis when analyzed as recommended in the "Class II Special Controls Guidance Document: Antimicrobial Susceptibility Test (AST) Systems; Guidance for Industry and FDA" demonstrates that the Phoenix® System is substantially equivalent to the Vitek® System.