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

A. 510(k) Number:
k050745

B. Purpose for Submission:
Addition of vancomycin to the BD Phoenix™ SMIC/ID and SMIC Panels

C. Measurand:
Vancomycin 0.0625 - 32 µg/ml

D. Type of Test:
Antimicrobial Susceptibility Test (AST) (Quantitative and Qualitative) colorimetric oxidation-reduction, growth-based

E. Applicant:
Becton, Dickinson & Company

F. Proprietary and Established Names:
BD Phoenix™ Automated Microbiology System – Vancomycin 0.0625 - 32 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™ Automated Microbiology System is intended for *in vitro* 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* and most gram-positive bacteria isolates from pure culture belonging to the genera

Staphylococcus, Enterococcus and *Streptococcus*.
The BD Phoenix™ SMIC/ID and SMIC Panel is intended for the *in vitro* rapid identification (ID) and quantitative determination of antimicrobial susceptibility by minimal inhibitory concentration (MIC) of most bacteria isolates from pure culture belonging to the genera *Streptococcus*.

2. Indication(s) for use:
   This submission is for the addition of the antibiotic vancomycin at concentrations of 0.0625 - 32 µg/mL to the *Streptococcus* susceptibility panel.

3. Special conditions for use statement(s):
   For prescription use only

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-S 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-S broth, which contains an AST- S indicator, prior to inoculating the panel. The AST-S broth is a non-blood, cation-adjusted broth containing purified water, Tween 80, pancreatic digest of casein, peptones and other additional supplements for optimization of streptococcal growth. After adding the indicator solution to the AST- S 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°C. The resulting 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 software driven "EXPERT" System using rules derived from the Clinical and Laboratory Standards Institute (CLSI).

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 *in vitro* 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
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:

Thirty three gram-positive on-scale organisms 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 CLSI recommended QC isolate, *S. pneumoniae* ATCC 49619 was 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 most of the time. Both QC organisms had the same mode with the reference and the BD Phoenix™.

Quality Control Table

ORGANISM	**conc.**	**Reference**	**Phoenix**
S. pneumoniae	0.125		28
ATCC 49619	0.25	123	95
Expected Range:	0.5	2	
0.125 – 0.5 µg/mL			

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. Five *Streptococcal* strains were evaluated to demonstrate acceptable reproducibility performance.

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. Clinical testing was performed at four sites. The broth reference panel was set up on MH supplemented with 2 – 5% lysed horse blood as recommended by CLSI. The test device had a growth rate of >95%. The testing included both fresh clinical isolates and stock isolates along with a challenge set with known results. A comparison was provided to the reference method with the following agreement.

Summary Table for *Streptococcus spp.*

	EA Tot	EA N	EA %	Eval EA Tot	Eval EA N	Eval EA %	CA N	CA %	NS
Clinical	**1815**	**1782**	**98.2**	**1810**	**1782**	**98.5**	**1812**	**99.8**	**1**
Challenge	**124**	**123**	**99.2**	**124**	**123**	**99.2**	**124**	**100**	**0**
Combined	**1939**	**1905**	**98.2**	**1934**	**1905**	**98.5**	**1936**	**99.8**	**1**

EA-Essential Agreement **CA**-Category Agreement
NS-Not Susceptible

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. Eval 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 reference device is slightly more resistant than the test device as reflected in the Accuracy and QC 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:
Streptococcus pneumoniae ≤1 (S)
Streptococcus spp. other than *S. pneumoniae* ≤1 (S)

The ability of the BD Phoenix™ system to detect resistance to vancomycin in *Streptococcus* organisms is unknown because resistant organisms were not available at the time of comparative testing.

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

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.