

**3510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY TEMPLATE**

A. 510(k) Number:

k060217

B. Purpose for Submission:

To add additional organism groups to the antibiotics moxifloxacin on the BD Phoenix™ gram-positive ID/AST or AST panel only, and ciprofloxacin on the BD Phoenix™ gram-negative ID/AST or AST panel only

C. Measurand:

Moxifloxacin 0.125 – 8 µg/mL

Ciprofloxacin 0.25 - 4 µg/mL

D. Type of Test:

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

E. Applicant:

Becton, Dickinson & Company

F. Proprietary and Established Names:

BD Phoenix™ Automated Microbiology System – Moxifloxacin (GP) 0.125 – 8 µg/mL, and Ciprofloxacin (GN) 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):
Moxifloxacin at 0.125 – 8 µg/mL on the Phoenix™ Gram Positive ID/AST or

AST only panel, Ciprofloxacin at 0.25 – 4 µg/mL on the Phoenix™ Gram Negative ID/AST or AST only panel is intended for use with the BD Phoenix Automated Microbiology System for the 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 addition of the antibiotics Moxifloxacin at 0.125 – 8 µg/mL on the Phoenix™ Gram Positive ID/AST or AST only panel, and Ciprofloxacin at 0.25 – 4 µg/mL on the Phoenix™ Gram Negative ID/AST or AST only panel.

3. Special conditions for use statement(s):

For prescription use only

Results for *S. maltophilia* with ciprofloxacin 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 35°C. 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 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 CLSI documentation.

Readings are taken every 20 minutes with 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> 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 | Automated growth based with detection using an |

| Differences | | |
|-------------|---|--|
| Item | Device | Predicate |
| | redox indicator (colorimetric oxidation-reduction) to detect organism growth. | 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-S16) “Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; Approved Standard.”

L. Test Principle:

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:*

Intersite and Intrasite testing demonstrated >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):*

Quality Control was performed on every test occasion with the following results. BD Phoenix™ produced acceptable QC results as compared to the reference method results >95% of the time.

Moxifloxacin – Gram Positive Quality Control Table

| ORGANISM | conc. (µg/mL) | Reference | | BD Phoenix™ | |
|---|--------------------------|------------------|--|------------------------|--|
| | | | | | |
| <i>E. faecalis</i> ATCC 10741 Expected Range: 0.25 - 2 µg/mL | ≤0.125 | | | 5 | |
| | 0.25 | 89 | | 15 | |
| | 0.5 | 151 | | 105 | |
| | 1 | 4 | | 111 | |
| | 2 | | | 11 | |

| | | | | | |
|--|--------|--|-----|--|-----|
| | | | | | |
| <i>E. faecalis</i> ATCC 29212 Expected Range : ≤0.5 µg/mL | ≤0.125 | | 61 | | 32 |
| | 0.25 | | 234 | | 112 |
| | 0.5 | | 7 | | 91 |
| | 1 | | | | 11 |
| | | | | | |
| <i>S. aureus</i> ATCC 29213 Expected Range : ≤0.125 µg/mL | ≤0.125 | | 241 | | 247 |
| | 0.25 | | 2 | | 1 |
| | 0.5 | | 1 | | |
| | | | | | |
| | | | | | |

Ciprofloxacin – Gram Negative Quality Control Table

| <i>ORGANISM</i> | conc. (µg/mL) | Reference | | BD Phoenix™ | |
|--|------------------|-----------|-----|----------------|-----|
| | | | | | |
| <i>E. coli</i> ATCC 25922 Expected Range: ≤0.25 µg/mL | ≤0.25 | | 369 | | 385 |
| | 0.5 | | | | 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 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. Performance charts below include all data, original and the additional organisms for fresh and challenge organisms.

**Gram Positive (GP) Accuracy Summary Clinical and Challenge Cleared
Performance Claims with Additional Organisms**

| Moxifloxacin | EA Tot | EA N | EA % | Eval EA Tot | Eval EA N | Eval EA % | CA N | CA % | #R | min | maj | vmj |
|--|-------------------|-----------------|-----------------|----------------------------|----------------------|----------------------|-----------------|-------------|------------|------------|------------|------------|
| Combined (Original Data and Additional Org) | 1777 | 1706 | 96 | 650 | 618 | 95.1 | 1601 | 90.1 | 307 | 163 | 9 | 4 |

The gram positive table above includes *Staphylococcus* spp., *E. faecalis* and Other *Enterococcus* organisms.

**Gram Negative (GN) Accuracy Summary Clinical and Challenge Cleared
Performance Claims with Additional Organisms**

| Ciprofloxacin | EA Tot | EA N | EA % | Eval EA Tot | Eval EA N | Eval EA % | CA N | CA % | #R | min | maj | vmj |
|--|-------------------|-----------------|-----------------|----------------------------|----------------------|----------------------|-----------------|-------------|------------|------------|------------|------------|
| Combined (Original Data and Additional Org) | 2836 | 2802 | 98.8 | 358 | 344 | 96.1 | 2700 | 95.2 | 650 | 125 | 7 | 4 |

The gram negative table above includes *Enterobacteriaceae*, *P. aeruginosa* and other Non- *Enterobacteriaceae*.

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:

Moxifloxacin

Enterobacteriaceae ≤2(S), 4 (I), ≥8 (R)

Staphylococcus species ≤2(S), 4 (I), ≥8 (R)

Enterococcus species ≤1(S), 2 (I), ≥4 (R)

Ciprofloxacin ≤1(S), 2 (I), ≥4 (R)

N. Proposed Labeling:

The interpretive criteria and QC will be included in the package insert.

O. Conclusion:

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