DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Food and Drug Administration
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March 15, 2016

BIOFIRE DIAGNOSTICS, LLC
KRISTEN KANACK, PHD
VICE PRESIDENT, REGULATED PRODUCTS & CLINICAL AFFAIRS
390 WAKARA WAY
SALT LAKE CITY UT 84108

Re: K160457
Trade/Device Name: FilmArray Blood Culture Identification (BCID) Panel for use with FilmArray Torch
Regulation Number: 21 CFR 866.3365
Regulation Name: Blood Culture Identification Panel (BCID) multiplex nucleic acid assay
Regulatory Class: II
Product Code: PEN, PAM, OOI
Dated: February 18, 2016
Received: February 19, 2016

Dear Dr. Kanack:

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Parts 801 and 809); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820); and if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

If you desire specific advice for your device on our labeling regulations (21 CFR Parts 801 and 809), please contact the Division of Industry and Consumer Education at its toll-free number (800) 638 2041 or (301) 796-7100 or at its Internet address http://www.fda.gov/MedicalDevices/ResourcesforYou/Industry/default.htm. Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to http://www.fda.gov/MedicalDevices/Safety/ReportaProblem/default.htm for the CDRH's Office of Surveillance and Biometrics/Division of Postmarket Surveillance.

You may obtain other general information on your responsibilities under the Act from the Division of Industry and Consumer Education at its toll-free number (800) 638-2041 or (301) 796-7100 or at its Internet address http://www.fda.gov/MedicalDevices/ResourcesforYou/Industry/default.htm.

Sincerely yours,

Steven R. Gitterman -S

For Uwe Scherf, M.Sc., Ph.D.
Director
Division of Microbiology Devices
Office of In Vitro Diagnostics
and Radiological Health
Center for Devices and Radiological Health

Enclosure

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Indications for Use

Form Approved: OMB No. 0910-0120
Expiration Date: January 31, 2017
See PRA Statement below.

510(k) Number *(if known)*
K160457

Device Name
FilmArray Blood Culture Identification (BCID) Panel

Indications for Use *(Describe)*

The FilmArray Blood Culture Identification (BCID) Panel is a qualitative multiplexed nucleic acid-based in vitro diagnostic test intended for use with FilmArray systems. The FilmArray BCID Panel is capable of simultaneous detection and identification of multiple bacterial and yeast nucleic acids and select genetic determinants of antimicrobial resistance. The BCID assay is performed directly on blood culture samples identified as positive by a continuous monitoring blood culture system that demonstrate the presence of organisms as determined by Gram stain.

The following gram-positive bacteria, gram-negative bacteria, and yeast are identified using the FilmArray BCID Panel: Enterococci, Listeria monocytogenes, Staphylococci (including specific differentiation of Staphylococcus aureus), Streptococci (with specific differentiation of Streptococcus agalactiae, Streptococcus pneumoniae, and Streptococcus pyogenes), Acinetobacter baumannii, Enterobacteriaceae (including specific differentiation of the Enterobacter cloacae complex, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus, and Serratia marcescens), Haemophilus influenzae, Neisseria meningitidis (encapsulated), Pseudomonas aeruginosa, Candida albicans, Candida glabrata, Candida krusei, Candida parapsilosis, and Candida tropicalis.

The FilmArray BCID Panel also contains assays for the detection of genetic determinants of resistance to methicillin (mecA), vancomycin (vanA and vanB), and carbapenems (blaKPC) to aid in the identification of potentially antimicrobial resistant organisms in positive blood culture samples. The antimicrobial resistance gene detected may or may not be associated with the agent responsible for disease. Negative results for these select antimicrobial resistance gene assays do not indicate susceptibility, as multiple mechanisms of resistance to methicillin, vancomycin, and carbapenems exist.

FilmArray BCID is indicated as an aid in the diagnosis of specific agents of bacteremia and fungemia and results should be used in conjunction with other clinical and laboratory findings. Positive FilmArray results do not rule out co-infection with organisms not included in the FilmArray BCID Panel. FilmArray BCID is not intended to monitor treatment for bacteremia or fungemia.

Subculturing of positive blood cultures is necessary to recover organisms for susceptibility testing and epidemiological typing, to identify organisms in the blood culture that are not detected by the FilmArray BCID Panel, and for species determination of some Staphylococci, Enterococci, Streptococci, and Enterobacteriaceae that are not specifically identified by the FilmArray BCID Panel assays.

Type of Use *(Select one or both, as applicable)*

☒ Prescription Use (Part 21 CFR 801 Subpart D) ☐ Over-The-Counter Use (21 CFR 801 Subpart C)

CONTINUE ON A SEPARATE PAGE IF NEEDED.

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Special 510(k) Summary
BioFire Diagnostics, LLC

FilmArray Blood Culture Identification (BCID) Panel
for use with FilmArray Torch

Introduction: According to the requirements of 21 CFR 807.92, the following information provides sufficient detail to understand the basis for a determination of substantial equivalence.

Submitted by:
BioFire Diagnostics, LLC
390 Wakara Way
Salt Lake City, UT 84108

Contact:
Kristen J. Kanack, Ph.D.
Telephone: 801-736-6354, ext. 330
Fax: 801-588-0507
Email: Kristen.kanack@biofiredx.com

Date Submitted:
February 18, 2016

Trade Name:
FilmArray Blood Culture Identification (BCID) Panel

Classification Name:
Multiplex devices that use DNA hybridization to detect bacteria and their resistance markers. (21 CFR 866.3365)

Predicate Device:
K143171 – FilmArray Blood Culture Identification (BCID) Panel

Intended Use:
The FilmArray Blood Culture Identification (BCID) Panel is a qualitative multiplexed nucleic acid-based *in vitro* diagnostic test intended for use with FilmArray systems. The FilmArray BCID Panel is capable of simultaneous detection and identification of multiple bacterial and yeast nucleic acids and select genetic determinants of antimicrobial resistance. The BCID assay is performed directly on blood culture samples identified as positive by a continuous monitoring blood culture system that demonstrate the presence of organisms as determined by Gram stain.

The following gram-positive bacteria, gram-negative bacteria, and yeast are identified using the FilmArray BCID Panel: *Enterococci*, *Listeria monocytogenes*, *Staphylococci* (including specific differentiation of *Staphylococcus aureus)*, *Streptococci* (with specific differentiation of *Streptococcus agalactiae*, *Streptococcus pneumoniae*, and *Streptococcus pyogenes*), *Acinetobacter baumannii*, *Enterobacteriaceae* (including specific differentiation of the *Enterobacter cloacae* complex, *Escherichia coli*, *Klebsiella oxytoca*, *Klebsiella pneumoniae*,

Proteus, and *Serratia marcescens*), *Haemophilus influenzae*, *Neisseria meningitidis* (encapsulated), *Pseudomonas aeruginosa*, *Candida albicans*, *Candida glabrata*, *Candida krusei*, *Candida parapsilosis*, and *Candida tropicalis*.

The FilmArray BCID Panel also contains assays for the detection of genetic determinants of resistance to methicillin (*mecA*), vancomycin (*vanA* and *vanB*), and carbapenems (bla_{KPC}) to aid in the identification of potentially antimicrobial resistant organisms in positive blood culture samples. The antimicrobial resistance gene detected may or may not be associated with the agent responsible for disease. Negative results for these select antimicrobial resistance gene assays do not indicate susceptibility, as multiple mechanisms of resistance to methicillin, vancomycin, and carbapenems exist.

FilmArray BCID is indicated as an aid in the diagnosis of specific agents of bacteremia and fungemia and results should be used in conjunction with other clinical and laboratory findings. Positive FilmArray results do not rule out co-infection with organisms not included in the FilmArray BCID Panel. FilmArray BCID is not intended to monitor treatment for bacteremia or fungemia.

Subculturing of positive blood cultures is necessary to recover organisms for susceptibility testing and epidemiological typing, to identify organisms in the blood culture that are not detected by the FilmArray BCID Panel, and for species determination of some *Staphylococci*, *Enterococci*, *Streptococci*, and *Enterobacteriaceae* that are not specifically identified by the FilmArray BCID Panel assays.

Device Description:

The FilmArray Blood Culture Identification (BCID) Panel is a multiplex nucleic acid test designed to be used with a FilmArray system. The FilmArray BCID pouch contains freeze-dried reagents to perform nucleic acid purification and nested, multiplex PCR with DNA melt analysis. The FilmArray Blood Culture Identification (BCID) Panel simultaneously tests a single positive blood culture sample to provide results for 24 different organisms and organism groups that cause bloodstream infections and three genetic markers that are known to confer antimicrobial resistance (see Table 1).

Table 1. FilmArray BCID Panel Test Results.

Gram-Positive Bacteria	Gram-Negative Bacteria	Yeast
Enterococcus	*Acinetobacter baumannii*	*Candida albicans*
Listeria monocytogenes	***Enterobacteriaceae***	*Candida glabrata*
Staphylococcus	*Enterobacter cloacae* complex	*Candida krusei*
Staphylococcus aureus	*Escherichia coli*	*Candida parapsilosis*
Streptococcus	*Klebsiella oxytoca*	*Candida tropicalis*
Streptococcus agalactiae	*Klebsiella pneumoniae*	**Antimicrobial resistance genes**
Streptococcus pneumoniae	*Proteus*	*mecA* – methicillin resistance
Streptococcus pyogenes	*Serratia marcescens*	*vanA/B* – vancomycin resistance
	Haemophilus influenzae	bla_{KPC} – carbapenem resistance
	Neisseria meningitidis (encapsulated)	
	Pseudomonas aeruginosa	

A test is initiated by loading Hydration Solution and a positive blood culture sample mixed with the provided Sample Buffer into the FilmArray BCID pouch. The pouch contains all of the reagents required for specimen testing and analysis in a freeze-dried format; the addition of Hydration Solution and sample/Sample Buffer Mix rehydrates the reagents. After the pouch is prepared, the software guides the user though the steps of placing the pouch into the instrument, scanning the pouch barcode, entering the sample identification, and initiating the run.

The FilmArray instrument contains a coordinated system of inflatable bladders and seal points, which act on the pouch to control the movement of liquid between the pouch blisters. When a bladder is inflated over a reagent blister, it forces liquid from the blister into connecting channels. Alternatively, when a seal is placed over a connecting channel it acts as a valve to open or close a channel. In addition, electronically controlled pneumatic pistons are positioned over multiple plungers in order to deliver the rehydrated reagents into the blisters at the appropriate times. Two Peltier devices control heating and cooling of the pouch to drive the PCR reactions and the melt curve analysis.

Nucleic acid extraction occurs within the FilmArray pouch using mechanical lysis and standard magnetic bead technology. After extracting and purifying nucleic acids from the unprocessed sample, a nested multiplex PCR is executed in two stages. During the first stage, a single, large volume, highly multiplexed PCR reaction which includes all primers of the outer primer sets, is performed. The products from first stage PCR are then diluted and combined with a fresh, primer-free master mix and a fluorescent double stranded DNA binding dye (LC Green® Plus, BioFire Defense, LLC). The solution is then distributed to each well of the array. Array wells contain sets of primers designed specifically to amplify sequences internal to the PCR products generated during the first stage PCR reaction. The 2nd stage PCR, or nested PCR, is performed in singleplex fashion in each well of the array. At the conclusion of the 2nd stage PCR, the array is interrogated by melt curve analysis for the detection of signature amplicons denoting the presence of specific targets. A digital camera placed in front of the array captures fluorescent images of the PCR reactions and software interprets the data.

The FilmArray software automatically interprets the results of each DNA melt curve analysis and combines the data with the results of the internal pouch controls to provide a test result for each organism on the panel.

Device Comparison:

The purpose of this submission is to add FilmArray Torch as an additional instrument system for use with the FilmArray Blood Culture Identification (BCID) Panel. There have been no changes to the previously cleared FilmArray BCID Panel reagent kit itself. In order to increase throughput capacity, the FilmArray 2.0 was modified to develop the FilmArray Torch by organizing densely packaged instruments (now called FilmArray Torch Modules) into a “tower” configuration having the computer with touchscreen interface incorporated into the system base. Pouches are now inserted horizontally rather than from the top. This configuration allows the FilmArray Torch Modules to be stacked directly on top of each other to minimize system footprint.

The following table compares the FilmArray BCID Panel for use with the FilmArray Torch to the previously cleared FilmArray BCID Panel for Use with the FilmArray 2.0 (K143171). The table outlines the similarities and differences between the two systems.

Table 2. Comparison of the FilmArray Blood Culture Identification (BCID) Panel for use with the FilmArray Torch to the current FilmArray Blood Culture Identification (BCID) Panel.

Element	Modified Device: FilmArray Blood Culture Identification (BCID) Panel for use with FilmArray Torch	Predicate: FilmArray Blood Culture Identification (BCID) Panel for use with FilmArray 2.0 (K143171)
Organisms Detected	*Enterococci*, *Listeria monocytogenes*, *Staphylococci* (including specific differentiation of *Staphylococcus aureus)*, *Streptococci* (with specific differentiation of *Streptococcus agalactiae*, *Streptococcus pneumoniae*, and *Streptococcus pyogenes*), *Acinetobacter baumannii*, *Enterobacteriaceae* (including specific differentiation of the *Enterobacter cloacae* complex, *Escherichia coli*, *Klebsiella oxytoca*, *Klebsiella pneumoniae*, *Proteus*, and *Serratia marcescens*), *Haemophilus influenzae*, *Neisseria meningitidis* (encapsulated), *Pseudomonas aeruginosa*, *Candida albicans*, *Candida glabrata*, *Candida krusei*, *Candida parapsilosis*, *Candida tropicalis*, and resistance markers *mecA*, *vanA*, *vanB*, and bla_{KPC} (KPC)	Same
Analyte	DNA	Same
Specimen Types	Positive blood culture samples containing gram-positive or gram-negative bacteria and/or yeast.	Same
Technological Principles	Nested multiplex PCR followed by high resolution melting analysis to confirm identity of amplified product.	Same
Instrumentation	Single instrument FilmArray System, FilmArray 2.0 System, or FilmArray Torch System	Single instrument FilmArray System or FilmArray 2.0 System
Instrument-Software Communication	Communication for multiple FilmArray Torch Modules travels via Ethernet cable/port.	Same (multiple instruments)
Time to result	About 1 hour	Same
Test Interpretation	Automated test interpretation and report generation. User cannot access raw data.	Same
Reagent Hydration and Sample Loading	FilmArray Injection Vial-based loading procedure	Same
Sample Preparation Method	Sample Processing is automated in the FilmArray BCID pouch.	Same
Reagent Storage	Reagents are stored at room temperature.	Same

Element	Modified Device: FilmArray Blood Culture Identification (BCID) Panel for use with FilmArray Torch	Predicate: FilmArray Blood Culture Identification (BCID) Panel for use with FilmArray 2.0 (K143171)
Controls	Two controls are included in each reagent pouch to control for sample processing and both stages of PCR and melt analysis.	Same
User Complexity	Moderate/Low	Same

Performance Characteristics of FilmArray BCID Panel on FilmArray Torch
Contrived samples containing each FilmArray BCID analyte (including antibiotic resistance markers) at concentrations consistent with the levels measured in positive blood culture bottles at the time of the initial indication of positivity were tested on three complete FilmArray Torch systems (12 FilmArray Torch Modules per system) over five days (30 replicates per analyte per system) for 90 total replicates per analyte. Reproducible detection was confirmed for each FilmArray BCID analyte with the expected Detected results for 100% of samples tested on FilmArray Torch systems. Agreement with the expected negative results (Not Detected) was ≥98% for each analyte.

Conclusion:
The intended use and fundamental scientific technology of the FilmArray BCID Panel used with the modified device, FilmArray Torch, is unchanged from use of the legally marketed FilmArray BCID Panel on FilmArray and FilmArray 2.0 systems. Non-clinical validation studies have established that the performance characteristics of FilmArray BCID, including reproducibility, are substantially equivalent on FilmArray, FilmArray 2.0, and FilmArray Torch. These data demonstrate that the device performs as well as the predicate device.