510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY

I Background Information:

A 510(k) Number

K203680

B Applicant

Maine Molecular Quality Controls, Inc.

C Proprietary and Established Names

BioFire JI Control Panel M420

D Regulatory Information

Product Code(s)	Classification	Regulation Section	Panel
PMN	Class II	21 CFR 866.3920 - Assayed Quality Control Material For Clinical Microbiology Assays	MI - Microbiology

II Submission/Device Overview:

A Purpose for Submission:

To obtain a substantial equivalence determination for the BioFire JI Control Panel M420

B Measurand:

Multi-analyte quality control materials

C Type of Test:

BioFire JI Control Panel M420 is intended for use as an external positive and negative assayed quality control to monitor the performance of in vitro laboratory nucleic acid testing procedures for the qualitative detection of Gram positive and Gram negative bacteria: *Anaerococcus prevotii/vaginalis*, *Clostridium perfringens, Cutibacterium avidum/granulosum, Enterococcus*

faecalis, Enterococcus faecium, Finegoldia magna, Parvimonas micra, Peptoniphilus, Peptostreptococcus anaerobius, Staphylococcus aureus. Staphylococcus lugdunensis, Streptococcus spp., Streptococcus agalactiae, Streptococcus pneumoniae, Streptococcus pyogenes, Bacteroides fragilis, Citrobacter, Enterobacter cloacae complex*, Escherichia coli, Haemophilus influenzae, Kingella kingae, Klebsiella aerogenes, Klebsiella pneumoniae* group*, Morganella morganii, Neisseria gonorrhoeae, Proteus* spp.*, Pseudomonas aeruginosa, Salmonella* spp*., and Serratia marcescens*, as well as antimicrobial resistance genes: CTX-M, IMP, KPC, *mecA/C* and MREJ (MRSA), NDM, OXA-48-like, *van*A/B, VIM, and yeast pathogens: *Candida* and *Candida albicans* on the BioFire JI Panel assay on the BioFire systems.

III Intended Use/Indications for Use:

A Intended Use(s):

See Indications for Use below.

B Indication(s) for Use:

BioFire JI Control Panel M420 is intended for use as an external positive and negative assayed quality control to monitor the performance of in vitro laboratory nucleic acid testing procedures for the qualitative detection of gram-positive and gram-negative bacteria: *Anaerococcus prevotii/vaginalis, Clostridium perfringens, Cutibacterium avidum/granulosum, Enterococcus faecalis, Enterococcus faecium, Finegoldia magna, Parvimonas micra, Peptoniphilus, Peptostreptococcus anaerobius, Staphylococcus aureus, Staphylococcus lugdunensis, Streptococcus spp., Streptococcus agalactiae, Streptococcus pneumoniae, Streptococcus pyogenes, Bacteroides fragilis, Citrobacter, Enterobacter cloacae complex, Escherichia coli, Haemophilus influenzae, Kingella kingae, Klebsiella aerogenes, Klebsiella pneumoniae group, Morganella morganii, Neisseria gonorrhoeae, Proteus spp., Pseudomonas aeruginosa, Salmonella spp.* and *Serratia marcescens*, antimicrobial resistance genes: CTX-M, IMP, KPC, *mecA/C* and MREJ (MRSA), NDM, OXA-48-like, *van*A/B, VIM, and yeast pathogens: *Candida and Candida albicans* on the BioFire JI Panel assay on the BioFire systems. BioFire JI Control Panel M420 is composed of synthetic DNA specifically designed for and intended to be used solely with the BioFire JI Panel assay. This product is not intended to replace manufacturer controls provided with the device.

C Special Conditions for Use Statement(s):

Rx - For Prescription Use Only

D Special Instrument Requirements:

The Biofire JI Control Panel was evaluated on the FilmArray 2.0 and FilmArray Torch instruments.

IV Device/System Characteristics:

A Device Description:

BioFire JI Control Panel M420, PIN M420, is a quality control panel consisting of two controls: BioFire JI Positive Control, PIN M42118, and Jl Negative Control, PIN M42218. The Positive Control contains non-infectious surrogate control material; a solution of synthetic DNA in

buffers, stabilizers and preservatives. The DNA in the Positive Control carries nucleic acid corresponding to the genome segments of all the pathogens and antimicrobial resistance genes detected and identified by the BioFire JI Panel assay (see Table 1 below) on the BioFire systems. The Negative Control contains only buffers, stabilizers and preservatives.

Table 1. Pathogens and antimicrobial resistance genes found in BioFire JI Control Panel M420, detected by the BioFire JI Panel Assay.

Analyte			
Gram Positive Bacteria			
Anaerococcus prevotii/vaginalis	***Enterococcus faecalis***	***Peptoniphilus***	***Streptococcus mutans***
Clostridium perfringens	***Enterococcus faecium***	***Peptostreptococcus anaerobius***	***Streptococcus agalactiae***
Cutibacterium avidum	***Finegoldia magna***	***Staphylococcus aureus***	***Streptococcus pneumoniae***
Cutibacterium granulosum	***Parvimonas micra***	***Staphylococcus lugdunensis***	***Streptococcus pyogenes***
Gram Negative Bacteria			
Bacteroides fragilis	***Haemophilus influenzae***	***Morganela morganii***	***Salmonella* spp.**
Citrobacter	***Kingella kingae***	***Neisseria gonorrhoeae***	***Serratia marcescens***
***Enterobacter cloacae* complex**	***Klebsiella aerogenes***	***Proteus* spp.**	
Escherichia coli	***Klebsiella pneumoniae* group**	***Pseudomonas aeruginosa***	
Yeast			
***Candida* spp.**		***Candida albicans***	
Antimicrobial Resistance Genes			
CTX-M	**KPC**	**NDM**	***vanA/B***
IMP	***mecA/C* and MREJ (MRSA)**	**OXA-48-like**	**VIM**

B Principle of Operation:

Not applicable.

V Substantial Equivalence Information:

A Predicate Device Name(s):

FilmArray BCID2 Control Panel M416

B Predicate 510(k) Number(s):

K200010

C Comparison with Predicate(s):

Device & Predicate Device(s):	K203680	K200010
Device Trade Name	BioFire JI Control Panel M420	FilmArray BCID2 Control Panel M416
General Device Characteristic Similarities		
Intended Use/Indications For Use	BioFire JI Control Panel M420 is intended for use as an external positive and negative assayed quality control to monitor the performance of in vitro laboratory nucleic acid testing procedures for the qualitative detection of gram-positive and gram-negative bacteria: *Anaerococcus prevotii/vaginalis, Clostridium perfringens, Cutibacterium avidum/granulosum, Enterococcus faecalis, Enterococcus faecium, Finegoldia magna, Parvimonas micra, Peptoniphilus, Peptostreptococcus anaerobius, Staphylococcus aureus, Staphylococcus lugdunensis, Streptococcus spp., Streptococcus agalactiae, Streptococcus pneumoniae, Streptococcus pyogenes, Bacteroides fragilis, Citrobacter, Enterobacter cloacae complex, Escherichia coli, Haemophilus influenzae, Kingella kingae, Klebsiella aerogenes, Klebsiella pneumoniae group, Morganella morganii, Neisseria gonorrhoeae, Proteus spp., Pseudomonas aeruginosa, Salmonella spp.*	FilmArray BCID2 Control Panel M416 is intended for use as an external positive and negative assayed quality control to monitor the performance of in vitro laboratory nucleic acid testing procedures for the qualitative detection of antimicrobial resistance genes: CTX-M, IMP, KPC, *mcr*-1, *mecA/C*, *mecA/C* and MREJ (MRSA), NDM, OXA-48-like, *van*A/B, VIM; Gram positive and Gram negative bacteria: *Enterococcus faecalis, Enterococcus faecium, Listeria monocytogenes, Staphylococcus spp., Staphylococcus aureus, Staphylococcus epidermidis, Staphylococcus lugdunensis, Streptococcus spp., Streptococcus agalactiae (Group B), Streptococcus pneumoniae, Streptococcus pyogenes (Group A), Acinetobacter calcoaceticusbaumannii complex, Bacteroides fragilis, Enteric bacteria, Enterobacter cloacaecomplex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniaegroup, Proteus spp., Salmonella spp., Serratia marcescens, Haemophilus* influenzae, Neisseria *meningitidis, Pseudomonas*

	and Serratia marcescens, antimicrobial resistance genes: CTX-M, IMP, KPC, *mecA/C* and MREJ (MRSA), NDM, OXA-48-like, *van*A/B, VIM, and yeast pathogens: *Candida* and *Candida albicans* on the BioFire JI Panel assay on the BioFire systems. BioFire JI Control Panel M420 is composed of synthetic DNA specifically designed for and intended to be used solely with the BioFire JI Panel assay. This product is not intended to replace manufacturer controls provided with the device.	*aeruginosa* and *Stenotrophomonas maltophilia;* and *yeast pathogens:Candida albicans, Candida auris, Candida glabrata, Candida krusei, Candida parapsilosis, Candida tropicalis,* and *Cryptococcus neoformans/gattii* on the BioFire Blood Culture Identification 2 (BCID2) Panel assay on FilmArray systems. FilmArray BCID2 Control Panel M416 is composed of synthetic DNA specifically designed for and intended to be used solely with the BioFire BCID2 Panel assay. This product is not intended to replace manufacturer controls provided with the device
Physical Format	Ready-to-use liquid	Same
Directions for Use	Process like patient sample (pipette from synovial fluid)	Process like patient sample (pipette from blood culture)
Composition	Synthetic DNA	Same
Assay Steps Monitored	Amplification, detection, identification	Same
Number of targets monitored in one assay	Multiple, > 30 targets	Same, >30 targets
General Device Characteristic Differences		
Targets	CTX-M, IMP, KPC, mecA/C and MREJ (MRSA), NDM, OXA-48-like, vanA/B, VIM, *Anaerococcus prevotii/vaginalis*, *Clostridium perfringens, Cutibacterium avidum/granulosum, Enterococcus faecalis, Enterococcus faecium, Finegoldia magna, Parvimonas micra, Peptoniphilus, Peptostreptococcus anaerobius, Staphylococcus*	CTX-M, IMP, KPC, mcr-1, mecA/C, mecA/C and MREJ (MRSA), NDM, OXA-48-like, vanA/B, VIM; *Enterococcus faecalis, Enterococcus faecium, Listeria monocytogenes, Staphylococcus* spp., *Staphylococcus aureus, Staphylococcus epidermidis, Staphylococcus lugdunensis, Streptococcus* spp., *Streptococcus agalactiae (Group B),*

	aureus. Staphylococcus lugdunensis, Streptococcus spp., Streptococcus agalactiae, Streptococcus pneumoniae, Streptococcus pyogenes, Bacteroides fragilis, Citrobacter, Enterobacter cloacae complex*, Escherichia coli, Haemophilus influenzae, Kingella kingae, Klebsiella aerogenes, Klebsiella pneumoniae* group*, Morganella morganii, Neisseria gonorrhoeae, Proteus* spp.*, Pseudomonas aeruginosa, Salmonella* spp.*, Serratia marcescens, Candida,* and *Candida albicans*	*Streptococcus pneumoniae, Streptococcus pyogenes (Group A), Acinetobacter calcoaceticus baumannii complex, Bacteroides fragilis, Enteric bacteria, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Proteus* spp.*, Salmonella* spp.*, Serratia marcescens, Haemophilus influenzae, Neisseria meningitidis, Pseudomonas aeruginosa and Stenotrophomonas maltophilia; and yeast pathogens: Candida albicans, Candida auris, Candida glabrata, Candida krusei, Candida parapsilosis, Candida tropicalis, and Cryptococcus neoformans/gattii*

VI Standards/Guidance Documents Referenced:

None referenced.

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:

A multi-site reproducibility study was performed with the BioFire JI Control Panel on FilmArray 2.0 and FilmArray Torch systems. Testing included evaluation of 10 samples of each of three lots of BioFire JI Control Panel M420 on different days at three CLIA-certified clinical sites using three BioFire JI Panel pouch lots, incorporating multiple operators for a total of 181 tests (one Invalid result was repeated).

Out of the 90 positive and 90 negative controls tested with valid pouch controls, the correct analytes were detected (for positive controls) or not detected (for negative controls) resulting in a correct call rate of 100% (Table 2).

Table 2. BioFire JI Control Panel M420: Summary of Reproducibility Results

Site	Total Tests	Invalid	Correct Positive Control Result	Incorrect Positive Control Result	% Correct Positive Control Result (95% CI)	Correct Negative Control Result	Incorrect Negative Control Result	% Correct Negative Control Result (95% CI)
1	61	1*	30	0	100	30	0	100
2	60	0	30	0	100	30	0	100
3	60	0	30	0	100	30	0	100
All	181	1*	90	0	100 (95.9%–100.0%)	90	0	100 (95.9%–100.0%)

*Invalid result was not included in percent correct

An internal precision study was performed by testing 20 samples of each of three lots of BioFire JI Control Panel M420 on different days with three BioFire JI Panel pouch lots by three operators for a total of 120 tests. The same pouch lots were used for both internal and external testing. All controls gave correct positive or negative results (Table 3).

Table 3. BioFire JI Control Panel M420: Summary of Internal Precision Results

Control	Lot #	No. Tests	Invalid	Correct Results	Incorrect Results	Percent Correct [95% CI]
BioFire JI Negative Control	1	20	0	20	0	100
	2	20	0	20	0	100
	3	20	0	20	0	100
	Total	60	0	60	0	100% [94-100%]
BioFire JI Positive Control	1	20	0	20	0	100
	2	20	0	20	0	100
	3	20	0	20	0	100
	Total	60	0	60	0	100% [94-100%]

A Cp data analysis was also conducted for the precision study results and no significant difference in the mean Cp values was observed based on testing of different Biofire JI Positive control lots on different days by multiple operators at external and internal sites. The reproducibility and precision studies evaluating the BioFire JI Control Panel M420 are acceptable.

2. Linearity:

Not applicable.

3. Analytical Specificity/Interference:

Not applicable.

4. Assay Reportable Range:

   Not applicable.

5. Traceability, Stability, Expected Values (Controls, Calibrators, or Methods):

   Open Vial Stability

   Not applicable because the BioFire JI Control Panel M420 is packaged for single use.

   Real-Time Stability Program

   Real-time stability studies are ongoing to support product claims and to monitor potential assay modifications for which the BioFire JI Control Panel M420 is indicated for use. Real-time stability study protocols and acceptance criteria were reviewed and found to be acceptable.

   Shipping Stability

   MMQCI ships DNA-based controls, such as BioFire JI Control Panel M420, on frozen gel packs with overnight delivery (U.S.), or 4-7 days (ex-U.S.), ensuring that the control material remains cold upon receipt. The control material is expected to be stored at 2-8°C upon receipt, as indicated in the BioFire JI Control Panel M420 package insert. A shipping study was performed to confirm the shipping process does not negatively impact performance, with and without a shipping delay with consequent arrival of gel packs no longer frozen or cold, and to investigate two extreme temperature excursions: 37°C and -20°C, that might occur during shipping. The study evaluated two lots of the BioFire JI Positive Control that was placed with two frozen gel packs. After two days, some vials were returned to the refrigerator at 2-8°C, and subsequently tested using the BioFire JI Panel assay, thus representing usual customer receipt of product. To simulate a shipping delay, the remaining 'shipped' vials from the two lots of the BioFire JI Positive Control were removed from the shipping box after two days and stored for up to six days at ambient room temperature. The vials were then returned to the refrigerator and subsequently tested using the BioFire JI Panel assay.

   The study demonstrated that the BioFire JI Control Panel M420 is stable for two days on frozen gel packs in MMQCI's standard shipping box. BioFire JI Positive Control is stable after six days at ambient temperatures of approximately 19-21°C. The BioFire JI Control Panel M420 should be stored refrigerated (2-8°C) as indicated in the package insert.

   To investigate control performance after exposure to extreme temperatures, two tubes each of two lots of BioFire JI Positive Control were warmed to room temperature, placed at -20°C and 37°C and subsequently tested using the BioFire JI Panel assay. The results from this study demonstrate that an overnight exposure to -20°C and 37°C does not impact control performance.

6. Detection Limit:

   Not applicable.

7. Assay Cut-Off:

   Not applicable.

B Comparison Studies:

1. Method Comparison with Predicate Device:

   Not applicable.

2. Matrix Effects:

   The matrix of the BioFire JI Control Panel M420 is synthetic. To investigate the potential effects of the synthetic matrix on the BioFire JI Panel assay, equal volumes of the same concentration of gDNA *Streptococcus pneumoniae, strain TCH8431* (BEI Resources, P/N HM-145D) were spiked into 270µL of BioFire JI Control Panel M420 matrix and 270µL of synovial fluid (Human Synovial Fluid; Innovative Research), then tested on the BioFire JI Panel assay in triplicate. The acceptance criteria were correct results for all spiked synovial fluid and spiked synthetic matrix samples.

   The expected results were obtained for all spiked human synovial fluid and spiked BioFire JI Control Panel M420 synthetic matrix (Detected for *Streptococcus spp. and S. pneumoniae*, Not Detected for all other assays).

   The results indicated that the BioFire JI Control Panel M420 matrix has no effect on the assay.

C Clinical Studies:

1. Clinical Sensitivity:

   Not applicable.

2. Clinical Specificity:

   Not applicable.

3. Other Clinical Supportive Data (When 1. and 2. Are Not Applicable):

   Not applicable.

D Clinical Cut-Off:

Not Applicable

E Expected Values/Reference Range:

BioFire JI Control Panel M420 is a qualitative control and the expected results are listed in the table below.

Table 5. BioFire JI Control Panel M420 Positive and Negative Result Summary

Analyte	Positive Control	Negative Control
Anaerococcus prevotii/vaginalis	Detected	Not Detected
Clostridium perfringens	Detected	Not Detected
Cutibacterium avidum	Detected	Not Detected
Cutibacterium granulosum	Detected	Not Detected
Enterococcus faecalis	Detected	Not Detected
Enterococcus faecium	Detected	Not Detected
Finegoldia magna	Detected	Not Detected
Parvimonas micra	Detected	Not Detected
Peptoniphilus	Detected	Not Detected
Peptostreptococcus anaerobius	Detected	Not Detected
Staphylococcus aureus	Detected	Not Detected
Staphylococcus lugdunensis	Detected	Not Detected
Streptococcus mutans	Detected	Not Detected
Streptococcus agalactiae	Detected	Not Detected
Streptococcus pneumoniae	Detected	Not Detected
Streptococcus pyogenes	Detected	Not Detected
Bacteroides fragilis	Detected	Not Detected
Citrobacter	Detected	Not Detected
***Crobacter cloacae* complex**	Detected	Not Detected
Escherichia coli	Detected	Not Detected
Haemophilus influenzae	Detected	Not Detected
Kingella kingae	Detected	Not Detected
Klebsiella aerogenes	Detected	Not Detected
***Klebsiella pneumoniae* group**	Detected	Not Detected
Morganela morganii	Detected	Not Detected
Neisseria gonorrhoeae	Detected	Not Detected
***Proteus* spp.**	Detected	Not Detected
Pseudomonas aeruginosa	Detected	Not Detected
***Salmonella* spp.**	Detected	Not Detected
Serratia marcescens	Detected	Not Detected
***Candida* spp.**	Detected	Not Detected
Candida albicans	Detected	Not Detected
AMR Genes		
CTX-M	Detected	N/A
IMP	Detected	N/A
KPC	Detected	N/A
***mecA/C* and MREJ (MRSA)**	Detected	N/A
NDM	Detected	N/A
OXA-48-like	Detected	N/A
vanA/B	Detected	N/A
VIM	Detected	N/A

VIII Proposed Labeling:

The labeling supports the finding of substantial equivalence for this device.

IX Conclusion:

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