510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY

I Background Information:

A 510(k) Number

K221253

B Applicant

Maine Molecular Quality Controls, Inc.

C Proprietary and Established Names

SPOTFIRE RSP Positive Control, SPOTFIRE RSP Negative Control

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 SPOTFIRE RSP Positive and Negative Controls.

B Measurand:

Multi-analyte surrogate control materials

C Type of Test:

The SPOTFIRE RSP Positive and Negative Controls are intended for *in vitro* diagnostic use as an assayed quality control material to monitor the qualitative reverse transcription, amplification, detection and identification steps of the BIOFIRE SPOTFIRE Respiratory (R) Panel on the BIOFIRE SPOTFIRE System, which is used to detect the following analytes: *Bordetella parapertussis*, *Bordetella pertussis*, *Chlamydia pneumoniae*, *Mycoplasma pneumoniae*,

Adenovirus, seasonal Coronavirus, Coronavirus SARS-CoV-2, Human Metapneumovirus, Human Rhinovirus/Enterovirus, Influenza A Virus subtype H1-2009 and subtype H3 (differentiated), Parainfluenza Virus and Respiratory Syncytial Virus.

III Intended Use/Indications for Use:

A Intended Use(s):

See Indications for Use below.

B Indication(s) for Use:

SPOTFIRE RSP Positive Control

SPOTFIRE RSP Positive Control is intended for use as an external positive assayed quality control to monitor performance of in vitro laboratory nucleic acid testing procedures for the qualitative detection of Bordetella parapertussis, Bordetella pertussis, Chlamydia pneumoniae, Mycoplasma pneumoniae, Adenovirus, seasonal Coronavirus, Coronavirus SARS-CoV-2, Human Metapneumovirus, Human Rhinovirus/Enterovirus, Influenza A Subtype H1-2009, Influenza A Subtype H3, Influenza B, Parainfluenza Virus and Respiratory Syncytial Virus using the BIOFIRE SPOTFIRE Respiratory (R) Panel performed on the BIOFIRE SPOTFIRE System. SPOTFIRE RSP Positive Control is comprised of in vitro RNA transcripts and stabilizing solution and is designed for and intended to be used solely with the BIOFIRE SPOTFIRE R Panel. This product is not intended to replace manufacturer internal controls provided with the device.

Quality control materials should be used in accordance with local, state, federal regulations, and accreditation requirements.

SPOTFIRE RSP Negative Control

SPOTFIRE RSP Negative Control is intended for use as an external negative assayed quality control to monitor performance of in vitro laboratory nucleic acid testing procedures for the qualitative detection of Bordetella parapertussis, Bordetella pertussis, Chlamydia pneumoniae, Mycoplasma pneumoniae, Adenovirus, seasonal Coronavirus, Coronavirus SARS-CoV-2, Human Metapneumovirus, Human Rhinovirus/Enterovirus, Influenza A Subtype H1-2009, Influenza A Subtype H3, Influenza B, Parainfluenza Virus and Respiratory Syncytial Virus using the BIOFIRE SPOTFIRE Respiratory (R) Panel performed on the BIOFIRE SPOTFIRE System. SPOTFIRE RSP Negative Control is comprised of a solution that does not contain target analytes and is designed for and intended to be used solely with the BIOFIRE SPOTFIRE R Panel. This product is not intended to replace manufacturer internal controls provided with the device.

Quality control materials should be used in accordance with local, state, federal regulations, and accreditation requirements.

C Special Conditions for Use Statement(s):

Rx - For Prescription Use Only

D Special Instrument Requirements:

The SPOTFIRE RSP Positive and Negative Controls are intended for use with the BIOFIRE SPOTFIRE Respiratory (R) Panel performed on the BIOFIRE SPOTFIRE System.

IV Device/System Characteristics:

A Device Description:

The SPOTFIRE RSP Positive and Negative Controls are ready-to-use, surrogate assayed quality control materials. The Positive Control comprises *in vitro* transcripts that include each target region of all the analytes on the BIOFIRE SPOTFIRE R Panel (**Table 1**) in a buffer containing a stabilizing agent and preservative. The Negative Control comprises buffer and preservative but no target nucleic acid. The SPOTFIRE RSP Positive and Negative Controls are provided in single-use aliquots and are available separately or together as a panel.

Table 1. Analytes included in the BIOFIRE SPOTFIRE R Panel and monitored using the SPOTFIRE RSP Panel Positive and Negative Controls

Viral Pathogens		**Bacterial Pathogens**
Adenovirus		*Bordetella parapertussis*
Seasonal Coronavirus [1]	Coronavirus 229E	*Bordetella pertussis*
	Coronavirus HKU1	*Chlamydia pneumoniae*
	Coronavirus OC43	*Mycoplasma pneumoniae*
	Coronavirus NL63	
Coronavirus SARS-CoV-2		
Human Metapneumovirus		
Human Rhinovirus/Enterovirus		
Influenza A Virus subtype H1-2009		
Influenza A Virus subtype H3		
Parainfluenza Virus [2]	Parainfluenza Virus 1	
	Parainfluenza Virus 2	
	Parainfluenza Virus 3	
	Parainfluenza Virus 4	
Respiratory Syncytial Virus		

[1] For patient samples, the BIOFIRE SPOTFIRE R Panel reports a single result for all 4 Seasonal Coronavirus species in combination; for Quality Control testing, the assay for each individual seasonal Coronavirus must produce the expected result.

[2] For patient samples, the SPOTFIRE R Panel reports a single result for all 4 Parainfluenza Virus serotypes in combination; for Quality Control testing, the assay for each individual Parainfluenza Virus serotype must produce the expected result.

B Principle of Operation:

The SPOTFIRE RSP Positive and Negative Controls are processed according to the instructions for quality control testing provided by the manufacturer of the BIOFIRE SPOTFIRE R Panel. Results are reported automatically by the BIOFIRE SPOTFIRE Panel Software as either "PASS", "FAIL" or "INVALID [failure reason]".

V Substantial Equivalence Information:

A Predicate Device Name(s):
BioFire RP2.1/RP2.1 plus Control Panel M441

B Predicate 510(k) Number(s):
K202196

C Comparison with Predicate(s):

Device & Predicate Device(s):	K221253	K202196
Device Trade Name	SPOTFIRE RSP Positive Control SPOTFIRE RSP Negative Control	BioFire RP2.1/RP2.1*plus* Control Panel M441
General Device Characteristic Similarities		
Intended Use/Indications For Use	SPOTFIRE RSP Positive Control is intended for use as an external positive assayed quality control to monitor performance of *in vitro* laboratory nucleic acid testing procedures for the qualitative detection of *Bordetella parapertussis*, *Bordetella pertussis*, *Chlamydia pneumoniae*, *Mycoplasma pneumoniae*, Adenovirus, seasonal Coronavirus, Coronavirus SARS-CoV-2, Human Metapneumovirus, Human Rhinovirus/Enterovirus, Influenza A Subtype H1-2009, Influenza A Subtype H3, Influenza B, Parainfluenza Virus	BioFire RP2.1/RP2.1*plus* Control Panel M441 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 Adenovirus, Coronavirus, Human Metapneumovirus, Human Rhinovirus/ Enterovirus, Influenza A, Influenza A subtype H1, Influenza A subtype H1-2009, Influenza A subtype H3, Influenza B, Middle East Respiratory Syndrome Coronavirus, Parainfluenza Virus, Respiratory Syncytial Virus, Severe Acute Respiratory Syndrome

	and Respiratory Syncytial Virus using the BIOFIRE SPOTFIRE Respiratory (R) Panel performed on the BIOFIRE SPOTFIRE System. SPOTFIRE RSP Positive Control is comprised of *in vitro* RNA transcripts and stabilizing solution and is designed for and intended to be used solely with the BIOFIRE SPOTFIRE R Panel. This product is not intended to replace manufacturer internal controls provided with the device. Quality control materials should be used in accordance with local, state, federal regulations, and accreditation requirements. SPOTFIRE RSP Negative Control is intended for use as an external negative assayed quality control to monitor performance of *in vitro* laboratory nucleic acid testing procedures for the qualitative detection of *Bordetella parapertussis*, *Bordetella pertussis*, *Chlamydia pneumoniae*, *Mycoplasma pneumoniae*, Adenovirus, seasonal Coronavirus,	Coronavirus 2, *Bordetella parapertussis, Bordetella pertussis, Chlamydia pneumoniae*, and *Mycoplasma pneumoniae* on the BioFire Respiratory Panel 2.1 (RP2.1), BioFire Respiratory Panel 2.1 *plus* (RP2.1*plus*) and BioFire Respiratory Panel 2.1-EZ (RP2.1-EZ) assays performed on BioFire FilmArray systems. BioFire RP2.1/RP2.1plus Positive control is composed of synthetic RNA transcripts specifically designed for and intended to be used solely with the BioFire RP2.1, BioFire RP2.1plus and BioFire RP2.1-EZ assays. This product is not intended to replace manufacturer controls provided with the device.

	Coronavirus SARS-CoV-2, Human Metapneumovirus, Human Rhinovirus/Enterovirus, Influenza A Subtype H1-2009, Influenza A Subtype H3, Influenza B, Parainfluenza Virus and Respiratory Syncytial Virus using the BIOFIRE SPOTFIRE Respiratory (R) Panel performed on the BIOFIRE SPOTFIRE System. SPOTFIRE RSP Negative Control is comprised of a solution that does not contain target analytes and is designed for and intended to be used solely with the BIOFIRE SPOTFIRE R Panel. This product is not intended to replace manufacturer internal controls provided with the device. Quality control materials should be used in accordance with local, state, federal regulations, and accreditation requirements.	
Physical format	Ready-to-use liquid	Same
Directions For Use	Process according to the Instructions For Use for the assay	Same
Composition	Synthetic RNA transcripts and stabilizing solution	Same
Assay steps monitored	Reverse transcription, amplification, detection,	Same

	identification	
Number of analytes monitored	Multiple	Same
Pathogens detected	Respiratory viruses and bacteria	Same
General Device Characteristic Differences		
Test System	BIOFIRE SPOTFIRE System	BioFire FilmArray 2.0 or FilmArrray Torch Systems

VI Standards/Guidance Documents Referenced:

Not applicable.

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:
The precision and reproducibility of results obtained with the SPOTFIRE RSP Positive and Negative Controls was evaluated using three lots of finished material that were tested with multiple lots of SPOTFIRE R Panel reagents, over multiple days, with multiple operators and using multiple BioFire SpotFire Systems, as follows.

External Sites
Testing was performed at 5 sites that were representative of the Intended Use environment for the SPOTFIRE R Panel (i.e., sites performing near-patient testing). The SPOTFIRE RSP Positive and Negative Controls were tested according to the SPOTFIRE R Panel instructions for use as intended during normal, day-to-day operations (e.g., training a new operator, upon receipt of new reagents or a new instrument, or following instrument service). The number of control panels tested varied by site according to the number of operators and volume of SPOTFIRE R Panel testing performed. A total of 37 SPOTFIRE instruments were used across the 5 study sites in conjunction with 25 lots of SPOTFIRE R Panel pouches.

Internal Maine Molecular Site
Testing of the SPOTFIRE RSP Positive and Negative Controls internally at Maine Molecular Quality Controls was performed over multiple days on a single SPOTFIRE instrument by 3 operators using 3 lots of control panels and 3 lots of SPOTFIRE R Panel pouches.

In total, 361 controls were tested across all sites, including 179 Positive Controls and 182 Negative Controls (**Table 2**). There were 10 invalid results affecting 7 Positive Controls and 3 Negative Controls (7 due to internal pouch control failure and 3 due to instrument errors).

All controls with invalid results were retested yielding a total of 351 valid control results (172 Positive Controls and 179 Negative Controls). One Positive Control failed because negative results were obtained for 4 of the target analytes. All other control results were as expected. The overall Positive Control failure rate was 0.6% (1/172).

The reproducibility and precision of the SPOTFIRE RSP Positive and Negative Controls was acceptable.

Table 2. Summary of control performance stratified by site and control lot

Site	Number Tested (Invalid or Failed)										
	Positive Controls					Negative Controls					
	Lot A	Lot B	Lot C	Total	% Pass [1]	Lot A	Lot B	Lot C	Lot D	Total	% Pass [1]
1	1	0	12	**13**	**100**	0	0	12	1	**13**	**100**
2	1	0	12	**13**	**100**	0	5	12 (1)	3	**20 (1)**	**100**
3	17 (2) [2]	24 (2)	16	**57 (4)**	**98.1**	25	11	18	9 (1)	**63 (1)**	**100**
4	3	0	18	**21**	**100**	0	6	12	5 (1)	**23 (1)**	**100**
5	0	9 (1)	0	**9 (1)**	**100**	0	0	0	0	**0**	**100**
MMQC	23 (2)	21	22 (1)	**66 (3)**	**100**	21	21	21	0	**63**	**100**
Total	**45 (4)**	**54 (3)**	**80 (1)**	**179 (8)**	**99.4**	**46**	**43**	**76 (1)**	**20 (2)**	**182 (3)**	**100**
% Pass [1]	**97.6**	**100**	**100**	**99.4**		**100**	**100**	**100**	**100**	**100**	

Testing of controls that produced invalid results (n = 10) was repeated.

[1] Invalid results due to instrument or pouch failure were excluded from calculation of control pass rate

[2] 1 Positive Control failed because negative results were obtained for Influenza A H1-2009, Influenza A H3 and Parainfluenza Virus. All other invalid results for the Positive and Negative Controls were due to pouch or instrument errors. The overall Positive Control failure rate across all sites and lots of controls was 0.6% (1/172).

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):

Real-time Reagent Stability Studies
Real-time Reagent Stability Studies to establish the shelf-life of the SPOTFIRE RSP Positive and Negative Controls are ongoing and include testing of 3 lots of each control type stored under 3 different conditions: room temperature (18 to 25 °C), refrigerated (2-8 °C) and

frozen (-25 to -15 °C). Testing of the SPOTFIRE RSP Positive and Negative Controls will be performed at intervals over at least 24 months or until product degradation is observed.

6. Detection Limit:

   Not applicable.

7. Assay Cut-Off:

   Not applicable.

B Comparison Studies:

1. Method Comparison with Predicate Device:

   Not applicable.

2. Matrix Comparison:

   Not applicable.

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:

The expected results for each analyte monitored by the SPOTFIRE RSP Positive and Negative Controls are shown in **Table 3**. The SPOTFIRE R Panel Quality Control software reports the control results as either "Pass", "Fail" or "Invalid" based on the combination of the individual test results within the panel.

Table 3. Expected results for the SPOTFIRE RSP Positive and Negative Controls

Analyte Type	BIOFIRE SPOTFIRE R Panel (K213954)	SPOTFIRE RSP Control Expected Result	
		Positive Control	Negative Control
Bacteria	*Bordetella parapertussis*	Positive	Negative
	Bordetella pertussis	Positive	Negative
	Chlamydia pneumoniae	Positive	Negative
	Mycoplasma pneumoniae	Positive	Negative
Viruses	Adenovirus	Positive	Negative
	Seasonal Coronavirus	Positive	Negative
	Coronavirus SARS-CoV-2	Positive	Negative
	Human metapneumovirus	Positive	Negative
	Human Rhinovirus/Enterovirus	Positive	Negative
	Influenza A Virus	Positive	Negative
	Influenza A Subtype H1-2009	Positive	Negative
	Influenza A Subtype H3	Positive	Negative
	Influenza B Virus	Positive	Negative
	Parainfluenza Virus	Positive	Negative
	Respiratory Syncytial Virus	Positive	Negative

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.