510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY

I Background Information:

A 510(k) Number

K233611

B Applicant

Maine Molecular Quality Controls, Inc.

C Proprietary and Established Names

SPOTFIRE RSP Pos & Neg Controls (M425), SPOTFIRE RSP Positive Control (M42638), SPOTFIRE RSP Negative Control (M42738)

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:

The purpose of this submission is to modify the Intended Use/Indications for use for the SPOTFIRE RSP Positive and Negative Controls that were most recently cleared under K230868 for use with the BIOFIRE SPOTFIRE (R) Panel (K213954/CW210006) and BIOFIRE SPOTFIRE R Panel Mini (K230719/CW230007) to specify that the controls may also be used with the BIOFIRE SPOTFIRE Respiratory/Sore Throat (R/ST) Panel (K232954/CW230018).

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 assayed quality control materials to monitor the qualitative reverse transcription, amplification, detection and identification steps of the BIOFIRE SPOTFIRE Respiratory (R) Panel, BIOFIRE SPOTFIRE Respiratory (R) Panel Mini and BIOFIRE SPOTFIRE Respiratory/Sore Throat (R/ST) Panel on the BIOFIRE SPOTFIRE System.

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 applicable) 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, Streptococcus dysgalactiae (Group C/G Strep), Streptococcus pyogenes (Group A Strep), Adenovirus, Coronavirus SARS-CoV-2, Coronavirus (seasonal), 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, BIOFIRE SPOTFIRE Respiratory (R) Panel Mini, and BIOFIRE SPOTFIRE Respiratory/Sore Throat (R/ST) Panel 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, BIOFIRE SPOTFIRE R Panel Mini, and BIOFIRE SPOTFIRE R/ST Panel assays. This product is not intended to replace manufacturer internal controls provided with these devices.

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 applicable) 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, Streptococcus dysgalactiae (Group C/G Strep), Streptococcus pyogenes (Group A Strep), Adenovirus, Coronavirus SARS-CoV-2, Coronavirus (seasonal), 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, BIOFIRE SPOTFIRE Respiratory (R) Panel Mini, and BIOFIRE SPOTFIRE Respiratory/Sore Throat (R/ST) Panel 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, BIOFIRE SPOTFIRE R Panel Mini, and BIOFIRE SPOTFIRE

R/ST Panel assays. This product is not intended to replace manufacturer internal controls provided with these devices.

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:

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/ST Panel (K232954), BIOFIRE SPOTFIRE R Panel (K213954) and BIOFIRE SPOTFIRE R Panel Mini (K230719) (**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 FDA-cleared BIOFIRE SPOTFIRE Panels that are monitored using the SPOTFIRE RSP Positive and Negative Controls

Group	Pathogen		BIOFIRE SPOTFIRE		
			Respiratory Panel [1]	Sore Throat Panel [2]	Respiratory Panel Mini
Viruses	Adenovirus		X	X	
	Coronavirus (seasonal) [3]	Coronavirus 229E	X	X	
		Coronavirus HKU1	X	X	
		Coronavirus OC43	X	X	
		Coronavirus NL63	X	X	
	Coronavirus SARS-CoV-2		X		X
	Human Metapneumovirus		X	X	
	Human Rhinovirus/Enterovirus		X	X	X [4]
	Influenza A Virus		X	X	X
	Influenza A Virus subtype H1-2009		X	X	
	Influenza A Virus subtype H3		X	X	
	Influenza B Virus		X	X	X
	Parainfluenza Virus [5]	Parainfluenza Virus 1	X	X	
		Parainfluenza Virus 2	X	X	
		Parainfluenza Virus 3	X	X	
		Parainfluenza Virus 4	X	X	

Group	Pathogen	BIOFIRE SPOTFIRE		
		Respiratory Panel [1]	Sore Throat Panel [2]	Respiratory Panel Mini
	Respiratory Syncytial Virus	X	X	X
Bacteria	*Bordetella parapertussis*	X		
	Bordetella pertussis	X		
	Chlamydia pneumoniae	X	X	
	Mycoplasma pneumoniae	X	X	
	Streptococcus dysgalactiae (Group C/G Strep)		X	
	Streptococcus pyogenes (Group A Strep)		X	

[1] The SPOTFIRE R Panel is available as a standalone assay (K213954) or as a selectable option within the SPOTFIRE R/ST Panel (K232954) based on the type of specimen to be tested.

[2] The SPOTFIRE ST Panel is available as a selectable option within the SPOTFIRE R/ST Panel (K232954) based on the type of specimen to be tested.

[3] For patient samples, the BIOFIRE SPOTFIRE R Panel (K213954) and R/ST Panel (K232954) report 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.

[4] In common with the BIOFIRE SPOTFIRE R Panel (K213954) and R/ST Panel (K232954), the BIOFIRE SPOTFIRE R Panel Mini (K230719) cannot distinguish Human Rhinovirus and Enterovirus; however, to simplify the test report, the BIOFIRE SPOTFIRE R Panel Mini refers to both analytes as Human Rhinovirus

[5] For patient samples, the BIOFIRE SPOTFIRE R Panel (K213954) and R/ST Panel (K232954) report 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 applicable BIOFIRE SPOTFIRE Panel assays (Respiratory/Sore Throat (R/ST) [K232954], Respiratory (R) [K213954] and Respiratory (R) Mini [K230719]). 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):

SPOTFIRE RSP Pos & Neg Controls, SPOTFIRE RSP Positive Control, SPOTFIRE RSP Negative Control

B Predicate 510(k) Number(s):

K230868

C Comparison with Predicate(s):

Device & Predicate Device(s):	K233611	K230868
Device Trade Name	SPOTFIRE RSP Pos & Neg Controls, SPOTFIRE RSP Positive Control and SPOTFIRE RSP Negative Control	Same
General Device Characteristic Similarities		

Intended Use/Indications For Use	SPOTFIRE RSP Positive Control is intended for use (as applicable) 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*, *Streptococcus dysgalactiae* (Group C/G Strep), *Streptococcus pyogenes* (Group A Strep), Adenovirus, Coronavirus SARS-CoV-2, Coronavirus (seasonal), 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, BIOFIRE SPOTFIRE Respiratory (R) Panel Mini, and BIOFIRE SPOTFIRE Respiratory/Sore Throat (R/ST) Panel 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, BIOFIRE SPOTFIRE R Panel Mini, and BIOFIRE SPOTFIRE R/ST Panel assays. This product is not	SPOTFIRE RSP Positive Control is intended for use (as applicable) 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 (SPOTFIRE R Panel) and BIOFIRE SPOTFIRE Respiratory (R) Panel Mini (SPOTFIRE R Panel Mini assays 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 SPOTFIRE R Panel and the SPOTFIRE R Panel Mini assays. 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,

	intended to replace manufacturer internal controls provided with these devices. Quality control materials should be used in accordance with local, state, federal regulations, and accreditation requirements.	federal regulations, and accreditation requirements.
	SPOTFIRE RSP Negative Control is intended for use (as applicable) 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*, *Streptococcus dysgalactiae* (Group C/G Strep), *Streptococcus pyogenes* (Group A Strep), Adenovirus, Coronavirus SARS-CoV-2, Coronavirus (seasonal), 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, BIOFIRE SPOTFIRE Respiratory (R) Panel Mini, and BIOFIRE SPOTFIRE Respiratory/Sore Throat (R/ST) Panel on the BIOFIRE SPOTFIRE System. SPOTFIRE RSP	SPOTFIRE RSP Negative Control is intended for use (as applicable) 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 (SPOTFIRE R Panel) and BIOFIRE SPOTFIRE Respiratory (R) Panel Mini (SPOTFIRE R Panel Mini) assays 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

	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, BIOFIRE SPOTFIRE R Panel Mini, and BIOFIRE SPOTFIRE R/ST Panel assays. This product is not intended to replace manufacturer internal controls provided with these devices. Quality control materials should be used in accordance with local, state, federal regulations, and accreditation requirements.	solely with the SPOTFIRE R Panel and SPOTFIRE R Panel Mini assays. 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, identification	Same
Number of analytes monitored	Multiple	Same
Instrument System	BIOFIRE SPOTFIRE	Same
General Device Characteristic Differences		
Applicable Assay Panels	Same *plus* BIOFIRE SPOTFIRE R/ST Panel	BIOFIRE SPOTFIRE R Panel and BIOFIRE SPOTFIRE R Panel Mini

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 different batches of finished material that were tested with multiple lots of BIOFIRE SPOTFIRE R/ST Panel reagents, over multiple days, with multiple operators and using multiple BIOFIRE SPOTFIRE Systems. Three lots of SPOTFIRE RSP Positive Controls and 4 lots of SPOTFIRE RSP Negative Controls were included in the study, as described below.

External Sites
Testing was performed at 5 sites that were representative of the Intended Use environment for the BIOFIRE SPOTFIRE R/ST Panel (i.e., sites performing near-patient testing). The SPOTFIRE RSP Positive and Negative Controls were tested according to the BIOFIRE SPOTFIRE R/ST 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 BIOFIRE SPOTFIRE R/ST Panel testing performed. A total of 37 BIOFIRE SPOTFIRE Systems was used across the 5 study sites in conjunction with 25 lots of BIOFIRE SPOTFIRE R/ST Panel pouches.

Internal Maine Molecular Site
Testing of the SPOTFIRE RSP Positive and Negative Controls internally at Maine Molecular Quality Controls (MMQC) was performed over multiple days on a single BIOFIRE SPOTFIRE System by 3 operators using 3 lots of control panels and 3 lots of BIOFIRE SPOTFIRE R/ST 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 repeated 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	SPOTFIRE RSP Controls Tested [Invalid/Failed] [1]										
	Positive					Negative					
	Lot A	Lot B	Lot C	Total	% Valid [2]	Lot A	Lot B	Lot C	Lot D	Total	% Valid [2]
1	1	0	12	**13**	**100 (13/13)**	0	0	12	1	**13**	**100 (13/13)**
2	1	0	12	**13**	**100 (13/13)**	0	5	11 [1/0]	3	**19 [1/0]**	**100 (19/19)**
3	16 [1/1] [3]	22 [2/0]	16	**54 [3/1]**	**98.1 (53/54)**	25	11	18	8 [1/0]	**62 [1/0]**	**100 (62/62)**
4	3	0	18	**21**	**100 (21/21)**	0	6	12	4 [1/0]	**22 [1/0]**	**100 (22/22)**
5	0	8 [1/0]	0	**8 [1/0]**	**100 (8/8)**	0	0	0	0	**0**	**N/A**
Subtotal	**21 [1/1]**	**30 [3/0]**	**58**	**109 [4/1]**	**99.1 (108/109)**	**25**	**22**	**53 [1/0]**	**16 [2/0]**	**116 [3/0]**	**100 (116/116)**
MMQC	**21 [2/0]**	**21**	**21 [1/0]**	**63 [3/0]**	**100 (63/63)**	**21**	**21**	**21**	**0**	**63**	**100 (63/63)**
Total	**42 [3/1]**	**51 [3/0]**	**79 [1/0]**	**172 [7/1]**	**99.4 (171/172)**	**46**	**43**	**74 [1/0]**	**16 [2/0]**	**179 [3/0]**	**100 (179/179)**
% Valid [2]	**97.6 (41/42)**	**100 (51/51)**	**100 (79/79)**	**99.4 (171/172)**		**100 (46/46)**	**100 (43/43)**	**100 (74/74)**	**100 (16/16)**	**100 (179/179)**	

N/A: Not applicable

[1] Testing of controls that produced invalid results (n = 10) was repeated

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

[3] 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/verify 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 different conditions: room temperature (18 to 25 °C), refrigerated (2-8 °C) or frozen (-25 to -15 °C). Testing of the SPOTFIRE RSP Positive and Negative Controls will be performed at intervals over at least 36 months or until product degradation is observed.

Expiration dating on the SPOTFIRE RSP Control product label will be based on the data obtained for real-time room temperature storage at 2-25 °C.

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 with each applicable BIOFIRE SPOTFIRE Panel are shown in **Table 3**. For each panel, the SPOTFIRE Panel 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	Analyte	Expected SPOTFIRE RSP Control Result					
		SPOTFIRE R/ST Panel		SPOTFIRE R Panel		SPOTFIRE R Panel Mini	
		Positive	Negative	Positive	Negative	Positive	Negative
Bacteria	*Bordetella parapertussis*	Positive	Negative				
	Bordetella pertussis	Positive	Negative				
	Chlamydia pneumoniae	Positive	Negative	Positive	Negative		
	Mycoplasma pneumoniae	Positive	Negative	Positive	Negative		
	Streptococcus dysgalactiae	Positive	Negative	Positive	Negative		
	Streptococcus pyogenes	Positive	Negative	Positive	Negative		
Viruses	Adenovirus	Positive	Negative	Positive	Negative		
	Coronavirus SARS-CoV-2	Positive	Negative	Positive	Negative	Positive	Negative
	Coronavirus (seasonal)	Positive	Negative	Positive	Negative		
	Human Metapneumovirus	Positive	Negative	Positive	Negative		
	Human Rhinovirus/Enterovirus	Positive	Negative	Positive	Negative	Positive [1]	Negative [1]
	Influenza A Virus	Positive	Negative	Positive	Negative	Positive	Negative
	Influenza A Virus A/H1-2009	Positive	Negative	Positive	Negative		
	Influenza A Virus A/H3	Positive	Negative	Positive	Negative		
	Influenza B Virus	Positive	Negative	Positive	Negative	Positive	Negative
	Parainfluenza Virus	Positive	Negative	Positive	Negative		
	Respiratory Syncytial Virus	Positive	Negative	Positive	Negative	Positive	Negative

[1] In common with the BIOFIRE SPOTFIRE R/ST Panel and R Panel, the BIOFIRE SPOTFIRE R Panel Mini cannot distinguish Human Rhinovirus and Enterovirus; however, to simplify the test report, the BIOFIRE SPOTFIRE R Panel Mini refers to both analytes as Human Rhinovirus.

VIII Proposed Labeling:

The labeling supports or 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.