510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY

A. 510(k) Number:
K143080

B. Purpose for Submission:
To obtain a Substantial Equivalence Determination for a new 510(k) application for the FilmArray Respiratory Panel (RP) for use with the FilmArray 2.0 and FilmArray Injection Vials.

C. Measurand:
Influenza A, Influenza A subtype H1, Influenza A subtype H3, Influenza A subtype 2009 H1, Influenza B, Respiratory Syncytial Virus, Human Metapneumovirus, Adenovirus, Parainfluenza virus 1, Parainfluenza virus 2, Parainfluenza virus 3, Parainfluenza virus 4, Human Rhinovirus/Enterovirus, Coronavirus HKU1, Coronavirus NL63, Coronavirus 229E, Coronavirus OC43, *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, and *Bordetella pertussis* DNA or RNA from nasopharyngeal swabs.

D. Type of Test:

The FilmArray RP uses a nested multiplex reverse transcription polymerase chain reaction (RT-PCR) followed by high resolution melting analysis to confirm the identity of the amplified product.

E. Applicant:

BioFire Diagnostics, LLC

F. Proprietary and Established Names:

Established name:
FilmArray® Respiratory Panel (RP)
Common Name(s):
FilmArray® Respiratory Panel (RP)
FilmArray® Respiratory Panel (RP) System
FilmArray® Respiratory Panel (FilmArray RP)
FilmArray RP Panel

G. Regulatory Information:

1. Regulation section:

   21 CFR 866.3980 Respiratory Viral Panel Multiplex Nucleic Acid Assay

2. Classification:

   Class II

3. Product code:

   OCC, OEM, OOU, OEP, OTG, OQW, OOI, OZZ, OZY, OZX

4. Panel:

   Microbiology (83)

H. Intended Use:

1. Intended use(s):

   The FilmArray Respiratory Panel (RP) is a multiplexed nucleic acid test intended for use with FilmArray Systems for the simultaneous qualitative detection and identification of multiple respiratory viral and bacterial nucleic acids in nasopharyngeal swabs (NPS) obtained from individuals suspected of respiratory tract infections. The following organism types and subtypes are identified using the FilmArray RP: Adenovirus, Coronavirus 229E, Coronavirus HKU1, Coronavirus NL63, Coronavirus OC43, Human Metapneumovirus, Influenza A, Influenza A subtype H1, Influenza A subtype H3, Influenza A subtype 2009 H1, Influenza B, Parainfluenza Virus 1, Parainfluenza Virus 2, Parainfluenza Virus 3, Parainfluenza Virus 4, Human Rhinovirus/Enterovirus, Respiratory Syncytial Virus, *Bordetella pertussis*, *Chlamydophila pneumoniae*, and *Mycoplasma pneumoniae*. The detection and identification of specific viral and bacterial nucleic acids from individuals exhibiting signs and symptoms of respiratory infection aids in the diagnosis of respiratory infection if used in conjunction with other clinical and epidemiological information. The results of this test should not be used as the sole basis for diagnosis, treatment, or other management decisions. Negative results in the setting of a respiratory illness may be due to infection with pathogens that are not detected by this test or, lower respiratory tract infection that is not detected by a nasopharyngeal swab specimen. Positive results do not rule out co-infection with other organisms: the agent(s) detected by the Film Array RP may not be the definite cause of disease. Additional laboratory testing (e.g. bacterial and viral culture, immunofluorescence, and radiography) may be necessary when evaluating a patient with possible respiratory tract infection.

   Due to the small number of positive specimens collected for certain organisms during the prospective clinical study, performance characteristics for *Bordetella pertussis*, Coronavirus 229E, Coronavirus OC43, Influenza A H1, Influenza A H3, Influenza A H1-2009, Influenza B, *Mycoplasma pneumoniae*, Parainfluenza Virus 1, Parainfluenza Virus 2, and Parainfluenza Virus 4 were established primarily with retrospective clinical specimens. Performance characteristics for *Chlamydophila pneumoniae* were established primarily using contrived clinical specimens.

   Due to the genetic similarity between Human Rhinovirus and Enterovirus, the FilmArray RP cannot reliably differentiate them. A positive FilmArray RP Rhinovirus/Enterovirus result should be followed-up using an alternate method (e.g., cell culture or sequence

analysis).

The FilmArray RP assay for Coronavirus OC43 may cross-react with some isolates of Coronavirus HKU1. A dual positive result may be due to cross-reactivity or may indicate a co- infection.

Performance characteristics for Influenza A were established when Influenza A 2009 H1N1, A H1, and A H3 were the predominant Influenza A viruses in circulation. Performance of detecting Influenza A may vary if other Influenza A strains are circulating or a novel Influenza A virus emerges. If infection with a novel Influenza A virus is suspected based on current clinical and epidemiological screening criteria recommended by public health authorities, specimens should be collected with appropriate infection control precautions for novel virulent Influenza viruses and sent to state or local health departments for testing. Viral culture should not be attempted in these cases unless a BSL 3+ facility is available to receive and culture specimens.

2. Indication(s) for use:

   Same as Intended Use.

3. Special conditions for use statement(s):

   This device is for prescription use only.

4. Special instrument requirements:

   FilmArray Instrument or FilmArray 2.0

I. Device Description:

The FilmArray Respiratory Panel is a multiplex nucleic acid test designed to be used with FilmArray system. The FilmArray RP pouch contains freeze-dried reagents to perform nucleic acid purification, reverse transcription, and nested, multiplex PCR with DNA melt analysis. FilmArray RP simultaneously conducts 20 tests for the identification of respiratory pathogens from nasopharyngeal swabs (NPS) obtained from individuals suspected of respiratory tract infections (Table 1). Results from the FilmArray RP test are available within about one hour.

Table 1. Bacteria and Viruses Detected by the FilmArray Respiratory Panel

Viral Respiratory Pathogens
Adenovirus
Coronavirus 229E
Coronavirus HKU1
Coronavirus NL63
Coronavirus OC43
Human Metapneumovirus
Human Rhinovirus/Enterovirus
Influenza A
H1 subtype
H3 subtype
H1-2009 subtype
Influenza B
Parainfluenza Virus 1
Parainfluenza Virus 2
Parainfluenza Virus 3
Parainfluenza Virus 4
Respiratory Syncytial Virus
Bacterial Respiratory Pathogens
Bordetella pertussis
Chlamydophila pneumoniae
Mycoplasma pneumoniae

A test is initiated by loading Hydration Solution and an unprocessed patient nasopharyngeal swab (NPS) specimen (i.e. specimen mixed with Sample Buffer) into the FilmArray RP pouch. The pouch contains all reagents required for specimen testing and analysis in a freeze- dried format; the addition of Hydration Solution and specimen/Sample Buffer Mix rehydrates the reagents. After the pouch is prepared, the FilmArray 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 and chemical lysis followed by purification using 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 reverse transcription PCR (rt-PCR) reaction 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.

J. Substantial Equivalence Information:

1. Predicate device name(s):
   FilmArray Respiratory Panel

2. Predicate 510(k) number(s):
   K123620

3. Comparison with predicate:

Element	Predicate: FilmArray Respiratory Panel (K123620)	New Device: FilmArray Respiratory Panel for use with FilmArray System 2.0 and FilmArray Injection Vials
Organisms Detected	Influenza A, Influenza A subtype H1, Influenza A subtype H3, Influenza A subtype 2009 H1, Influenza B, Respiratory Syncytial Virus, Human Metapneumovirus, Adenovirus, Parainfluenza 1, Parainfluenza 2, Parainfluenza virus 3, Parainfluenza 4, Human Rhinovirus/Enterovirus, Coronavirus HKU1, Coronavirus NL63, Coronavirus 229E, Coronavirus OC43, *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, and *Bordetella pertussis*.	Same
Analyte	RNA/DNA	Same
Specimen Types	Nasopharyngeal swabs (NPS)	Same
Technological Principles	Nested multiplex RT-PCR followed by high resolution melting analysis to confirm identity of amplified product.	Same
Instrumentation	FilmArray	FilmArray or FilmArray System 2.0
Time to result	About 1 hour	Same
Test Interpretation	Automated test interpretation and report generation. User cannot access raw data.	Same

Element	Predicate: FilmArray Respiratory Panel (K123620)	New Device: FilmArray Respiratory Panel for use with FilmArray System 2.0 and FilmArray Injection Vials
Reagent Hydration and Sample Loading	Syringe-based loading procedure	Syringe-based loading procedure or FilmArray Injection Vial-based loading procedure
Sample Preparation Method	Sample Processing is automated in the FilmArray RP pouch.	Same
Reagent Storage	Reagents are stored at room temperature.	Same
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

K. Standard/Guidance Document Referenced (if applicable):

1. User Protocol for Evaluation of Qualitative Test Performance, Clinical and Laboratory Standards Institute Approved Guideline, EP12-A (August 2002)
2. Molecular Diagnostic Methods for Infectious Diseases, Clinical and Laboratory Standards Institute Approved Guideline, MM3-A (December 1995)
3. Interference Testing in Clinical Chemistry, Clinical and Laboratory Standards Institute Approved Guideline EP7-A (December 2002)
4. Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices, FDA Guidance Document (May 11, 2005)
5. Establishing Performance Characteristics of In Vitro Diagnostic Devices for Detection or Detection and Differentiation of Influenza Viruses (February 15, 2008)
6. Guidance for Industry and FDA Staff - Class II Special Controls Guidance Document: Testing for Detection and Differentiation of Influenza A Virus Subtypes Using Multiplex Assays (October 9, 2009)
7. Guidance for Industry and FDA Staff - Class II Special Controls Guidance Document: Respiratory Viral Panel Multiplex Nucleic Acid Assay (October 9, 2009)
8. Guidance for Industry and FDA Staff - Class II Special Controls Guidance Document: Testing for Human Metapneumovirus (hMPV) Using Nucleic Acid Assays (October 9, 2009)
9. Guidance for Industry and FDA Staff - Class II Special Controls Guidance Document: Instrumentation for Clinical Multiplex Test Systems (March 10, 2005)
10. Guidance for Industry, FDA Reviewers and Compliance on Off-The-Shelf Software Use in Medical Devices (September 9, 1999)
11. Nucleic Acid Based in Vitro Diagnostic Devices for Detection of Microbial Pathogens, FDA Guidance Document (DRAFT: December 8, 2005)
12. User Protocol for Evaluation of Qualitative Test Performance, National Committee on Clinical Laboratory Standards (NCCLS) Approved Guideline, EP12-A (August 2002)
13. Guidance for Industry and FDA Staff – Use of Symbols on Labels and in Labeling of In Vitro Diagnostic Devices Intended for Professional Use (November 30, 2004)

L. Test Principle:

The FilmArray RP System is multiplex nucleic acid test system composed of the FilmArray instrument, the FilmArray software (preinstalled on a laptop computer) and the FilmArray RP pouch. The FilmArray RP pouch contains freeze-dried reagents to perform nucleic acid purification, reverse transcription, and nested, multiplex PCR with DNA melt analysis. A FilmArray test is initiated by loading water and a patient NPS sample mixed with the provided Sample Buffer into the FilmArray RP pouch and placing it in the FilmArray instrument. This process is simplified by the use of a specifically designed pouch loading station. After the pouch is prepared, the FilmArray software guides the user though the steps of placing the pouch in the instrument, scanning the pouch barcode, entering the sample identification, and initiating the run. Please refer to previously cleared submissions k103175, k110764, k120267 and k123620 for additional information.

M. Performance Characteristics (if/when applicable):

The scope of this 510(k) submission is limited to presenting supporting data to obtain FDA clearance for use of the RP Panel with the BioFire Multi-instrument FilmArray 2.0 system (i.e. modified system) using two different methods to place sample into the pouch; the syringe method, which is the method used in the predicate (K123620) and the injection vial, which is an improved more simplified way of introducing sample to the pouch. Currently the other FilmArray assays use the injection vial.

1. Analytical performance:

   a. Precision/Reproducibility:

   The goal of this study was to demonstrate that the performance of the FilmArray Respiratory Panel (RP) was highly reproducible when evaluated on the modified system in conjunction with both the current (syringe) and modified (injection vial) pouch loading procedures. Testing was performed at three sites by multiple operators using three different pouch lots over the course of five days, 3sites x 2 operators x 3 lots x 5 days =90 replicates per condition.

   Reproducibility of the FilmArray RP was evaluated for a subset of four RP analytes representative of the types of organism(s) detected by the panel; bacteria (*Bordatella pertussis*) and both DNA (Adenovirus C1) and RNA (Influenza A H1N1 2009, RSV A) viruses. Each analyte was evaluated in a viral transport medium (VTM) sample matrix at different concentrations; Moderate Positive (3xLoD), Low Positive (1xLoD), and Negative. For each pouch loading procedure, a total of 90 replicates per concentration were tested and the observed tests were compared to the expected results to calculate percent agreement with the expected results and the corresponding 95% confidence interval. The study design was similar to the original RP reproducibility evaluation performed in k123620.

   The following table shows the summary of results for the reproducibility study. The results show that the assay had appropriate reproducibility at both the external clinical sites (sites A and B) and the in-house laboratory (site C). The reproducibility of the predicate system from submission k103175 is listed in the last column of the table as

reference to the original reproducibility. The reproducibility for this device is acceptable. The instances where the expected result differed from the actual result are within what is reasonable for C_5 and C_{95} samples.

Organism Tested	Concentration Tested	Expected Result	% Agreement with Expected Result[a]								
			Multi-instrument + Syringe				Multi-instrument + Injection Vial				Single-instrument + Syringe (Study 279)
			Site/ System A	Site/ System B	Site/ System C	All Sites/Systems (95% Confidence Interval)	Site/ System A	Site/ System B	Site/ System C	All Sites/Systems (95% Confidence Interval)	All Sites (95% Confidence Interval)
***Bordetella pertussis* Strain A639** Zeptometrix 0801459	**Moderate Positive** 3× LoD $1.2x10^4$ CFU/mL	Detected	29/29[b] 100%	30/30 100%	30/30 100%	89/89[b] 100% (95.9-100%)	30/30 100%	**29/30 96.7%**	30/30 100%	**89/90 98.9% (94.0-100%)**	60/60 100% (94.0-100%)
	Low Positive 1× LoD $4x10^3$ CFU/mL	Detected	**29/30 96.7%**	30/30 100%	**27/30 90.0%**	**86/90 95.6% (89.0-98.8%)**	30/30 100%	30/30 100%	30/30 100%	90/90 100% (96.0-100%)	60/60 100% (94.0-100%)
	Negative	Not Detected	30/30 100%	30/30 100%	30/30 100%	90/90 100% (96.0-100%)	30/30 100%	30/30 100%	30/30 100%	90/90 100% (96.0-100%)	540/540 100% (99.3-100%)
Adenovirus Species C Serotype 1 Zeptometrix 0810050CF	**Moderate Positive** 3× LoD $3.0x10^2$ $TCID_{50}$/mL	Detected	30/30 100%	30/30 100%	**28/30 93.3%**	**88/90 97.8% (92.2%-99.7%)**	**29/30 96.7%**	30/30 100%	30/30 100%	**89/90 98.9% (94.0-100%)**	60/60 100% (94.0-100%)
	Low Positive 1× LoD $1.0x10^2$ $TCID_{50}$/mL	Detected	**28/29[b] 96.6%**	30/30 100%	**28/30 93.3%**	**86/89[b] 96.6% (90.5%-99.3%)**	30/30 100%	30/30 100%	**29/30 96.7%**	**89/90 98.9% (94.0-100%)**	60/60 100% (94.0-100%)
	Negative	Not Detected	30/30 100%	30/30 100%	30/30 100%	90/90 100% (96.0-100%)	30/30 100%	30/30 100%	30/30 100%	90/90 100% (96.0-100%)	540/540 100% (99.3-100%)
Influenza A H1N1-2009 A/SwineNY/03/2009 Zeptometrix 0810109CFN	**Moderate Positive** 3× LoD $3.0x10^2$ $TCID_{50}$/mL	Detected	29/29[b] 100%	30/30 100%	30/30 100%	89/89[b] 100% (95.9-100%)	30/30 100%	30/30 100%	30/30 100%	90/90 100% (96.0-100%)	60/60 100% (94.0-100%)
	Low Positive 1× LoD $1.0x10^2$ $TCID_{50}$/mL	Detected	30/30 100%	30/30 100%	30/30 100%	90/90 100% (96.0-100%)	30/30 100%	30/30 100%	30/30 100%	90/90 100% (96.0-100%)	60/60 100% (94.0-100%)
	Negative	Not Detected	30/30 100%	30/30 100%	30/30 100%	90/90 100% (96.0-	30/30 100%	30/30 100%	30/30 100%	90/90 100% (96.0-	540/540 100% (99.3-

Organism Tested	Concentration Tested	Expected Result	% Agreement with Expected Result[a]								
			Multi-instrument + Syringe				Multi-instrument + Injection Vial				Single-instrument + Syringe (Study 279)
			Site/ System A	Site/ System B	Site/ System C	All Sites/Systems (95% Confidence Interval)	Site/ System A	Site/ System B	Site/ System C	All Sites/Systems (95% Confidence Interval)	All Sites (95% Confidence Interval)
						100%)				100%)	100%)
Respiratory Syncytial Virus Type A Zeptometrix 0810040ACF	**Moderate Positive** 3× LoD 6.0 $TCID_{50}$/mL	Detected	30/30 100%	30/30 100 %	30/30 100%	90/90% 100% (96.0-100%)	30/30 100%	30/30 100 %	30/30 100 %	90/90 100% (96.0-100%)	180/180 100% (98.0-100%)
	Low Positive 1× LoD 2.0 $TCID_{50}$/mL	Detected	29/29[b] 100%	30/30 100 %	30/30 100%	89/89[b] 100% (95.9-100%)	30/30 100%	30/30 100 %	30/30 100 %	90/90 100% (96.0-100%)	120/120 100% (97.0-100%)
	Negative	Not Detected	30/30 100%	30/30 100 %	30/30 100%	90/90 100% (96.0-100%)	30/30 100%	30/30 100 %	30/30 100 %	90/90 100% (96.0-100%)	360/360 100% (99.0-100%)

b. Linearity/assay reportable range:

Not applicable.

c. Traceability, Stability, Expected values (controls, calibrators, or methods):

There are no changes to the traceability, stability or controls for the modified assay. Please refer to previously FDA-cleared 510(k) Premarket Notifications, k103175, k110764, k120267 and k123620.

d. Detection limit:

Performance of the current FilmArray system and the modified system with both poach loading procedures was evaluated at high and low analyte levels. All three systems were tested at 10xLoD, 1xLoD, 0.1xLoD and 0.01xLoD based on LoD data from the predicate device. The samples were generated by titration of the stock source and the titers tested are listed below.

Organism	Isolate/ID	Concentration Tested				Units
		10x	1x	0.1x	0.01x	
Mix 1						
Coronavirus 229E	ATCC VR-740	40	4	0.4	0.04	$TCID_{50}$/mL
Adenovirus C1	Zeptometrix #0810050CF	1.0×10^3	100	10	1	$TCID_{50}$/mL
Influenza A H1N1	A/Brisbane/59/07	2.0×10^3	200	20	2	$TCID_{50}$/mL
Parainfluenza Virus 1	Zeptometrix #0810014CF	5.0×10^3	500	50	5	$TCID_{50}$/mL
Respiratory Syncytial Virus (RSV-A)	Zeptometrix #0810040ACF	20	2	0.2	0.02	$TCID_{50}$/mL
Mix 2						
Coronavirus HKU1[a]	Clinical Specimen Arg 42/08	1.9×10^7	1.9×10^6	1.9×10^5	1.9×10^4	RNA copies/mL
Human Rhinovirus	Zeptometrix #0810012CFN	10	1	0.1	0.01	$TCID_{50}$/mL
Influenza A H1N1-2009	A/SwineNY/03/2009	1.0×10^3	100	10	1	$TCID_{50}$/mL
Parainfluenza Virus 2	Zeptometrix #0810015CF	100	10	1	0.1	$TCID_{50}$/mL
Mycoplasma pneumoniae	Zeptometrix #0801579	300	30	3	0.3	$TCID_{50}$/mL
Mix 3						
Coronavirus NL63	NR-470	50	5	0.5	0.05	$TCID_{50}$/mL
Enterovirus (Echovirus 6)	Echovirus 6	3.0×10^5	3.0×10^4	3.0×10^3	300	$TCID_{50}$/mL
Influenza A H3N2	A/Wisconsin/67/2005	50	5	0.5	0.05	$TCID_{50}$/mL
Parainfluenza Virus 3	Zeptomerix #0810016CF	100	10	1	0.1	$TCID_{50}$/mL
Bordetella pertussis	A639	4.0×10^4	4.0×10^3	400	40	CFU/mL
Mix 4						
Coronavirus OC43[b]	ATCC VR-759	6.0×10^3	600	60	6	$TCID_{50}$/mL
Human Metapneumovirus	IA10-2003 (Type A1)	20	2	0.2	0.02	$TCID_{50}$/mL
Influenza B	B/Florida/04/06	600	60	6	0.6	$TCID_{50}$/mL
Parainfluenza Virus 4	Zeptometrix #0810060CF	5.0×10^4	5.0×10^3	500	50	$TCID_{50}$/mL
Chlamydophila pneumoniae	TW183	3.0×10^4	3.0×10^3	300	30	DNA copies/mL

Once initial testing confirmed that the detection of all analytes was equivalent between the configurations at each concentration additional side-by-side testing was performed with 20 replicates at 1xLoD shown below (and 10 replicates at 0.1xLoD, not shown). Testing confirmed the LoD for all systems and loading procedures were the same as the previously determined LoD titer.

Respiratory Panel Analyte	Current System (Syringe) # Detected % Positive [95% Confidence Interval]	Modified System (Syringe) # Detected % Positive [95% Confidence Interval]	Modified System (Injection Vial) # Detected % Positive [95% Confidence Interval]
Adenovirus	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Bordetella pertussis	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Chlamydophila pneumoniae	19/20 **95%** [75.1-99.9%]	17/20 **85%**[a] [62.1-96.8%]	20/20 **100%** [83.2-100%]

Coronavirus 229E	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Coronavirus HKU1[b]	5/5 **100%** [47.8-100%]	5/5 **100%** [47.8-100%]	5/5 **100%** [47.8-100%]
Coronavirus NL63	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Coronavirus OC43	19/20 **95%** [75.1-99.9%]	18/20 **90%**[a] [68.3-98.8%]	20/20 **100%** [83.2-100%]
Human Metapneumovirus	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Human Rhinovirus	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Enterovirus	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Inlfuenza A H1	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Influenza A H1-2009	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Influenza A H3	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Influenza B	18/20 **90%**[a] [68.3-98.8%]	18/20 **90%**[a] [68.3-98.8%]	20/20 **100%** [83.2-100%]
Mycoplasma pneumoniae	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Parainfluenza Virus 1	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Parainfluenza Virus 2	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]
Parainfluenza Virus 3	20/20 **100%** [83.2-100%]	19/20 **95%** [75.1-99.9%]	20/20 **100%** [83.2-100%]
Parainfluenza Virus 4	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	19/20 **95%** [75.1-99.9%]
Respiratory Syncytial Virus	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]	20/20 **100%** [83.2-100%]

e. Analytical specificity:

There are no changes to the analytical specificity for the modified assay. Please refer to previously FDA-cleared 510(k) Premarket Notifications, k103175, k110764, k120267 and k123620.

f. Analytical Reactivity:

There are no changes to the analytical reactivity for the modified assay. Please refer to previously FDA-cleared 510(k) Premarket Notifications, k103175, k110764, k120267 and k123620.

g. Competitive Interference:

There are no changes to the competitive interference for the modified assay. Please refer to previously FDA-cleared 510(k) Premarket Notifications, k103175, k110764, k120267 and k123620.

h. Assay cut-off:

There are no changes to the assay cut-off for the modified assay. Please refer to previously FDA-cleared 510(k) Premarket Notifications, k103175, k110764, k120267 and k123620.

2. Comparison studies:

a. Method comparison with predicate device:

The specimens used for this study were previously obtained during the original FilmArray RP prospective clinical evaluations. These specimens were supplemented with archived specimens collected from external medical facilities and reference laboratories to increase the number of positives for low prevalence analytes being tested. A total of 100 specimens were selected that represented 3-5 positives for each analyte targeted by the FilmArray RP. Specimens with more than one positive analyte result were not excluded and there was no effort to choose higher analyte level specimens. During the course of testing, it was discovered that some specimens had either been mislabeled by the source laboratory and found to contain analytes other than what had been indicated or the analyte of interest was not present. When the analyte of interest was not present in all three testing systems the specimen was excluded from analysis. In order to ensure that at least three positive detections were observed for each analyte, two additional *B. pertussis* specimens were added to sample set at the end of testing. FilmArray operators were unaware of the analyte content of these two extra specimens at the time of testing. Therefore, the total number of specimens tested in the study was 102.The following is a summary of the specimens selected for this study.

Analyte	#
Adenovirus	5
Coronavirus 229E	5
Coronavirus HKU1	5
Coronavirus NL63	5
Coronavirus OC43	5
Human Metapneumovirus	5
Human Rhinovirus / Enterovirus	5
Influenza A	16
Influenza A/H1N1	4
Influenza A/H1N1 2009	6
Influenza A/H3	6
Influenza B	6
Parainfluenza Virus 1	6
Parainfluenza Virus 2	6
Parainfluenza Virus 3	6
Parainfluenza Virus 4	5
Respiratory Syncytial Virus	6
Bordetella pertussis	7
Chlamydophila pneumoniae	3
Mycoplasma pneumoniae	6
Total	**102**

Three specimens were misidentified/mislabeled by the source laboratory. The data on these specimens is in the table below. This did not impact the performance data.

SCN	Laboratory Identification	Original ID Method	Coronavirus HKU1			Coronavirus NL63		
			CS+S	MS+S	MS+F	CS+S	MS+S	MS+F
014111-RP-0014	Coronavirus NL63	FilmArray RP	D	D	D	ND	ND	ND
014111-RP-0080	Influenza B	FilmArray RP	D	D	D	ND	ND	ND
014111-RP-0078	Parainfluenza 4	FilmArray RP	D	D	D	ND	ND	ND

All specimens were assigned a new study code number (SCN) in order to randomize and blind the known analyte content to the operators. This allowed for specimens which are positive for one (or multiple) panel member analyte(s) to be followed by samples which were anticipated to be negative for the same panel member analyte(s). In this way, the carryover potential of the new design was further evaluated. Specimens were thawed for testing and then split into three different aliquots for testing with the current system with syringes (CS + S), the modified system with syringes (MS + S), and the modified system with FAIVs (MS + F).

Test results were then analyzed to compare system performance ($\frac{MS+S}{CS+S}$; where the system is the only variable compared), loading tools performance ($\frac{MS+F}{MS+S}$; where loading tools are the only variable compared), and multifactor performance ($\frac{MS+F}{CS+S}$; where both system and loading tool variables are compared).

For the current system, a total of 108 FilmArray runs were attempted, 104 of which were completed (96.3%; 104/108). There were two run failures each for software (1.9%) and instrument (1.9%) errors. No control failures were observed. Two specimens were retested due to Influenza A 'equivocal' results. For the Modified System (paired with syringe and FAIV loading) a total of 205 FilmArray runs were attempted, all of which were completed (100%; 205/205). There were no control failures. One specimen tested with the FAIV loading tools was retested due to an Influenza A 'equivocal' result. All specimens were of sufficient volume that retesting was possible in order to obtain valid runs for all testing configurations.

Analyte	MS+S vs CS+S (System Comparison)				MS+F vs MS+S (Loading Tools Comparison)				MS+F vs CS+S (Multifactor Comparison)			
	PPA	%	NPA	%	PPA	%	NPA	%	PPA	%	NPA	%
Adenovirus	5/5	100%	97/97	100%	5/5	100%	97/97	100%	5/5	100%	97/97	100%
Coronavirus 229E	5/5	100%	97/97	100%	5/5	100%	97/97	100%	5/5	100%	97/97	100%
Coronavirus HKU1	6/6	100%	95/96[a]	99%	7/7	100%	95/95	100%	6/6	100%	95/96[a]	99%
Coronavirus NL63	6/6	100%	96/96	100%	6/6	100%	96/96	100%	6/6	100%	96/96	100%
Coronavirus OC43	4/5[b]	80%	97/97	100%	4/4	100%	98/98	100%	4/5[b]	80%	97/97	100%
Human Metapneumo-virus	5/5	100%	97/97	100%	5/5	100%	97/97	100%	5/5	100%	97/97	100%
Human Rhinovirus/ Enterovirus	8/10[c]	80%	92/92	100%	8/8	100%	92/94[c]	97.9%	9/10[c]	90%	91/92[c]	98.9%
Influenza A	16/16	100%	86/86	100%	16/16	100%	86/86	100%	16/16	100%	86/86	100%
Influenza A H1	3/3	100%	99/99	100%	3/3	100%	99/99	100%	3/3	100%	99/99	100%
Influenza A H1-2009	6/6	100%	96/96	100%	6/6	100%	96/96	100%	6/6	100%	96/96	100%
Influenza A H3	7/7	100%	95/95	100%	7/7	100%	95/95	100%	7/7	100%	95/95	100%
Influenza B	5/5	100%	97/97	100%	5/5	100%	97/97	100%	5/5	100%	97/97	100%
Parainfluenza Virus 1	7/7	100%	95/95	100%	7/7	100%	95/95	100%	7/7	100%	95/95	100%
Parainfluenza Virus 2	6/6	100%	96/96	100%	6/6	100%	95/96[d]	99%	6/6	100%	95/96[d]	99%
Parainfluenza Virus 3	6/6	100%	96/96	100%	6/6	100%	96/96	100%	6/6	100%	96/96	100%

Parainfluenza Virus 4	6/6	100%	96/96	100%	5/6[e]	83.3%	96/96	100%	5/6[e]	83.3%	96/96	100%
Respiratory Syncytial Virus	8/8	100%	94/94	100%	8/8	100%	94/94	100%	8/8	100%	94/94	100%
Bordetella pertussis	4/4	100%	98/98	100%	4/4	100%	97/98[f]	99%	4/4	100%	97/98[f]	99%
Chlamydophila pneumoniae	3/3	100%	99/99	100%	3/3	100%	99/99	100%	3/3	100%	99/99	100%
Mycoplasma pneumoniae	5/6[g]	83.3%	96/96	100%	5/5	100%	97/97	100%	5/6[g]	83.3%	96/96	100%
Overall Agreement	**121/125**	**96.8%**	**1914/1915**	**99.9%**	**121/122**	**99.2%**	**1914/1918**	**99.8%**	**121/125**	**96.8%**	**1911/1915**	**99.8%**
95% CI	**92.0-99.1%**		**99.7-100%**		**95.5-100%**		**99.5-99.9%**		**92.0-99.1%**		**99.5-99.9%**	

[a] Specimen 014111-RP-0037 Coronavirus HKU1was detected in two systems MS+S and MS+F in a laboratory identified Coronavirus NL63 specimen
[b] Specimen 014111-RP-0045 Coronavirus OC43 was detected in one system, CD+S in a laboratory identified Coronavirus HKU1 specimen
[c] Three specimens (014111-RP-0012, 014111-RP-0100, and 014111-RP-0101) demonstrated detection of HRV/EV; 014111-RP-0012 in one system MS+S in laboratory identified Influenza A H1N1 2009 specimen, 014111-RP-0100 in two systems, CS+S and MS+F, in laboratory identified Adenovirus specimen and 014111-RP-0101 in one system CS+S in a laboratory identified *B. pertussis* specimen.
[d] Specimen 014111-RP-0091 PIV2 was detected in one system MS+F in a laboratory identified Coronavirus 229E specimen
[e] Specimen 014111-RP-0101 PIV4 was detected in two systems CS+S and MS+S in a laboratory identified *B.pertussis* specimen
[f] Specimen 014111-RP-0097 *Bordatella pertussis* was not detected in two systems, CS+S and MS+S
[g] Specimen 014111-RP-0073 *M. pneumoniae* was not detected in two systems MS+S and MS+F

This data demonstrates that the new FilmArrays System 2.0 with either the injection vial or syringe as a loading system has the same performance as the predicate device.

b. Matrix comparison:

Matrix comparison studies were not performed because there were no changes to the matricies used in the submission studies. Please refer to previously FDA-cleared 510(k) Premarket Notifications, k103175, k110764, k120267 and k123620.

3. Clinical studies:

Clinical performance characteristics of FilmArray RP were established earlier; please refer to the decision summaries of previously cleared submissions k103175, k110764, k120267 and k123620 for detailed information.

4. Clinical cut-off**:**

Not applicable.

5. Expected values/Reference range:

Not applicable

N. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

O. Conclusion:

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