510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY

I Background Information:

A 510(k) Number

K260577

B Applicant

Maine Molecular Quality Controls, Inc.

C Proprietary and Established Names

FilmArray TF Control Panel M527

D Regulatory Information

Product Code(s)	Classification	Regulation Section	Panel
PMN	Class II	866.3920	MI

II Submission/Device Overview:

A Purpose for Submission:

To obtain a substantial equivalence determination for the FilmArray TF Control Panel M527.

B Measurand:

Multi-analyte external quality control materials for microbiology NAAT assays

C Type of Test:

The FilmArray TF Control Panel M527, is a quality control panel consisting of two single-use, ready-to-use, liquid controls, FilmArray TF Positive and FilmArray TF Negative. Each kit of FilmArray TF Control Panel M527 is comprised of six tubes of FilmArray TF Positive and six tubes of FilmArray TF Negative. FilmArray TF Positive contains synthetic DNA and RNA corresponding to genome segments of all the pathogens detected by the BIOFIRE FILMARRAY

Tropical Fever (TF) Panel suspended in a non-infectious solution of buffers, preservatives and stabilizers. FilmArray TF Negative contains buffer and preservatives with no nucleic acids.

III Intended Use/Indications for Use:

A Intended Use(s):

See Indications for Use below.

B Indication(s) for Use:

The FilmArray TF Control Panel M527 is intended for use as an external positive and negative assayed quality control to monitor the performance of the BIOFIRE FILMARRAY Tropical Fever (TF) Panel assay on the BIOFIRE FILMARRAY Systems. The BIOFIRE FILMARRAY TF Panel assay qualitatively detects the following target pathogens: chikungunya virus, dengue virus (serotypes 1, 2, 3, and 4), *Leptospira* spp., and *Plasmodium* spp. (including species differentiation of *Plasmodium falciparum* and *Plasmodium vivax*/*ovale*). The FilmArray TF Positive control is composed of synthetic DNA and RNA in stabilizing solutions, buffers, and preservatives. The FilmArray TF Negative control contains buffers and preservatives. The FilmArray TF Control Panel M527 is designed for and intended to be used solely with the BIOFIRE FILMARRAY TF Panel. This product is not intended to replace manufacturer internal controls provided with this device.

C Special Conditions for Use Statement(s):

Rx – For Prescription Use Only

D Special Instrument Requirements:

BIOFIRE FILMARRAY 2.0 and BIOFIRE FILMARRAY TORCH systems

IV Device/System Characteristics:

A Device Description:

The FilmArray TF Control Panel M527 is a quality control panel consisting of two single-use, ready-to-use, liquid controls: FilmArray TF Positive and FilmArray TF Negative. The FilmArray TF Control Panel M527 is intended for use as external positive and negative quality controls to monitor the detection and identification of all the pathogens detected by BIOFIRE FILMARRAY Tropical Fever (TF) Panel (Table 1). Each kit of FilmArray TF Control Panel M527 is comprised of six tubes of FilmArray TF Positive and six tubes of FilmArray TF Negative. FilmArray TF Positive controls contain synthetic DNA and RNA corresponding to genome segments of all the pathogens detected by the BIOFIRE FILMARRAY TF Panel, suspended in a non-infectious solution of buffers, preservatives and stabilizers. The synthetic DNA and RNA contained in FilmArray TF Positive is specifically designed for and intended to be used solely with the BIOFIRE FILMARRAY TF Panel on the BIOFIRE FILMARRAY 2.0 and BIOFIRE FILMARRAY TORCH systems. FilmArray TF Positive contains DNA and RNA corresponding to two viral targets, one parasite, and one bacterial target detected by the BIOFIRE FILMARRAY TF Panel listed in Table 1 below. FilmArray TF Negative serves as a

true negative control containing buffer and preservatives with no DNA and RNA and listed in Table 1 below.

Table 1. Analytes Detected by the BIOFIRE FILMARRAY TF Panel

Viruses
Chikungunya Virus
Dengue Virus
Parasites
Plasmodium spp.
Plasmodium falciparum
Plasmodium vivax/ovale
Bacteria
Leptospira spp.

Assay results for the external controls are reported as "Detected," "Not Detected," or "Invalid."

B Principle of Operation:

Each liquid control of FilmArray TF Control Panel M527 is processed separately according to the assay manufacturer's Instructions for Use and monitors the detection and identification of the organisms detected by the BIOFIRE FILMARRAY TF Panel. Results are reported automatically by instrument software as either "Detected", "Not Detected", or "Invalid."

V Substantial Equivalence Information:

A Predicate Device Name(s):

FilmArray GI Control Panel M238

B Predicate 510(k) Number(s):

K251526

C Comparison with Predicate(s):

Device & Predicate Device(s):	K260577	K251526
Device Trade Name	FilmArray TF Control Panel M527	FilmArray GI Control Panel M238
General Device Characteristic Similarities		
Intended Use/Indications For Use	The FilmArray TF Control Panel M527 is intended for use as an external positive and negative assayed quality control to monitor the	FilmArray GI Control Panel M238 is intended for use as an external positive and negative assayed quality control to monitor the performance of in

	performance of the BIOFIRE FILMARRAY Tropical Fever (TF) Panel assay on the BIOFIRE FILMARRAY Systems. The BIOFIRE FILMARRAY TF Panel assay qualitatively detects the following target pathogens: chikungunya virus, dengue virus (serotypes 1, 2, 3, and 4), *Leptospira* spp., and *Plasmodium* spp. (including species differentiation of *Plasmodium falciparum* and *Plasmodium vivax*/*ovale*). The FilmArray TF Positive control is composed of synthetic DNA and RNA in stabilizing solutions, buffers, and preservatives. The FilmArray TF Negative control contains buffers and preservatives. The FilmArray TF Control Panel M527 is designed for and intended to be used solely with the BIOFIRE FILMARRAY TF Panel. This product is not intended to replace manufacturer internal controls provided with this device.	vitro laboratory nucleic acid testing procedures for the qualitative detection of *Campylobacter* (*C. jejuni*/*C. coli*/*C. upsaliensis*), *Clostridium difficile* (toxin A/B), *Plesiomonas shigelloides*, *Salmonella*, *Vibrio* (*V. parahaemolyticus*/ *V. vulnificus*/ *V. cholerae*), (including *Vibrio cholerae*), *Yersinia enterocolitica*, Enteroaggregative *E. coli* (EAEC), Enteropathogenic *E. coli* (EPEC), Enterotoxigenic *E. coli* (ETEC) lt/st, Shiga-like toxin-producing *E. coli* (STEC) stx1/stx2 (*E. coli* O157), Shigella/ Enteroinvasive *E. coli* (EIEC), *Cryptosporidium*, *Cyclospora cayetanensis*, *Entamoeba histolytica*, *Giardia lamblia*, Adenovirus F 40/41, Astrovirus, Norovirus GI/GII, Rotavirus A and Sapovirus (Genogroups I, II, IV, and V) using the BIOFIRE FILMARRAY Gastrointestinal (GI) Panel and the BIOFIRE FILMARRAY Gastrointestinal (GI) Panel Mid assays on BIOFIRE FILMARRAY systems. The FilmArray GI Control Panel M238 is designed for and intended to be used solely with the BIOFIRE GI Panel and the BIOFIRE GI Panel Mid assays. The FilmArray GI Control M239, and FilmArray GI Control M240 contains synthetic RNA transcripts in stabilizing solution, buffers, and preservatives. This product is not intended to replace manufacturer internal

		controls provided with these devices.
Physical format	Same	Ready-to-Use Liquid
Test System	Same	BIOFIRE FILMARRAY 2.0 BIOFIRE FILMARRAY TORCH systems
Assay steps monitored	Same	Reverse transcription, amplification, detection, identification
General Device Characteristic Differences		
Targets	Chikungunya virus, Dengue virus (serotypes 1, 2, 3, and 4) *Leptospira* spp. *Plasmodium* spp. *Plasmodium falciparum* *Plasmodium vivax*/*ovale*).	*Campylobacter* (*C. jejuni*/*C. coli*/*C. upsaliensis*), *Clostridium difficile* (toxin A/B), *Plesiomonas shigelloides*, *Salmonella*, *Vibrio* (*V. parahaemolyticus*/ *V. vulnificus*/ *V. cholerae*), (including *Vibrio cholerae*), *Yersinia enterocolitica*, Enteroaggregative *E. coli* (EAEC), Enteropathogenic *E. coli* (EPEC), Enterotoxigenic *E. coli* (ETEC) lt/st, Shiga-like toxin-producing *E. coli* (STEC) stx1/stx2 (*E. coli* O157), Shigella/ Enteroinvasive *E. coli* (EIEC), *Cryptosporidium*, *Cyclospora cayetanensis*, *Entamoeba histolytica*, *Giardia lamblia*, Adenovirus F 40/41, Astrovirus, Norovirus GI/GII, Rotavirus A and Sapovirus (Genogroups I, II, IV, and V)
Composition	Synthetic DNA and RNA transcripts suspended in a non-infectious solution of buffers, preservatives and stabilizers.	Synthetic RNA transcripts suspended in a non-infectious solution of buffers, preservatives and stabilizers.
Number of assay's reported targets	4	22

VI Standards/Guidance Documents Referenced:

Not applicable

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision:
   Within-run precision on the BIOFIRE FILMARRAY 2.0 and BIOFIRE FILMARRAY Torch systems was determined by testing two lots of FilmArray TF Positive, and FilmArray TF Negative controls six times using one pouch lot of the BIOFIRE FILMARRAY TF Panel, at one site, by the same operator and on the same day (Table 2).

   Precision study crossing point (Cp) data for FilmArray TF Control Panel M527 were further analyzed to calculate the mean Cp, SD and %CV for each analyte detected by the BIOFIRE FILMARRAY TF Panel for each lot used. Analyses of the Cp data are shown in Table 3 below.

Table 2. Within-run Precision for the FilmArray TF Control Panel M527

Control	Control Lot #	Tests	Invalid Results	Pouch Lot #	Correct Results
FilmArray TF Positive	A19SEP24A	6	0	309624D	6/6
FilmArray TF Positive	F24SEP24A	6	0	321324D	6/6
FilmArray TF Negative	F15FEB24T	6	0	321324D	6/6
FilmArray TF Negative	T04JUN24G	6	0	309624D	6/6

Table 3. Precision Data Analysis for the FilmArray TF Control Panel M527

Analytes	Lot 1			Lot 2			Between Lots		
	Mean	SD	%CV	Mean	SD	%CV	Mean	SD	%CV
CHIKV 1	20	0.9	4.5%	16.9	0.4	2.4%	18.5	1.8	9.50%
CHIKV 2	16.7	0.1	0.6%	14.2	0.6	4.2%	15.4	1.3	8.50%
DENV 1	18	0.1	0.6%	15.6	0.5	3.2%	16.8	1.3	7.80%
DENV 2_1	20.3	0.4	2.0%	17.7	0.3	1.7%	19	1.4	7.40%
DENV 2_2	17.8	0.2	1.1%	15.6	0.6	3.8%	16.7	1.2	7.50%
DENV 3	20.2	0.4	2.0%	17.4	0.4	2.3%	18.8	1.5	8%
DENV 4	17.1	0.3	1.8%	15	0.6	4.0%	16	1.2	7.30%
Plasmodium spp.	15.5	0.4	2.6%	15	0.6	4.0%	15.3	0.6	3.70%
P. falciparum	16.5	0.3	1.8%	15.9	0.6	3.8%	16.2	0.5	3.40%
P. vivax/ovale	17.1	1.4	8.2%	16.6	0.6	3.6%	16.8	1.1	6.40%
Leptospira 1	15.7	0.3	1.9%	15.1	0.8	5.3%	15.4	0.6	4.20%

All results from the precision study for the FilmArray TF Control Panel M527 were valid and with correct calls. These results support the repeatability of the FilmArray TF Control Panel M527 across two separately manufactured control lots.

2. Reproducibility:

A multi-site reproducibility study was conducted by testing one hundred twenty-eight samples of FilmArray TF Positive and one hundred twenty-seven samples of FilmArray TF Negative using three lots of each control. Testing was conducted across three sites with the BIOFIRE FILMARRAY TF Panel using the BIOFIRE FILMARRAY 2.0 and BIOFIRE FILMARRAY Torch systems. The study included nine unique BioFire Global Fever (GF) Panel pouch lots, 13 operators and multiple instruments, for a total of 255 reproducibility replicates. The BioFire GF Panel pouches are identical to the BioFire FilmArray TF Panel pouches.

Of the 255 samples tested, all the analytes in the positive control were detected, and not detected in the negative control for a 100% agreement for both controls. Furthermore, three results were invalid and the remaining 252 results were valid and correct calls, as shown in Table 4 below.

Table 4. Summary of Reproducibility Study Results

Site	Total Tests	Invalid*	Correct Positive Control Results	Incorrect Positive Control Results	PPA	Correct Negative Control Results	Incorrect Negative Control Results	NPA
1	120	0	60	0	100%	60	0	100%
2	73	1	36	0	100%	36	0	100%
3	62	2	30	0	100%	30	0	100%
Total	255	3	126	0	100%	126	0	100%

*Invalid results are not included in performance calculations

Acceptance criteria for the FilmArray TF Control Panel M527 reproducibility study were established as >/= 95% agreement with the expected results e.g., correct calls and CV<20% for all analytes.

Reproducibility and between-lot crossing point (Cp) data for the FilmArray TF Control Panel M527 at the three sites were further analyzed to calculate the for mean Cp, SD and %CV for each analyte detected by the BIOFIRE FILMARRAY TF Panel. Analyses of the Cp data are shown in Tables 5 and 6 below.

Table 5. FilmArray TF Positive – Reproducibility Data Analysis by Analyte

Analytes	Site 1			Site 2			Site 3			Between sites		
	Mean	SD	%CV	Mean	SD	%CV	Mean	SD	%CV	Mean	SD	%CV
CHIKV 1	18.47	1.21	6.6%	19.49	2.03	10.4%	19.61	1.92	9.8%	19.19	0.63	3.3%
CHIKV 2	15.87	0.78	4.9%	16.15	1.34	8.3%	15.78	1.02	6.4%	15.93	0.19	1.2%
DENV 1	17.32	0.76	4.4%	17.55	1.48	8.5%	17.23	0.92	5.4%	17.37	0.17	1.0%
DENV 2_1	19.47	0.81	4.1%	19.59	1.33	6.8%	19.37	1.39	7.2%	19.48	0.11	0.6%
DENV 2_2	17.12	0.77	4.5%	17.49	1.58	9.1%	17.08	1.04	6.1%	17.23	0.23	1.3%

DENV 3	19.17	0.79	4.1%	19.35	1.66	8.6%	20.06	2.11	10.5%	19.53	0.47	2.4%
DENV 4	16.25	0.78	4.8%	16.81	1.65	9.8%	16.25	1.17	7.2%	16.43	0.32	2.0%
Plasmodium spp.	15.70	0.54	3.4%	15.61	0.79	5.1%	15.80	0.58	3.7%	15.70	0.10	0.6%
P. falciparum	16.86	0.50	3.0%	16.42	0.77	4.7%	16.68	0.65	3.9%	16.65	0.22	1.3%
P. vivax/ovale	17.12	0.74	4.3%	16.98	0.85	5.0%	16.98	1.11	6.5%	17.03	0.08	0.5%
Leptospira 1	15.81	0.48	3.1%	15.69	0.78	4.9%	15.85	0.57	3.6%	15.78	0.08	0.5%

Table 6. FilmArray TF Positive – Lot- to Lot Variability Data Analysis by Analyte

Analytes	Lot 1			Lot 2			Lot 3			Total lots		
	Mean	SD	%CV	Mean	SD	%CV	Mean	SD	%CV	Mean	SD	%CV
CHIKV 1	20.1	1.3	6.5%	17.7	0.9	5.1%	20.5	1.1	5.4%	19.4	1.7	8.6%
CHIKV 2	16.6	0.8	4.8%	15.1	0.7	4.6%	16.8	0.8	4.8%	16.2	1.1	6.6%
DENV 1	18	1	5.6%	16.6	0.7	4.2%	18.2	0.8	4.4%	17.6	1.1	6.2%
DENV 2_1	20	0.7	3.5%	18.7	0.9	4.8%	20.5	1.1	5.4%	19.7	1.2	5.9%
DENV 2_2	17.8	1	5.6%	16.5	0.8	4.8%	18	0.9	5.0%	17.4	1.1	6.5%
DENV 3	20.1	1.2	6.0%	18.8	1.5	8.0%	20.2	1.3	6.4%	19.7	1.5	7.5%
DENV 4	17	1	5.9%	15.6	0.9	5.8%	17.3	0.9	5.2%	16.6	1.2	7.2%
Plasmodium spp.	15.7	0.6	3.8%	15.7	0.6	3.8%	15.9	0.6	3.8%	15.8	0.6	4%
P. falciparum	16.7	0.6	3.6%	16.6	0.6	3.6%	16.9	0.7	4.1%	16.7	0.7	3.9%
P. vivax/ovale	17	0.7	4.1%	16.9	0.9	5.3%	17.4	1	5.7%	17.1	0.9	5.1%
Lepto 1	15.8	0.6	3.8%	15.8	0.6	3.8%	16	0.6	3.8%	15.8	0.6	3.9%

The results support the reproducibility of the FilmArray TF Control Panel M527 across three separately manufactured control lots, sites, days, and operators.

2. Linearity:

   Not applicable

3. Analytical Specificity/Interference:

   Not applicable

4. Detection Limit and Assay Reportable Range:

   Not applicable

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

a. Closed Vial Real-time Stability

The FilmArray TF Control Panel M527 closed vial real-time stability study tested three lots of each FilmArray TF Positive and FilmArray TF Negative controls when stored at refrigeration temperature (2°- 8°C) for up to 12 months. Testing was performed with the BIOFIRE FILMARRAY TF Panel on the BIOFIRE FILMARRAY 2.0 and BIOFIRE FILMARRAY Torch systems. The real-time stability study for the FilmArray TF Control Panel M527 supports a shelf-life of 12 months, when stored under refrigerated conditions (2°- 8°C).

b. Shipping Stability

The FilmArray TF Control Panel M527 shipping study evaluated the control kit performance after shipping in dry-ice and in cold gel packs. Two lots of each FilmArray TF Positive, and FilmArray TF Negative, were used in the study, and all samples were tested with the BIOFIRE FILMARRAY TF Panel on the BIOFIRE FILMARRAY 2.0 and BIOFIRE FILMARRAY Torch systems. Simulated shipping studies for the FilmArray TF Control Panel M527 support stability of the control kit after shipping overnight in dry ice or in cold gel pack.

6. Assay Cut-Off:

   Not applicable

B Comparison Studies:

1. Method Comparison with Predicate Device:

   Not applicable

2. Matrix Comparison:

   The FilmArray TF Control Panel M527 is formulated as synthetic, non-infectious material. To demonstrate equivalent performance between the synthetic material of the controls and clinical sample matrix on the BIOFIRE FILMARRAY TF panel, a study was conducted where gDNA *Plasmodium falciparum* was spiked into FilmArray TF Positive control matrix and EDTA whole blood in a 1:200 dilution, then tested in duplicate with the BIOFIRE FILMARRAY TF Panel on the BIOFIRE FA 2.0 and BIOFIRE FA Torch systems. The acceptance criterion is 100% agreement between the spiked EDTA whole blood and spiked FilmArray TF Positive control matrix.

   After testing, 100% agreement between the spiked simulated clinical sample matrix and spiked FilmArray TF Positive control matrix was observed ("Detected" for *Plasmodium* spp. and *Plasmodium falciparum*; "Not Detected" for all other analytes)**,** as seen in Table 7. The mean Crossing points (Cp) for *Plasmodium* spp. and *Plasmodium falciparum* across both sample types were similar, as seen in Table 8.

Table 7. FilmArray TF Positive Control – Matrix Testing

Analytes	Positive Control	Negative Control		*P. falciparum* spiked into FilmArray TF Positive Control matrix		*P. falciparum* spiked into simulated patient sample matrix (EDTA Whole blood)	
	FilmArray TF Pos F24SEP24A	Unspiked Whole Blood	Unspiked control Matrix	*P. falciparum* spiked in Control Matrix		*P. falciparum* spiked in Whole Blood	
CHIKV 1	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
CHIKV 2	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
DENV 1	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
DENV 2_1	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
DENV 2_2	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
DENV 3	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
DENV 4	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Plasmodium spp.	Detected	Not Detected	Not Detected	Detected	Detected	Detected	Detected
Plasmodium falciparum	Detected	Not Detected	Not Detected	Detected	Detected	Detected	Detected
Plasmodium vivax/ovale	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Leptospira 1	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected

Table 8. Matrix Testing Data Analysis

Pathogen Analyte	*Plasmodium falciparum* spiked into FilmArray TF Positive Control matrix and patient sample matrix (EDTA Whole Blood)					
	MMQCI Control Matrix		Mean	Whole blood		Mean Cp
Plasmodium spp.	10.3	9.8	10.1	10.7	11.5	11.1
Plasmodium falciparum	16.5	15.7	16.1	17.2	17.4	17.3

The results demonstrate that the FilmArray TF Control Panel M527 matrix has no effect on target detection (no inhibition and/or false negative results) when tested with the BIOFIRE FILMARRAY TF Panel.

C Clinical Studies:

1. Clinical Sensitivity:

   Not applicable

2. Clinical Specificity:

   Not applicable

3. Clinical Cut-Off:

   Not applicable

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

   Not applicable

D Expected Values/Reference Range:

The BioFire FilmArray TF Control Panel M527 is a qualitative control and the expected results for BIOFIRE FILMARRAY TF Panel are listed in Tables 9 and 10 below.

Table 9. FilmArray TF Positive Control

FilmArray TF Positive Control	Expected Result
Viruses	
Chikungunya virus	Detected
Dengue virus	Detected
Parasites	
Plasmodium spp.	Detected
Plasmodium falciparum	Detected
Plasmodium vivax/ovale	Detected
Bacteria	
Leptospira spp.	Detected

Table 10. FilmArray TF Negative Control

FilmArray TF Negative Control	Expected Result
Viruses	
Chikungunya virus	Not Detected
Dengue virus	Not Detected
Parasites	
Plasmodium spp.	Not Detected
Plasmodium falciparum	Not Detected
Plasmodium vivax/ovale	Not Detected
Bacteria	
Leptospira spp.	Not Detected

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.