



**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY**

I Background Information:

A 510(k) Number

K212576

B Applicant

Streck, Inc

C Proprietary and Established Names

MDx-Chex for BCID2

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 substantive equivalence determination for the MDx-Chex for BCID2.

B Measurand:

Multi-analyte quality control materials

C Type of Test:

MDx-Chex for BCID2 is intended for *in vitro* diagnostic use as an external assayed quality control material to monitor the qualitative amplification, detection, and identification steps of the laboratory nucleic acid test BioFire FilmArray Blood Culture Identification 2 (BCID2) Panel on the FilmArray 2.0 and FilmArray systems. The BioFire BCID2 Panel on the FilmArray 2.0 or FilmArray Torch system detects multiple bacterial and yeast nucleic acids and select genetic

determinants of antimicrobial resistance from positive blood cultures. Control 1 - GN: Gram negative bacteria: *Acinetobacter colcoaceticus-baumannii* complex, *Bacteroides fragilis*, *Enterobacter cloacae* complex, *Escherichia coli*, *Klebsiella aerogenes*, *Klebsiella oxytoca*, *Klebsiella pneumoniae* group, *Proteus* spp., *Salmonella* spp., *Serratia marcescens*, *Haemophilus influenza*, *Neisseria meningitides*, *Pseudomonas aeruginosa*, *Stenotrophomonas maltophilia*; antimicrobial resistance genes: KPC, CTX-M, IMP, NDM, OXA-48-like, VIM, *mcr-1*. Control 2 - GPY: Gram positive bacteria: *Enterococcus faecalis*, *Enterococcus faecium*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Staphylococcus lugdunesis*, *Streptococcus agalactiae*, *Streptococcus pneumonia*, *Streptococcus pyogenes*; yeast: *Candida albicans*, *Candida auris*, *Candida glabrata*, *Candida krusei*, *Candida parapsilosis*, *Candida tropicalis*, *Cryptococcus neoformans/gatti*; antimicrobial resistance genes: *mecA/C* and *MREJ*, *vanA/B*.

III Intended Use/Indications for Use:

A Intended Use(s):

MDx-Chex for BCID2 is intended for use as an external positive and negative assayed control to monitor the performance of the qualitative detection of yeast, Gram positive and Gram negative bacteria, as well as associated antimicrobial resistance genes, by the BioFire FilmArray Blood Culture Identification 2 (BCID2) Panel on FilmArray systems. Control 1 - GN: Gram negative bacteria: *Acinetobacter colcoaceticus-baumannii* complex, *Bacteroides fragilis*, *Enterobacter cloacae* complex, *Escherichia coli*, *Klebsiella aerogenes*, *Klebsiella oxytoca*, *Klebsiella pneumoniae* group, *Proteus* spp., *Salmonella* spp., *Serratia marcescens*, *Haemophilus influenza*, *Neisseria meningitides*, *Pseudomonas aeruginosa*, *Stenotrophomonas maltophilia*; antimicrobial resistance genes: KPC, CTX-M, IMP, NDM, OXA-48-like, VIM, *mcr-1*. Control 2 - GPY: Gram positive bacteria: *Enterococcus faecalis*, *Enterococcus faecium*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Staphylococcus lugdunesis*, *Streptococcus agalactiae*, *Streptococcus pneumonia*, *Streptococcus pyogenes*; yeast: *Candida albicans*, *Candida auris*, *Candida glabrata*, *Candida krusei*, *Candida parapsilosis*, *Candida tropicalis*, *Cryptococcus neoformans/gatti*; antimicrobial resistance genes: *mecA/C* and *MREJ*, *vanA/B*. This product is not intended to replace manufacturer controls provided with the device.

B Indication(s) for Use:

See Indications for Use below.

C Special Conditions for Use Statement(s):

Rx - For Prescription Use Only

For in vitro diagnostic use only

D Special Instrument Requirements:

The MDx-Chex for BCID2 was evaluated on the FilmArray 2.0 and FilmArray Torch instruments.

IV Device/System Characteristics:

A Device Description:

Streack Molecular Control (SMC; trade name: MDx-Chex for BCID2) is an external positive and negative assayed control consisting of two levels of control, Control 1- Gram negative (GN) and Control 2- GPY (Gram positive and yeast). Each control contains stabilized human leukocytes and erythrocytes, and inactivated bacteria in a simulated blood culture media. Both controls contain target sequence in intact and inactivated bacterial and yeast cells, as well as antimicrobial gene targets (in relevant pathogens that are intact and inactivated) that are detected by the BioFire FilmArray Blood Culture Identification 2 (BCID2) Panel on FilmArray systems. MDx-Chex for BCID2 is a full-process, cellular-based control for the BioFire BCID2 Panel that evaluates the entire analytical process including sample lysis, nucleic acid isolation and purification, amplification, detection, and analysis, as well as the impact of PCR inhibitors and preanalytical variables. Each control for the MDx-Chex for BCID2 is processed separately according to the BioFire BCID2 Panel Package Insert for patient samples.

B Pathogens and antimicrobial resistance genes found in MDx-Chex for BCID2 and detected by BioFire BCID2 Panel assay

Antimicrobial resistance genes	
CTX-M	<i>mecA/C</i> and MREJ (MRSA)
IMP	NDM
KPC	OXA-48-like
<i>mcr-1</i>	<i>vanA/B</i>
<i>mecA/C</i>	VIM
Gram Positive Bacteria	
<i>Enterococcus faecalis</i>	<i>Streptococcus</i> spp.
<i>Enterococcus faecium</i>	<i>Streptococcus agalactiae</i> (Group B)
<i>Listeria monocytogenes</i>	<i>Streptococcus pneumoniae</i>
<i>Staphylococcus</i> spp.	<i>Streptococcus pyogenes</i> (Group A)
<i>Staphylococcus aureus</i>	
<i>Staphylococcus epidermidis</i>	
<i>Staphylococcus lugdunensis</i>	
Gram Negative Bacteria	
<i>Acinetobacter calcoaceticus-baumannii</i> complex	Enteric bacteria
<i>Bacteroides fragilis</i>	<i>Enterobacter cloacae</i> complex
<i>Haemophilus influenzae</i>	<i>Escherichia coli</i>
<i>Neisseria meningitidis</i>	<i>Klebsiella aerogenes</i>
<i>Pseudomonas aeruginosa</i>	<i>Klebsiella oxytoca</i>
<i>Stenotrophomonas maltophilia</i>	<i>Klebsiella pneumoniae</i> group
	<i>Salmonella</i> spp
	<i>Serratia marcescens</i>
Yeast	
<i>Candida albicans</i>	<i>Candida parapsilosis</i>
<i>Candida auris</i>	<i>Candida tropicalis</i>
<i>Candida glabrata</i>	<i>Cryptococcus neoformans/gattii</i>
<i>Candida krusei</i>	

C Principle of Operation:

Not Applicable

V Substantial Equivalence Information:**A Predicate Device Name(s):**

FilmArray BCID2 Control Panel M416

B Predicate 510(k) Number(s):

K200010

C Comparison with Predicate(s):

Device & Predicate Device(s):	<u>K212576</u>	<u>K200010</u>
Device Trade Name	MDx-Chex for BCID2	FilmArray BCID2 Control Panel M416
General Device Characteristic Similarities		
Intended Use/Indications For Use	MDx-Chex for BCID2 is intended for use as an external positive and negative assayed control to monitor the performance of the qualitative detection of yeast, Gram positive and Gram negative bacteria, as well as associated antimicrobial resistance genes, by the BioFire FilmArray Blood Culture Identification 2 (BCID2) Panel on FilmArray systems. Control 1 - GN: Gram negative bacteria: <i>Acinetobacter colcoeticus-baumannii</i> complex, <i>Bacteroides fragilis</i> , <i>Enterobacter cloacae</i> complex, <i>Escherichia coli</i> , <i>Klebsiella aerogenes</i> , <i>Klebsiella oxytoca</i> , <i>Klebsiella pneumoniae</i> group, <i>Proteus spp.</i> , <i>Salmonella spp.</i> , <i>Serratia marcescens</i> , <i>Haemophilus influenza</i> , <i>Neisseria meningitidis</i> , <i>Pseudomonas aeruginosa</i> , <i>Stenotrophomonas maltophilia</i> ; antimicrobial resistance genes: KPC, CTX-M, IMP, NDM, OXA-48-like, VIM, <i>mcr-1</i> . Control 2 - GPY: Gram positive bacteria: <i>Enterococcus faecalis</i> , <i>Enterococcus faecium</i> , <i>Listeria monocytogenes</i> ,	FilmArray BCID2 Control Panel M416 is intended for use as an external positive and negative assayed quality control to monitor the performance of <i>in vitro</i> laboratory nucleic acid testing procedures for the qualitative detection of antimicrobial resistance genes: CTX-M, IMP, KPC, <i>mcr-1</i> , <i>mecA/C</i> , <i>mecA/C</i> and MREJ (MRSA), NDM, OXA-48-like, vanA/B, VIM; Gram positive and Gram-negative bacteria: <i>Enterococcus faecalis</i> , <i>Enterococcus faecium</i> , <i>Listeria monocytogenes</i> , <i>Staphylococcus spp.</i> , <i>Staphylococcus aureus</i> , <i>Staphylococcus epidermidis</i> , <i>Staphylococcus lugdunensis</i> , <i>Streptococcus spp.</i> , <i>Streptococcus agalactiae</i> (Group B), <i>Streptococcus pneumoniae</i> , <i>Streptococcus pyogenes</i> (Group A), <i>Acinetobacter calcoeticus baumannii</i> complex, <i>Bacteroides fragilis</i> , Enteric bacteria, <i>Enterobacter cloacae</i> complex, <i>Escherichia coli</i> , <i>Klebsiella aerogenes</i> , <i>Klebsiella oxytoca</i> ,

	<i>Staphylococcus aureus</i>, <i>Staphylococcus epidermidis</i>, <i>Staphylococcus lugdunensis</i>, <i>Streptococcus agalactiae</i>, <i>Streptococcus pneumoniae</i>, <i>Streptococcus pyogenes</i>; yeast: <i>Candida albicans</i>, <i>Candida auris</i>, <i>Candida glabrata</i>, <i>Candida krusei</i>, <i>Candida parapsilosis</i>, <i>Candida tropicalis</i>, <i>Cryptococcus neoformans/gattii</i>; antimicrobial resistance genes: <i>mecA/C</i> and <i>MREJ</i>, <i>vanA/B</i>. This product is not intended to replace manufacturer controls provided with the device.	<i>Klebsiella pneumoniae</i> group, <i>Proteus</i> spp., <i>Salmonella</i> spp., <i>Serratia marcescens</i>, <i>Haemophilus influenzae</i>, <i>Neisseria meningitidis</i>, <i>Pseudomonas aeruginosa</i> and <i>Stenotrophomonas maltophilia</i>; and yeast pathogens: <i>Candida albicans</i>, <i>Candida auris</i>, <i>Candida glabrata</i>, <i>Candida krusei</i>, <i>Candida parapsilosis</i>, <i>Candida tropicalis</i>, and <i>Cryptococcus neoformans/gattii</i> on the BioFire Blood Culture Identification 2 (BCID2) Panel assay on FilmArray systems. FilmArray BCID2 Control Panel M416 is composed of synthetic DNA specifically designed for and intended to be used solely with the BioFire BCID2 Panel assay. This product is not intended to replace manufacturer controls provided with the device.
Physical Format	Ready-to-Use Liquid	Same
Direction for Use	Process like patient sample	Same
Number of targets monitored in one assay	Multiple, >30 targets	Same
General Device Characteristic Differences		
Composition	Intact inactivated bacteria, human erythrocytes and leukocytes, and relevant components of blood culture media	Synthetic DNA
Assay Steps Monitored	Lysis, nucleic acid isolation/purification/PCR inhibitor removal, amplification, detection, identification/data reporting	Reverse transcription, amplification, detection

VI Standards/Guidance Documents Referenced:

None Referenced

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:

A multi-site reproducibility study was performed with the MDx-Chex for BCID2 at four different study sites using three lots of MDx-Chex for BCID2 panel per test site. Testing

consisted of a total of 20 samples being analyzed per lot. Eleven operators participated in the study with 2-4 operator per site. The study was performed on FilmArray instrument 2.0 (used at test sites 1 and 4) and FilmArray Torch systems (used at test sites 1, 2, and 3). A total of 240 external controls were tested. Of the 240 controls tested, 10 positive controls were false negatives, however upon retesting were confirmed as positive controls. As part of the workflow, if an unexpected result is observed for one or more targets within a given run, that sample may be rerun no more than one time to determine if the correct results are obtained for the targets with unexpected results during the first run. Also, of the 10 false negatives, 6 were for not detecting the *mecA/C* and MREJ antimicrobil resistance gene across three of the four test sites. This resulted in a positive percent agreement of 95.8% (n=230/240); see Table 1 below. Also, of the 240 controls tested, 1 negative control was false positive and upon retesting was confirmed as a negative control. This resulted in a negative percent agreement of 99.6% (n=239/240); see Table 2 below.

Table 1: Streck Molecular Control (SMC) Reproducibility Summary: Positive Percent Agreement

Category	Site #1		Site #2		Site #3		Site #4		Percent Agreement (all sites combined)
	# Observed Results/# Expected Results ¹	Positive Percent Agreement	# Observed Results/# Expected Results ¹	Positive Percent Agreement	# Observed Results/# Expected Results ¹	Positive Percent Agreement	# Observed Results/# Expected Results ¹	Positive Percent Agreement	
SMC Level 1 (GN) and Level 2 (GPY), Combined	59/60*	98.3%	57/60*	95%	58/60*	96.7%	56/60*	95%	95.8% (230/240)

* 10 Positive controls gave initial false negative results; all produced the correct results upon a single retest.

¹ Expected result for the Positive Control is positive. Denominator = total # of results for Level 1-GN and Level 2-GPY controls. GPY = Gram-positive and yeast control, GN = Gram-negative control.

Table 2: Streck Molecular Control (SMC) Reproducibility Summary: Negative Percent Agreement

Category	Site #1		Site #2		Site #3		Site #4		Percent Agreement (all sites combined)
	# Observed Results/# Expected Results ¹	Negative Percent Agreement	#Observed Results/# Expected Results ¹	Negative Percent Agreement	# Observed Results/# Expected Results ¹	Negative Percent Agreement	# Observed Results/# Expected Results ¹	Negative Percent Agreement	
SMC Level 1 (GN) and Level 2 (GPY), Combined	60/60	100%	60/60	100%	60/60	100%	59/60*	98.3%	99.6% (239/240)

* 1 Negative control gave initial false positive result and produced correct result upon a single retest.

¹ Expected result for the Negative Control is negative. Denominator = total # of results for Level 1-GN and Level 2-GPY controls. GPY = Gram-positive and yeast control, GN = Gram-negative control.

The results suggest that there are no significant differences between different users and different study sites on different days. External reproducibility studies for the MDx-Chex for BCID2 are acceptable.

Precision

An internal precision study for the MDx-Chex for BCID2 was conducted over 20 non-consecutive days by testing three different control lots. Each lot was tested on two FilmArray Torch instruments. A total of 20 samples were tested per lot and level (Level 1- GN and Level 2- GPY) by four operators. Samples and pouches were prepared according to BCID2 and control instructions. All controls gave correct results except for 6 positive control that gave false negative results, however upon retesting was confirmed as positive controls; This resulted in a positive percent agreement of 95% (n=114/120) and a negative percent agreement of 100% (n= 120/120); see Tables 3 and 4 below.

Table 3: Streck Molecular Control (SMC) Precision Summary: Positive Percent Agreement

Category	# Observed Results/ # Expected Results ¹	Positive Percent Agreement
SMC Level 1-GN and Level 2-GPY, Combined	114/120*	95%

* 6 Positive controls gave initial false negative results; all produced the correct results upon a single retest.

¹ Expected result for the Positive Control is positive. Denominator = total # of results for GN (Level 1) and GPY (Level 2) controls. GPY = gram-positive and yeast control, GN = gram negative control.

Table 4: Streck Molecular Control (SMC) Precision Summary: Negative Percent Agreement

Category	# Observed Results/ # Expected Results ¹	Negative Percent Agreement
SMC Level 1- GN and Level 2-GPY, Combined	120/120	100%

¹ Expected result for the Negative Control is negative. Denominator = total # of results for GN (Level 1) and GPY (Level 2) controls. GPY = gram-positive and yeast control, GN = gram negative control.

There appears to be no significant differences in the detection of the control organisms and antimicrobial resistance genes when testing different control lots on different days. Precision studies are acceptable.

Within-run Testing

Within-run precision was demonstrated in a separate study using a single lot of MDx-Chex for BCID2 analyzed on a single day. Six control vials were tested for each control level (Level 1-GN and Level 2- GPY). The samples were analyzed on the FilmArray Torch instrument. The results are shown in Tables 5 and 6 below:

Table 5: Streck Molecular Control (SMC) Within-run Precision Summary: Positive Percent Agreement

Category	SMC Lot	# Observed Results/ # Expected Results ¹	Positive Percent Agreement
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SMC Level 1(GN) and Level 2 (GPY), Combined	21129	12/12	100%
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¹ Expected result for the Positive Control is positive. Denominator = total # of expected positive result sets for Level 1-GN and Level 2-GPY controls. GN = gram negative control, GPY = gram-positive and yeast control.

Table 6: Streck Molecular Control (SMC) Within-run Precision Summary: Negative Percent Agreement

Category	SMC Lot	# Observed Results/ # Expected Results ¹	Negative Percent Agreement
SMC Level 1(GN) and Level 2 (GPY), Combined	21129	12/12	100%

¹ Expected result for the Negative Control is negative. Denominator = total # of expected negative result sets for Level 1-GN and Level 2-GPY controls. GN = gram negative control, GPY = gram-positive and yeast control.

Within-run reproducibility studies for the MDx-Chex for BCID2 are acceptable.

Lot-to-lot Testing

Lot-to-lot reproducibility was demonstrated by testing three lots of MDx-Chex for BCID2. Samples were prepared and analyzed on the BioFire FilmArray Torch per SMC and BCID2 Instructions for Use. Of the positive controls, one sample gave a false negative result that was confirmed as a positive control upon retesting. Results are shown in Tables 7 and 8 below.

Table 7: Streck Molecular Control (SMC) Lot-to-Lot Precision Summary: Positive Percent Agreement

Category	SMC Lot	# Observed Results/ # Expected Results ¹	Positive Percent Agreement
SMC Level 1(GN) and Level 2 (GPY), Combined	20363	11/12*	91.7%
	20366	12/12	100%
	21129	12/12	100%

* 1 Positive control gave an initial false negative result; it produced the correct result upon a single retest.

¹ Expected result for the Positive Control is positive. Denominator = total # of expected positive result sets for Level 1-GN and Level 2-GPY controls. GN = gram negative control, GPY = gram-positive and yeast control.

Table 8: Streck Molecular Control (SMC) Lot-to-Lot Precision Summary: Negative Percent Agreement

Category	SMC Lot	# Observed Results/ # Expected Results ¹	Negative Percent Agreement
SMC Level 1(GN) and Level 2 (GPY), Combined	20363	12/12	100%
	20366	12/12	100%

	21129	12/12	100%
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¹ Expected result for the Negative Control is negative. Denominator = total # of expected negative result sets for Level 1-GN and Level 2-GPY controls. GN = gram negative control, GPY = gram-positive and yeast control.

Lot-to-Lot reproducibility studies for the MDx-Chex for BCID2 are acceptable.

2. Linearity:

Not Applicable

3. Analytical Specificity/Interference:

Not Applicable

4. Assay Reportable Range:

Not Applicable

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

Open Vial Stability

A real-time open-vial stability study is ongoing using three lots of MDx-Chex for BCID2. Samples were stored in a controlled refrigerated (2-8°C) or controlled room temperature (20-25°C). Ten samples per lot per level is being tested at day 0 (baseline= a total of 60 samples per temperature) and a minimum of 61 days for each lot and storage condition. Each lot was tested for different duration (Lot 20263 was tested for 77 days, Lot 20366 was tested for 75 days and Lot 21129 was tested for 63 days) and therefore the shelf-life in Table 9 was denoted as day 61⁺ for each temperature tested. At baseline, 120 total tubes were tested then divided in half for storage at the two temperatures stated above. All samples are analyzed on the FilmArray Torch instrument. The data presented here are to support a 60 day open-vial stability claim and data to support a longer open-vial stability claim will be submitted at a later date. The data for the 61⁺ day study showed that at baseline, there were five false negatives and three false positive, that upon retesting were correctly confirmed as positive controls and negative controls, respectively. The data also showed that on day 61⁺, three samples, stored at 20-25°C, were false negatives and were correctly confirmed as positive controls upon retesting. Therefore, giving an overall PPA and NPA are 96.9% and 99.2%, respectively. The results are shown in Tables 9 and 10 below.

Table 9. Streck Molecular Control (SMC) Open-Vial Stability: Positive Percent Agreement

Shelf-Life	Storage Temperature	#Observed Results/ #Expected Results ¹	Positive Percent Agreement	PPA ≥ 90% Acceptance
Day 0*	NA	115/120**	95.8%	Pass

Day 61 ⁺	2-8°C	60/60	100%	Pass
Day 61 ⁺	20-25°C	57/60***	95%	Pass

¹ Expected result for the Positive Control is positive. Denominator = total combined # of expected positive results for Level 1-GN and Level 2-GPY controls. GPY = gram-positive and yeast control, GN = gram negative control.

* 120 tubes were completed for Day 0 (baseline). Tubes were divided in half for storage.

** 5 Positive controls gave false negative results on the first test; all reruns produced correct results upon a single retest.

*** 3 positive controls gave false negative results on the first test; all reruns produced correct results upon a single retest.

⁺ Indicates that each lot was tested for at least 61 days. Lot 20263 (77 days); Lot 20366 (75 days); and Lot 21129 (63 days).

Table 10. Streck Molecular Control (SMC) Open-Vial Stability: Negative Percent Agreement

Shelf-Life	Storage Temperature	#Observed Results/ #Expected Results ¹	Negative Percent Agreement	NPA ≥ 90% Acceptance
Day 0*	NA	117/120**	97.5%	Pass
Day 61 ⁺	2-8°C	60/60	100%	Pass
Day 61 ⁺	20-25°C	60/60	100%	Pass

¹ Expected result for the Negative Control is negative. Denominator = total combined # of expected negative results for Level 1-GN and Level 2-GPY controls. GPY = Gram-positive and yeast control, GN = Gram-negative control.

* 120 tubes were completed for Day 0 (baseline). Tubes were divided in half for storage.

** 3 negative controls gave false positive results on the first test; all reruns produced correct results upon a single retest.

⁺ Indicates that each lot was tested for at least 61 days. Lot 20263 (77 days); Lot 20366 (75 days); and Lot 21129 (63 days).

The data for the ongoing open-vial stability study support the conclusion that MDx-Chex for BCID2 has an open-vial stability of 60 days when stored at 2-25°C.

Closed-vial Stability

A real-time closed-vial stability study is ongoing using three lots of MDx-Chex for BCID2. Samples were stored in a controlled refrigerated (2-8°C) or controlled room temperature (20-25°C). Ten samples per lot per level is being tested at day 0 (baseline= a total of 60 samples per temperature) and a minimum of 61 days (60⁺) for each lot and storage condition. At baseline, 120 total tubes were tested then divided in half for storage at the two temperatures stated above. All samples are analyzed on the FilmArray Torch instrument. The data presented here are for at least 61 days and data to support a longer closed-vial stability claim will be submitted at a later date. The same baseline data used for the open-vial stability study above was used here. The closed-vial stability study data showed that on day 61⁺ at refrigerated temperature, two samples were false negatives and one sample was false positive, that upon retesting were correctly confirmed as positive controls and negative control, respectively. The data also showed that on day 61⁺ at room temperature, one sample was false positive that was correctly confirmed as negative control upon retesting. Therefore, the overall PPA and NPA are 97.5% and 98%, respectively. The results are shown in Tables 11 and 12 below.

Table 11. Streck Molecular Control (SMC) Close-Vial Stability: Positive Percent Agreement

Shelf-Life	Storage Temperature	#Observed Results/ #Expected Results ¹	Positive Percent Agreement	PPA ≥ 90% Acceptance
Day 0*	NA	115/120**	95.8%	Pass
Day 61 ⁺	2-8°C	58/60***	96.7%	Pass
Day 61 ⁺	20-25°C	60/60	100%	Pass

¹ Expected result for the Positive Control is positive. Denominator = total combined # of expected positive results for Level 1-GN and Level 2-GPY controls. GPY = gram-positive and yeast control, GN = gram negative control.

* 120 tubes were completed for Day 0 (baseline). Tubes were divided in half for storage.

** 5 Positive controls gave false negative results on the first test; all reruns produced correct results upon a single retest.

*** 2 Positive controls gave false negative results on the first test; all reruns produced correct results upon a single retest.

⁺ Indicates that each lot was tested for at least 61 days. Lot 20263 (77 days); Lot 20366 (75 days); and Lot 21129 (63 days).

Table 12. Streck Molecular Control (SMC) Close-Vial Stability: Negative Percent Agreement

Shelf-Life	Storage Temperature	#Observed Results/ #Expected Results ¹	Negative Percent Agreement	NPA ≥ 90% Acceptance
Day 0*	NA	117/120**	97.5%	Pass
Day 61 ⁺	2-8°C	59/60***	98.3%	Pass
Day 61 ⁺	20-25°C	59/60****	98.3%	Pass

¹ Expected result for the Negative Control is negative. Denominator = total combined # of expected negative results for Level 1-GN and Level 2-GPY controls. GPY = Gram-positive and yeast control, GN = Gram-negative control.

* 120 tubes were completed for Day 0 (baseline). Tubes were divided in half for storage.

** 3 negative controls gave false positive results on the first test; all reruns produced correct results upon a single retest.

*** 1 negative control gave a false positive result on the first test; all reruns produced correct results upon a single retest.

**** 1 negative control gave false positive result on the first test; rerun produced correct result upon a single retest.

⁺ Indicates that each lot was tested for at least 61 days. Lot 20263 (77 days); Lot 20366 (75 days); and Lot 21129 (63 days).

The data for the ongoing closed-vial stability study support the conclusion that MDx-Chex for BCID2 has a closed-vial stability of 60 days when stored at 2-25°C.

Real-time Stability Testing

Real-time stability studies are ongoing to support product claims for the MDx-Chex for BCID2. Real-time stability study protocols and acceptance criteria were reviewed and found to be acceptable.

Shipping Stability

A shipping stability study was performed to validate the stability of MDx-Chex for BCID2 during shipment. Using a single lot, two sets of samples were simulated into a summer or winter months profile over five days. Temperature stress conditions for Summer followed a

120-hour exposure period with the following temperature profile: 5h at 22°C, 14h at 26°C, 5.5h at 22°C, 5.5h at 25°C, 10h at 22°C, 2h at 40°C, 15h at 29°C, 5h at 40°C, 17.5h at 26°C, 11.5h at 29°C, 10h at 22°C, 7.5h at 30°C, and 11.5h at 24°C. Temperature stress conditions for Winter followed a 120-hour exposure with the following temperature profile: 5h at 22°C, 14h at 15°C, 5.5h at 22°C, 5.5h at 17°C, 10h at 22°C, 2h at -10°C, 15h at 10°C, 5h at -10°C, 17.5h at 15°C, 11.5h at 10°C, 10h at 22°C, 7.5h at 8°C, and 11.5h at 18°C. After temperature stress, samples were then incubated at 2-8°C for a week prior to being tested on the FilmArray Torch instrument. Ten samples were analyzed for each control (Level 1 and Level 2) for a total of 20 samples analyzed. Data showed that analysis using the summer profile resulted in one false negative and one false positive that upon retesting was correctly confirmed as a positive control and a negative control, respectively. Therefore, the overall PPA and NPA were 97.5% individually. Results are presented in Tables 13 and 14 below.

Table 13: Summary of Shipping Study for the Streck Molecular Control MDx-Chex: Positive Agreement

Category	# Expected results / # Tested ¹	Positive Percent Agreement
Summer	19/20*	95%
Winter	20/20	100%

¹ Expected result for the Positive Control is positive.

* 1 Positive control gave initial false negative result; it produced the correct result upon a single retest.

Table 14: Summary of Shipping Study for the Streck Molecular Control MDx-Chex: Negative Agreement

Category	# Expected results / # Tested ¹	Negative Percent Agreement
Summer	19/20*	95%
Winter	20/20	100%

¹ Expected result for the Negative Control is negative.

* 1 Negative control gave initial false positive result; it produced correct result upon a single retest.

The data support a claim that MDx-Chex for BCID2 remains functional after exposure to extreme temperature that may occur during shipping.

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:

The matrix of MDx-Chex for BCID2 is made of stabilized blood components (erythrocytes and leukocytes) in a simulated blood culture media. Since the matrix is not identical to that of the routine BCID2 assay sample, blood culture media, a test was performed to investigate the effect of the matrix on the assay.

To confirm that the matrix has no effect on the assay or control, inactivated *Streptococcus pneumoniae* was spiked into the MDx-Chex for BCID2 matrix as well as into BD BACTEC Plus Aerobic/F culture vial with negative whole blood to simulate a clinical sample. These samples were then tested in triplicate using the BCID2 Panel. Three replicates of each simulated matrix with no spike-in organism were also tested to serve as negative controls. Samples were analyzed on FilmArray Torch instrument. The results showed PPA and NPA of 100% and results are shown in Tables 15 and 16 below.

Table 15: Effect of Streck Molecular Control MDx-Chex and Clinical Samples Spiked with *S. pneumoniae*, Tested on BCID-2 panel

Matrix type	# Expected results / # tested ¹	Percent Agreement
MDx-Chex, Positive Matrix	3/3	100%
Clinical, Positive Matrix	3/3	100%

¹ Expected result for the Positive Matrix is positive.

Table 16: Effect of Negative Streck Molecular Control MDx-Chex and Negative Clinical Samples, Tested on BCID-2 panel

Matrix type	# Expected results / #tested ¹	Percent Agreement
MDx-Chex, Negative Matrix	3/3	100%
Clinical, Negative Matrix	3/3	100%

¹ Expected result for Negative Matrix is negative.

The results show that samples prepared with the MDx-Chex for BCID2 matrix showed no inhibition and/or false negative results when used with the FilmArray BCID2 panel. The data

also support the conclusion that the SMC MDx-Chex performs identically to a clinical BCID2 panel sample, positive blood culture sample.

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:

MDx-Chex for BCID2 is a qualitative control and the expected results are listed in Table 17 below.

Table 17 – Pathogens and antimicrobial resistance genes detected by MDx-Chex for BCID2 Control

Gram-Negative Bacteria		
Pathogen	MDx-Chex for BCID2 Control 1 - GN	MDx-Chex for BCID2 Control 2 - GPY
<i>Acinetobacter colcoaceticus-baumannii</i> complex	Detected	Not detected
<i>Bacteroides fragilis</i>	Detected	Not detected
<i>Enterobacter cloacae</i> complex	Detected	Not detected
<i>Escherichia coli</i>	Detected	Not detected
<i>Klebsiella aerogenes</i>	Detected	Not detected
<i>Klebsiella oxytoca</i>	Detected	Not detected
<i>Klebsiella pneumoniae</i> group	Detected	Not detected
<i>Proteus</i> spp.	Detected	Not detected
<i>Salmonella</i> spp.	Detected	Not detected
<i>Serratia marcescens</i>	Detected	Not detected
<i>Haemophilus influenzae</i>	Detected	Not detected
<i>Neisseria meningitides</i>	Detected	Not detected
<i>Pseudomonas aeruginosa</i>	Detected	Not detected
<i>Stenotrophomonas maltophilia</i>	Detected	Not detected
Gram-Positive Bacteria		
Pathogen	MDx-Chex for BCID2 Control 1 - GN	MDx-Chex for BCID2 Control 2 - GPY
<i>Enterococcus faecalis</i>	Not detected	Detected
<i>Enterococcus faecium</i>	Not detected	Detected

<i>Listeria monocytogenes</i>	Not detected	Detected
<i>Staphylococcus aureus</i>	Not detected	Detected
<i>Staphylococcus epidermidis</i>	Not detected	Detected
<i>Staphylococcus lugdunensis</i>	Not detected	Detected
<i>Streptococcus agalactiae</i>	Not detected	Detected
<i>Streptococcus pneumoniae</i>	Not detected	Detected
<i>Streptococcus pyogenes</i>	Not detected	Detected
Yeast		
Pathogen	MDx-Chex for BCID2 Control 1 - GN	MDx-Chex for BCID2 Control 2 - GPY
<i>Candida albicans</i>	Not detected	Detected
<i>Candida auris</i>	Not detected	Detected
<i>Candida glabrata</i>	Not detected	Detected
<i>Candida krusei</i>	Not detected	Detected
<i>Candida parapsilosis</i>	Not detected	Detected
<i>Candida tropicalis</i>	Not detected	Detected
<i>Cryptococcus neoformans/gatti</i>	Not detected	Detected
Antimicrobial Resistance Genes		
Gene	MDx-Chex for BCID2 Control 1 - GN	MDx-Chex for BCID2 Control 2 - GPY
<i>mecA/C</i> and <i>MREJ</i>	Not detected	Detected
<i>vanA/B</i>	Not detected	Detected
KPC	Detected	Not detected
CTX-M	Detected	Not detected
IMP	Detected	Not detected
NDM	Detected	Not detected
OXA-48-like	Detected	Not detected
VIM	Detected	Not detected
<i>mcr-1</i>	Detected	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 does support a substantial equivalence decision.