



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

I Background Information:

A 510(k) Number

K250273

B Applicant

Abbott Diagnostics Scarborough, Inc.

C Proprietary and Established Names

BinaxNOW COVID-19 Ag Card

D Regulatory Information

Product Code(s)	Classification	Regulation Section	Panel
QVF	Class II	21 CFR 866.3982 - Simple Point-Of-Care Device To Directly Detect SARS-Cov-2 Viral Targets From Clinical Specimens In Near-Patient Settings	MI - Microbiology

II Submission/Device Overview:

A Purpose for Submission:

To obtain 510(k) clearance for the BinaxNOW COVID-19 Ag Card.

B Measurand:

Nucleocapsid protein antigen from SARS-Coronavirus 2 (SARS-CoV-2)

C Type of Test:

Qualitative lateral flow immunoassay

III Intended Use/Indications for Use:

A Intended Use(s):

See Indications for Use below.

B Indication(s) for Use:

The BinaxNOW COVID-19 Ag Card is a lateral flow immunochromatographic assay for the rapid, qualitative detection of the SARS-CoV-2 nucleocapsid protein antigen directly in anterior nasal swab specimens from individuals with signs and symptoms of upper respiratory tract infection (i.e., symptomatic). The test is intended for use as an aid in the diagnosis of SARS-CoV-2 infections (COVID-19) in symptomatic individuals when either: tested at least twice over

three days with at least 48 hours between tests; or when tested once, and negative by the BinaxNOW COVID-19 Ag Card and followed up with a molecular test.

A negative test is presumptive and does not preclude SARS-CoV-2 infection, it is recommended these results be confirmed by a molecular SARS-CoV-2 assay.

Positive results do not rule out co-infection with other bacteria or viruses and should not be used as the sole basis for diagnosis, treatment, or other patient management decisions.

Performance characteristics for SARS-CoV-2 were established from November 2020 to July 2022, when SARS-CoV-2 Delta and Omicron were dominant. When other SARS-CoV-2 virus variants are emerging, performance characteristics may vary.

C Special Conditions for Use Statement(s):

Rx - For Prescription Use Only

D Special Instrument Requirements:

N/A

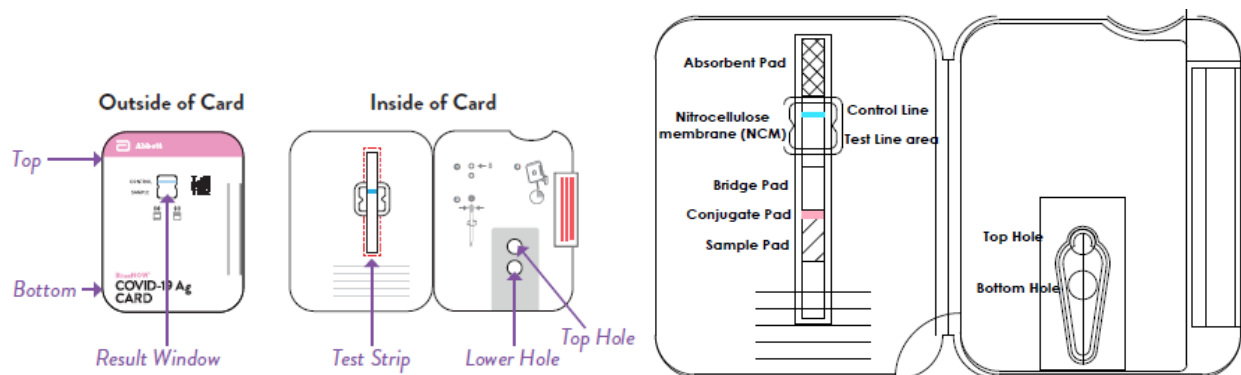
IV Device/System Characteristics:

A Device Description:

The BinaxNOW COVID-19 Ag Card is a visually read lateral flow in vitro diagnostic immunoassay intended for the qualitative detection of nucleocapsid protein antigen from SARS-CoV-2. The test uses antibodies to detect SARS-CoV-2 nucleocapsid protein from anterior nasal swab specimens. SARS-CoV-2 specific antibodies and a control antibody are immobilized onto a membrane as two distinct lines and, combined with other reagents/pads, comprise the test strip. This test strip and a well to hold the swab specimen are mounted on opposite sides of a cardboard, book-shaped hinged test card. The sample flow across the test strip only starts when the test card is closed, and the test strip is brought in direct physical contact with the sample well.

The BinaxNOW COVID-19 Ag Card is comprised of:

- Test Cards: A cardboard, book-shaped hinged test card containing the test strip
- Extraction Reagent: Bottle containing 7.5 mL of extraction reagent
- Nasal Swabs
- Positive Control Swab: Non-infectious recombinant SARS-CoV-2 nucleocapsid antigen dried onto a swab
- Negative Control Swab
- Product Insert
- Procedure Card



Materials Available as an Optional Accessory:

- **REF 195-080:** BinaxNOW COVID-19 Ag Positive Control Swab Pack (Contains ten (10) Positive Control Swabs).
- **REF 190-090:** BinaxNOW COVID-19 Ag Reagent Accessory Pack (Contains two (2) bottles of 7.5 mL Extraction Reagent bottles).

B Principle of Operation:

The BinaxNOW COVID-19 Ag Card is an immunochromatographic membrane assay that uses antibodies to detect SARS-CoV-2 nucleocapsid protein from anterior nasal swab specimens. The device consists of a nitrocellulose membrane with adsorbed anti-SARS-CoV-2 antibodies for the sample line and adsorbed Chicken antibodies for the control line. Anti-Chicken and anti-SARS-CoV-2 specific antibodies are conjugated to visualizing particles that are dried onto an inert fibrous support referred to as conjugate pad. The conjugate pad and striped membrane are combined to construct the test strip. The test strip and a well to hold the swab specimen are mounted on opposite sides of a hinged, book shaped test device.

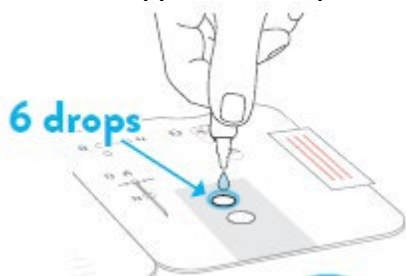
To perform the test, an anterior nasal swab specimen is collected from the patient. Extraction reagent (6 drops) is added from a dropper bottle to the swab well and then the swab is inserted into the test card. The swab is rotated 3 times to elute, lyse and homogenize the sample material from the swab. The card is then closed, bringing the extracted sample into contact with the test strip. As the sample flows along the strip, SARS-CoV-2 antigen first binds to a colloidal gold-conjugated anti-SARS-Cov-2 specific antibody and then is captured by immobilized anti-SARS-CoV-2 antibody, resulting in the presence of a visible line. The control line is formed when colloidal gold-conjugated anti-Chicken antibodies are carried along the test strip by the sample and captured by immobilized Chicken antibodies. Test results are read visually at 15 minutes without the use of an instrument.

C Description of Test Steps

1. Remove test card from pouch. Make sure the blue control line is present in the result window. Open the card and lay it flat on the table with the pink side down.

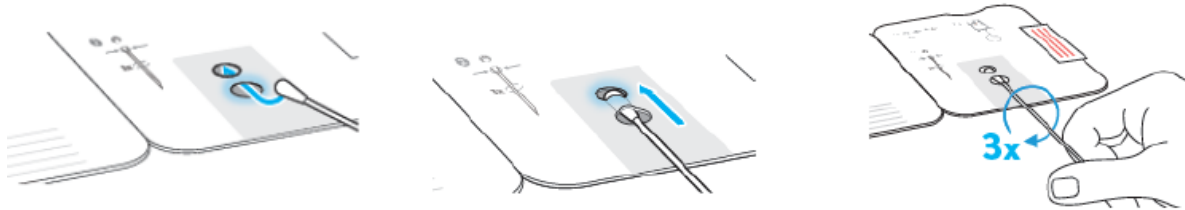


2. Remove dropper bottle cap. Put 6 drops into the top hole.



3. Collect nasal swab, swabbing each nostril for about 15 seconds.

4. Insert swab tip into the lower hole of the test card. Push the swab tip from the lower hole until it is visible in the top hole. Turn swab to the right 3 times to mix the swab with the drops.



5. Peel the adhesive liner off and close left side of the card over swab. Press firmly to seal.



6. Read the result at 15 minutes.
7. Interpretation of Results:

Negative A negative specimen will give a single pink/purple colored Control Line in the top half of the window, indicating a negative result. This Control Line means that the detection part of the test was done correctly, but no COVID-19 antigen was detected.	 Pink/Purple Control Line
Positive A positive specimen will give two pink/purple colored lines. This means that COVID-19 antigen was detected. Specimens with low levels of antigen may give a faint Sample Line. Any visible pink/purple colored line is positive.	 Pink/Purple Control Line Pink/Purple Sample Line
Invalid If no lines are seen, if just the Sample Line is seen, or the Blue Control Line remains blue, the assay is invalid. Invalid tests should be repeated.	Invalid Result  No Control Line  Sample Line Only  Blue Control Line Only  Blue Control Line Sample Line

V Substantial Equivalence Information:

A Predicate Device Name(s):

Nano-Check COVID-19 Antigen Test

B Predicate 510(k) Number(s):

K231187

C Comparison with Predicate(s):

Device & Predicate Device(s):	<u>K250273</u> (Candidate Device)	<u>K231187</u> (Predicate Device)
Device Trade Name	BinaxNOW COVID-19 Ag Card	Nano-Check COVID-19 Antigen Test
General Device Characteristic Similarities		
Product Code	QVF	Same
Assay Target	SARS-CoV-2 Nucleocapsid Protein	Same
Intended Use/Indications For Use	The BinaxNOW COVID-19 Ag Card is a lateral flow immunochromatographic assay for the rapid, qualitative detection of the SARS-CoV-2 nucleocapsid protein antigen directly in anterior nasal swab specimens from individuals with signs and symptoms of upper respiratory tract infection (i.e., symptomatic). The test is intended for use as an aide in the diagnosis of SARS-CoV-2 infections (COVID-19) in symptomatic individuals when either: tested at least twice over three days with at least 48 hours between tests; or when tested once, and negative by the BinaxNOW COVID-19 Ag Card and followed up with a molecular test. A negative test result is presumptive and does not preclude SARS-CoV-2 infection; it is recommended these results be confirmed by a molecular SARS-CoV-2 assay.	The Nano-Check COVID-19 Antigen Test is a lateral flow immunochromatographic assay for the rapid, qualitative detection of SARS-CoV-2 nucleoprotein protein antigens directly in anterior nasal swab specimens from individuals with signs and symptoms of upper respiratory infection (i.e., symptomatic) when testing is started within 4 days of symptom onset. The test is intended for use as an aid in the diagnosis of SARS-CoV-2 infections (COVID-19) in symptomatic individuals when either: tested at least twice over three days with at least 48 hours between tests; or when tested once, and negative by the Nano-Check COVID-19 Antigen Test and followed with a molecular test. The test does not differentiate between SARS-CoV or SARS-CoV-2. A negative test result is presumptive, and it is recommended these results be confirmed by a molecular SARS-CoV-2 assay.

Device & Predicate Device(s):	<u>K250273</u> (Candidate Device)	<u>K231187</u> (Predicate Device)
	Positive results do not rule out co-infection with other bacteria or viruses and should not be used as the sole basis for diagnosis, treatment, or other patient management decisions. Performance characteristics for SARS-COV-2 were established from November 2020 to July 2022, when SARS-CoV-2 Delta and Omicron were dominant. When other SARS-CoV-2 virus variants are emerging, performance characteristics may vary.	Positive results do not rule out co-infection with other bacteria or viruses and should not be used as the sole basis for diagnosis, treatment, other patient management decisions. Performance characteristics for SARS-Cov-2 were established during the 2022 SARS-CoV-2 pandemic when SARS-CoV-2 Omicron was the predominate SARS-CoV-2 variant in circulation. When other SARS-CoV-2 virus variants are emerging, performance characteristics may vary.
Instrument	None	Same
Automated Assay	No	Same
Sample Type	Anterior Nasal Swabs	Same
Test Technology	Lateral Flow Immunoassay	Same
Target Analyte	SARS-CoV-2 Nucleocapsid Protein	Same
Internal Control	Yes	Same
Result Interpretation	Visually Read	Same
Assay Result	Qualitative	Same
Time to Result	15 Minutes	Same
Differences		
Test Cassette	Cardboard, book-shaped hinge test card containing test strip.	Plastic housing containing test strip.
Extraction Reagent	Bottle (7.5 mL)	Ampule (0.3 mL)
Empty Reaction Tube for Sample Extraction	No	Yes
Volume of Extracted Patient Sample to Swab/Cassette	Six (6) drops added to top hole of test card containing swab.	Two (2) drops added to sample well.

VI Standards/Guidance Documents Referenced:

Document Title	Issued by	Applicable study	Purpose
Special Controls			
<u>Special Controls under 21 CFR 866.3982</u>	FDA/CDRH	All Studies	General Use
Consensus Standard			
ISO 11135:2014, <i>Sterilization of health care products - Ethylene oxide - Requirements for development, validation and routine control of a sterilization process for medical devices</i>	ISO	Sterility	Declaration of Conformity
ISO 10993-7, <i>Biological Evaluation of Medical Devices – Part 7: Ethylene Oxide Sterilization Residuals</i>	ISO	Sterility	Declaration of Conformity
ISO 11137-1:2015, <i>Sterilization of health care products — Radiation</i>	ISO	Sterility	Declaration of Conformity
ISO 10993-1:2018, <i>Biological evaluation of Medical Devices Evaluation testing within a risk management process</i>	ISO	Biocompatibility	Declaration of Conformity
ISO 10993-2:2006, <i>Biological Evaluation of Medical Devices Animal welfare requirements</i>	ISO	Biocompatibility	Declaration of Conformity
ISO 10993-5:2009, <i>Biological Evaluation of Medical Devices Tests for In vitro cytotoxicity</i>	ISO	Biocompatibility	Declaration of Conformity
ISO 10993-10:2013, <i>Biological Evaluation of Medical Devices Tests for irritation and skin sensitization</i>	ISO	Biocompatibility	Declaration of Conformity
ISO 14971:2019, <i>Application of risk management to medical devices</i>	ISO	Biocompatibility	Declaration of Conformity
USP 87 (2018), <i>Biological reactivity tests, in vitro</i>	USP	Biocompatibility	General Use
ISO 10993-10:2010, <i>Biological evaluation of medical devices – Part 10: Tests for irritation and skin sensitization</i>	ISO	Biocompatibility	General Use
ISO 10993-12:2012, <i>Biological evaluation of medical devices - Part 12: Sample preparation and reference materials</i>	ISO	Biocompatibility	General Use
ISO 10993-17:2009, <i>Biological evaluation of medical devices - Establishment of allowable limits for leachable substances</i>	ISO	Biocompatibility	General Use
ISO 10993-18:2020, <i>Biological Evaluation of Medical Devices Chemical characterization of material</i>	ISO	Biocompatibility	General Use

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:

A precision/reproducibility study was conducted with the BinaxNOW CoVID-19 Ag Card at three (3) CLIA-waived external sites by a total of nine (9) untrained operators (3 operators per site). Each operator tested six (6) samples comprised of four (4) panel members (Table 1), two (2) times a day (AM and PM), across five (5) non-consecutive days. Contrived samples were prepared utilizing inactivated SARS-CoV-2 (USA-WA1/2020) diluted into

negative nasal swab matrix (NSM) to Moderate Positive (5X LoD), Low Positive (1X LoD), and High Negative (0.05X LoD). True negative (TN) samples consisted of NSM only. Contrived samples were applied to individual dry nasal swabs which were blinded, randomized, and tested across three (3) reagent lot numbers. Results were generated from a total 540 samples (3 sites x 3 operators/site x 2 times a day x 5 non-consecutive days x 6 replicates/operator/day). Over the course of the study, each operator tested fifteen (15) samples per panel member.

Table 1. Contrived Positive and Negative Panel Members

Sample	SARS-CoV-2 Concentration	Expected Results
Moderate Positive (5X LoD)	2187.5 TCID ₅₀ /mL	Positive
Low Positive (1X LoD)	437.5 TCID ₅₀ /mL	
High Negative (0.05X LoD)	23.03 TCID ₅₀ /mL	Negative
True Negative	NSM Only	

A summary of percent agreement with expected results for each panel member by operator, site, and reagent lot number is presented in Tables 2 and 3 below. All daily controls performed by each operator generated the expected results on each day of testing (data not shown).

Table 2. Reproducibility: Percent Agreement with Expected Results by Untrained Operators

Sample	Positive Percent Agreement / Total									
	Site: 1			Site: 2			Site: 3			Totals
	Operators			Operators			Operators			
	X _{1A} [#]	Y ₁	Z ₁	X ₂	Y ₂	Z ₂	X ₃	Y ₃	Z ₃	95% CI
Moderate Positive (5X LoD)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (135/135)
										97.2%-100%
Low Positive (1X LoD)	100% (15/15)	86.7% (13/15)	93.3% (14/15)	100% (15/15)	93.3% (14/15)	100% (15/15)	80% (12/15)	93.3% (14/15)	100% (15/15)	94.1% (127/135)
										88.7%-97.0%
High Negative (0.05X LoD)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	92.3%* (12/13)	99.2% (132/133)
										95.9%-99.9%
True Negative	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	93.3% (14/15)	99.3% (134/135)
										95.9%-99.9%
# Operator X _{1A} replaced Operator X ₁ who did not participate in study due to time constraints.										
* Two samples excluded: Interpreted before 15 minutes was completed.										

Table 3. Lot-to-Lot Precision Results

Untrained Operators					
Sample	Lot 1 (381213)	Lot 2 (391213)	Lot 3 (371213)	% Agreement	95% CI
Moderate Positive (5X LoD)	100% (45/45)	100% (45/45)	100% (45/45)	100% (135/135)	97.2% - 100.0%

Low Positive (1X LoD)	93.3% (42/45)	90.9% (40/44)	97.8% (45/46)	94.1% (127/135)	88.7% - 97.0%
High Negative (0.05X LoD)	100%* (44/44)	97.8% (44/45)	100%* (44/44)	99.2% (132/133)	95.9% - 99.9%
True Negative	100% (45/45)	97.8% (44/45)	100% (45/45)	99.3% (134/135)	95.9% - 99.9%
* Excluded Sample: Interpreted before 15 minutes was completed.					

The results obtained from this study demonstrated that the BinaxNOW COVID-19 Ag Card that untrained operators in CLIA waived settings can perform this test consistently and accurately with organism concentrations near the assay LoD and that performance is consistent across multiple lots.

2. Linearity:

Not applicable; this test device only produces binary qualitative results.

3. Analytical Specificity/Interference:

a) *Cross-Reactivity and Microbial Interference Study*

Cross reactivity and potential microbial interference with the BinaxNOW COVID-19 Ag Card was evaluated by testing 28 commensal and pathogenic microorganisms that are reasonably likely to be encountered in nasal swab specimens. A total of 9 bacteria, 17 viruses, 1 yeast and 1 negative clinical matrix sample (pooled human nasal wash) were tested. Each organism/virus was tested in five replicates in NSM in the absence (cross-reactivity) and presence (interference) of 3X LoD SARS-CoV-2 (inactivated USA-WA1/2020) in a randomized and blinded manner. No cross-reactivity or interference was seen with the microorganisms in the table below when tested at 1×10^6 CFU/mL for bacteria and yeast and at 1×10^5 TCID₅₀/mL for viruses. Results are summarized below, reflecting the number of SARS-CoV-2 positive results obtained.

Table 4. Microorganisms evaluated for Cross-Reactivity and Microbial Interference

Type	Microorganism	Cross-reactivity	Microbial Interference
Viruses	Human Adenovirus 1	0% (0/5)	100% (5/5)
	Human Coronavirus 229E	0% (0/5)	100% (5/5)
	Human Coronavirus NL63	0% (0/5)	100% (5/5)
	Human Coronavirus OC43	0% (0/5)	100% (5/5)
	Human Coronavirus HKU1*	0% (0/5)	100% (5/5)
	Enterovirus 70	0% (0/5)	100% (5/5)
	Human Metapneumovirus (hMPV)	0% (0/5)	100% (5/5)
	Human Parainfluenza virus 1	0% (0/5)	100% (5/5)
	Human Parainfluenza virus 2	0% (0/5)	100% (5/5)
	Human Parainfluenza virus 3	0% (0/5)	100% (5/5)
	Human Parainfluenza virus 4	0% (0/5)	100% (5/5)
	RSV A	0% (0/5)	100% (5/5)
	Rhinovirus 1A	0% (0/5)	100% (5/5)
	MERS-coronavirus	0% (0/5)	100% (5/5)
	Human Influenza A/California/07/09	0% (0/5)	100% (5/5)
	Human Influenza A/New Caledonia/20/99	0% (0/5)	100% (5/5)
	Human Influenza A/Brisbane/02/18	0% (0/5)	100% (5/5)
	Human Influenza B/Wisconsin/1/10	0% (0/5)	100% (5/5)

Bacteria	<i>Bordetella pertussis</i>	0% (0/5)	100% (5/5)
	<i>Chlamydia pneumoniae</i>	0% (0/5)	100% (5/5)
	<i>Haemophilus influenzae</i>	0% (0/5)	100% (5/5)
	<i>Legionella pneumophila</i>	0% (0/5)	100% (5/5)
	<i>Mycoplasma pneumoniae</i>	0% (0/5)	100% (5/5)
	<i>Staphylococcus aureus</i>	0% (0/5)	100% (5/5)
	<i>Staphylococcus epidermidis</i>	0% (0/5)	100% (5/5)
	<i>Streptococcus pneumoniae</i>	0% (0/5)	100% (5/5)
	<i>Streptococcus pyogenes</i>	0% (0/5)	100% (5/5)
Yeast	<i>Candida albicans</i>	0% (0/5)	100% (5/5)
Other	Pooled Human Nasal Wash	0% (0/5)	100% (5/5)

*Human Coronavirus HKU1 was evaluated as a clinical sample in VTM (i.e., not cultured). Accordingly, the relative concentration was quantified in Ct-values, wherein four positive clinical samples ranging from 22.3 – 32.0 Ct were evaluated herein. No cross-reactivity or interference with SARS-CoV-2 was observed.

b) *Endogenous and Exogenous Interfering Substances Study*

An interfering substances study was conducted to assess if frequently encountered endogenous or exogenous substances interfere with the performance of the BinaxNOW COVID-19 Ag Card. Each potentially interfering substance was tested in five replicates in NSM in the presence or absence of 3X LoD SARS-CoV-2 (USA-WA1/2020) and at concentrations as indicated in Table 5 below. Samples were prepared by applying 20 µL of sample to the dry swab and thereafter swabs were processed according to the test instructions for use using one lot of test device. The effects of the substances were evaluated by the agreement with the expected positive or negative results. None of the evaluated substances demonstrated interference with the assay at the tested concentrations. Results are summarized below (Table 5), reflecting the number of SARS-CoV-2 positive results obtained.

Table 5. *Endogenous and Exogenous Substances evaluated for Interference*

Substance	Active Ingredient	Concentration	Cross-reactivity	Interference
Throat Lozenge	Menthol, Benzocaine	3 mg/mL	0% (0/5)	100% (5/5)
Sore Throat Spray	Phenol	5% w/v	0% (0/5)	100% (5/5)
OTC Nasal Spray 1	Mometasone Furoate	15% v/v	0% (0/5)	100% (5/5)
OTC Nasal Spray 2	Triamcinolone	15% v/v	0% (0/5)	100% (5/5)
OTC Nasal Spray 3	Budesonide	15% v/v	0% (0/5)	100% (5/5)
OTC Nasal Spray 4	Fluticasone	15% v/v	0% (0/5)	100% (5/5)
OTC nasal gel	Sodium Chloride with Preservatives	15% v/v	0% (0/5)	100% (5/5)
OTC Nasal Spray 5	Phenylephrine	15% v/v	0% (0/5)	100% (5/5)
OTC Nasal Spray 6	Oxymetazoline	15% v/v	0% (0/5)	100% (5/5)
OTC Nasal Spray 7	Cromolyn	15% v/v	0% (0/5)	100% (5/5)

Substance	Active Ingredient	Concentration	Cross-reactivity	Interference
OTC Homeopathic Nasal Spray	<i>Zicam (Galphimia glauca, Histaminum hydrochloricum, Luffa operculata, sulfur)</i>	15% v/v	0% (0/5)	100% (5/5)
OTC Homeopathic Nasal Wash	Alkalol	15% v/v	0% (0/5)	100% (5/5)
Hand Sanitizer	Ethyl Alcohol 62%	1% w/v	0% (0/5)	100% (5/5)
Hand Soap		1% w/v	0% (0/5)	100% (5/5)
Endogenous	Whole Blood	2.5% v/v	0% (0/5)	100% (5/5)
Endogenous	Mucin	2.5 mg/mL	0% (0/5)	100% (5/5)
Endogenous	Leukocytes	5 x 10 ⁶ cells/mL	0% (0/5)	100% (5/5)
Antibiotic, Nasal Ointment	Mupirocin	10 mg/mL	0% (0/5)	100% (5/5)
Nasal Corticosteroid 1	Beclomethasone	15% v/v	0% (0/5)	100% (5/5)
Nasal Corticosteroid 2	Dexamethasone	15% v/v	0% (0/5)	100% (5/5)
Nasal Corticosteroid 3	Flunisolide	15% v/v	0% (0/5)	100% (5/5)
Anti-Viral Drug 1	Tamiflu (Oseltamivir Phosphate)	5 mg/mL	0% (0/5)	100% (5/5)
Anti-Viral Drug 2	Remdesivir	5 mg/mL	0% (0/5)	100% (5/5)
Anti-Viral Drug 3	Molnupiravir	5 mg/mL	0% (0/5)	100% (5/5)
Antibiotic	Tobramycin	1.44 mg/mL	0% (0/5)	100% (5/5)
Anti-Viral Drug	Zanamivir	281.5 ng/mL	0% (0/5)	100% (5/5)

4. Assay Reportable Range:

Not applicable; this test device only produces qualitative results.

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

a) *Internal Controls*

The test uses an internal control antibody immobilized onto the test strip that forms a line distinct from the analyte specific test line on each individual test. The pink-to-purple line at the “Control” position serves as an internal procedural control. If the test flows and the reagents work, this line will always appear.

b) *External Positive and Negative Controls*

Each BinaxNOW COVID-19 Ag Card kit contains a Positive Control Swab and sterile patient nasal swab which can be used as a Negative Control Swab. These swabs will monitor the entire assay. These controls are recommended to be tested as follows:

- Each new shipment of BinaxNOW COVID-19 Ag Card kits received.
- Once for each untrained operator.

- Additional testing may be needed to conform with local, state, and/or federal regulations, accrediting groups, or a laboratory standard Quality Control procedures.

c) Specimen Stability

Specimen stability was assessed using contrived positive samples prepared with 2X LoD inactivated SARS-CoV-2 (USA-WA1/2020 isolate) in negative clinical matrix (NCM). Negative samples prepared with NCM only were also included. Swab samples were inoculated with positive or negative material and either tested immediately or stored at 28 – 32°C. Samples were blinded and then provided to different operators who performed the testing. Five (5) replicates of positive samples and five (5) replicates of negative samples were tested in accordance with the package insert at each timepoint for each storage condition. Results are summarized below (Table 6). All samples gave expected results.

Table 6. Specimen Stability – Percent Agreement with Expected Results

Sample	Timepoints (hours)									
	0	1	1.5	2	3	4	5	6	7	8
2x LoD	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)
NCM	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)

d) Reagent Stability and Shelf-life

To determine the shelf-life of the BinaxNOW COVID-19 Ag Card in the intended storage conditions (15-30°C), real-time stability studies were conducted using three lots of each test kit component. Component lots were stored at room temperature (28-32°C) and were held at these conditions for the duration of the study.

The test components were tested at specified time points using positive test samples with analyte concentrations near the LoD of the test ($\leq 3X$ LoD) and negative test samples (Negative Clinical Matrix).

Results obtained at each storage timepoint were compared to testing at baseline (t=0). Data collected to date across all real-time shelf-life studies support a test kit shelf-life of 22 months.

6. Detection Limit:

a) Limit of Detection

The limit of detection (LoD) of the BinaxNOW COVID-19 Ag Card was determined by evaluating different dilutions of SARS-CoV-2 in negative clinical matrix (NCM), using two strains: 1) heat inactivated SARS-CoV-2 isolate USA-WA1/2020; and 2) heat inactivated SARS-CoV-2 Omicron variant lineage B.1.1.529. A total of three lots of test devices were used across each of the two strains. Samples were prepared by inoculating a dry swab with 20 μ L of the indicated dilution and then processing the swab according to the test instructions for use.

1:10 serial dilutions were first prepared in NSM and tested in triplicate on each of three lots of BinaxNOW COVID-19 Ag Card until negative results were generated for all replicates. Thereafter, 1:2 serial dilutions were prepared (starting from the lowest 1:10

dilution level that produced positive results for all replicates) and were tested in 20 replicates until <95% of results were positive. The preliminary LOD was determined to be the lowest level tested that produced 100% positive results (n=20) on all three lots of test devices.

Confirmation of the preliminary LOD was performed by preparing dilutions to 0.5X, 1X, and 2X the preliminary LOD determined for each SARS-CoV-2 strain. Each dilution was tested in 60 replicates per lot. The final LoD for the SCoV-2 Ag Detect Rapid Test was determined to be:

- SARS-CoV-2 isolate USA-WA1/2020: 3.5×10^3 TCID₅₀/mL
- SARS-CoV-2 Omicron variant lineage B.1.1.529: 1.6×10^3 TCID₅₀/mL

Table 7. Limit of Detection – Confirmatory Study Results

USA-WA1/2020			
SARS-CoV-2 Concentration (TCID₅₀/mL)	Lot 1	Lot 2	Lot 3
7,000	60/60 (100.0 %)	60/60 (100.0 %)	60/60 (100.0 %)
3,500	60/60 (100.0 %)	60/60 (100.0 %)	60/60 (100.0 %)
1,750	47/60 (78.3%)	37/60 (61.7%)	21/60 (35.0%)
B.1.1.529 (Omicron)			
SARS-CoV-2 Concentration (TCID₅₀/mL)	Lot 1	Lot 2	Lot 3
3,206.4	60/60 (100.0 %)	60/60 (100.0 %)	60/60 (100.0%)
1,603.2	60/60 (100.0 %)	60/60 (100.0 %)	59/60 (98.3%)
801.6	19/60 (31.7%)	12/60 (20.0%)	6/60 (10.0%)

Table 8. Limit of Detection – Final Results

Strain	LoD (TCID₅₀/mL)	LoD (TCID₅₀/swab)
USA-WA1/2020	3,500	70
B.1.1.529 (Omicron)	1603.2	32.064

b) International Standard Material NIBSC code: 21/368 – Limit of Detection

The LoD of the BinaxNOW COVID-19 Ag Card was also determined by evaluating different dilutions of the International Standard Material for SARS-CoV-2 antigen (NIBSC code: 21/368) in NSM. The SARS-CoV-2 standard containing lyophilized SARS-CoV-2 antigen was reconstituted in 250 µL of ultra-pure water for a final concentration of 20,000 IU/mL. Swab samples were prepared by dispensing 20 µL of the testing dilution onto a swab head and tested according to the test instructions.

The LoD was determined as the lowest virus concentration that was detected $\geq 95\%$ of the time (i.e., concentration at which at least 19 out of 20 replicates tested positive). The limit of detection was established in two phases. For the preliminary LoD, five serial 1:2 dilutions were prepared in NSM and tested in triplicate on the BinaxNOW COVID-19 Ag Card until negative results were generated for all replicates. Confirmation of the preliminary LoD (500 IU/mL) was performed by preparing 17 additional swabs with the preliminary LoD dilution and testing on BinaxNOW COVID-19 Ag Card (added to the initial triplicate results for a total of twenty replicates). The results are summarized below.

Table 9. Limit of Detection – International Standard Material NIBSC code: 21/368

Standard Material (IU/mL)	% Detected (n/N)
500	100% (20/20)
375	100% (20/20)
250	20% (4/20)

The analytical sensitivity (LoD) for the BinaxNOW COVID-19 Ag Card with the International Standard Material NIBSC code: 21/368 for SARS-CoV-2 Antigen is 375 IU/mL or 7.5 IU/swab.

7. High-dose Hook Effect:

A high-dose Hook Effect study was conducted to assess the performance of the BinaxNOW COVID-19 Ag Card for a potential hook effect at high concentrations of SARS-CoV-2 (i.e., false negatives). Positive samples were prepared from inactivated SARS-CoV-2 (USA-WA1/2020) at three high concentrations. Positive and negative samples (comprising negative clinical matrix only) were tested in five replicates each, per the IFU. Test samples were prepared by a study operator and then provided to different operators who were blinded to the sample identity to perform the test. No high dose hook effect was observed when tested with up to a concentration of 1.4×10^6 TCID₅₀/mL of inactivated SARS-CoV-2 virus with the BinaxNOW COVID-19 Ag Card.

Table 10. High-dose Hook Effect Study

Sample	Concentration	% Detected (n/N)
SARS-CoV-2	1.4×10^6 TCID ₅₀ /mL	100% (5/5)
	7.0×10^5 TCID ₅₀ /mL	100% (5/5)
	7.0×10^4 TCID ₅₀ /mL	100% (5/5)
Negative	0 TCID ₅₀ /mL	100% (5/5)

8. Inclusivity (Analytical Reactivity):

An inclusivity study was performed to demonstrate that the BinaxNOW COVID-19 Ag Card can detect the nucleocapsid protein across a variety of SARS-CoV-2 strains. 19 variants of SARS-CoV-2 were prepared in NSM, and each tested in five (5) replicates. 20µL of the dilutions were applied directly to the dry swab head and swabs processed according to the test instructions for use. The lowest concentration that produces 5/5 COVID-19 positive results were considered the 100% detection rate. Results are summarized below.

Table 11. Analytical Reactivity with SARS-CoV-2 Variants

SARS-CoV-2 Variant	Concentration (TCID ₅₀ /mL)	% Positive (n/N)
Alpha (B.1.1.7)	3.50×10^4	100% (5/5)
Beta (B.1.351)	7.00×10^3	100% (5/5)
Delta (B.1.617.2)	1.75×10^3	100% (5/5)
Gamma (P.1)	1.75×10^3	100% (5/5)
Iota (B.1.526)	7.00×10^3	100% (5/5)
Italy-INMI ₁	3.50×10^4	100% (5/5)
Kappa (B.1.617.1)	1.05×10^4	100% (5/5)
Omicron (BA.2.3)	2.63×10^3	100% (5/5)
Omicron (BA.2.12.1)	1.31×10^3	100% (5/5)
Omicron (BA.2.75.5)	8.75×10^2	100% (5/5)
Omicron (BA.4.6)	3.50×10^3	100% (5/5)
Omicron (BA.5)	5.60×10^4	100% (5/5)

Omicron (BA.5.5)	1.10×10^2	100% (5/5)
Omicron (BF.5)	3.50×10^3	100% (5/5)
Omicron (BF.7)	1.40×10^4	100% (5/5)
Omicron (BQ.1)	7.00×10^3	100% (5/5)
Omicron (BQ1.1)	8.75×10^2	100% (5/5)
Omicron (JN.1)*	3.63×10^2	100% (5/5)
Omicron (XBB)	2.80×10^4	100% (5/5)
Zeta (P.2)	3.50×10^3	100% (5/5)

*Units quantified in terms of IFU/mL, instead of TCID₅₀/mL.

9. Assay Cut-Off:

Not applicable; this test device only produces qualitative results.

B Comparison Studies:

1. Method Comparison with Predicate Device:

See Section C (Clinical Studies) below.

2. Matrix Comparison:

The BinaxNOW COVID-19 Ag Card is only intended for qualitative detection of nucleocapsid protein antigen from SARS-CoV-2 in direct anterior nasal swab specimens. As no other sample type is claimed for this device, a matrix comparison study to support other sample types for clinical testing with this device was not performed.

C Clinical Studies:

The performance of the BinaxNOW COVID-19 Ag Card in detecting SARS-CoV-2 viral nucleoprotein antigen from anterior nasal swab samples was evaluated in a multi-center, prospective study with lay users in the U.S. during two distinct time frames ranging from November 2020 to July 2022. Across six sites, a total of 765 untrained lay users were enrolled into the study and self-tested (or tested another). The study only enrolled subjects with symptoms of respiratory infection consistent with SARS-CoV-2 infection.

An anterior nasal (AN) swab was self-collected by each study subject and immediately tested with the BinaxNOW COVID-19 Ag Card according to the test device's quick reference instructions. A second swab was collected by the study operator (either an anterior nasal swab or mid-turbinate swab), placed into a transport tube containing viral transport media, refrigerated, and shipped to a central lab for testing with a highly sensitive RT-PCR comparator assay. The investigational sample was collected first, followed then by the comparator swab. Demographics, symptom information, and health history were also collected from each subject.

There were 604 evaluable subjects with an average age of 37 years. Approximately 43% (262/604) were male and 56% (342/604) were female (2 subjects were undisclosed; 0.33%). A total of 161 subjects of the total 765 enrolled were excluded because they did not meet the inclusion criteria, or their samples had invalid or missing comparator results. Results obtained with the BinaxNOW COVID-19 Ag Card were compared to the results obtained with a highly sensitive RT-PCR comparator test to determine agreement with the true clinical status of the patient.

The BinaxNOW COVID-19 Ag Card demonstrated a positive percent agreement (PPA) of 86.9% (186/214; 95% CI: 81.7% - 90.8%) and a negative percent agreement (NPA) of 98.5% (384/390; 95% CI: 96.7% - 99.3%) when compared to the comparator method.

Table 12. Performance of BinaxNOW COVID-19 Ag Card against RT-PCR Comparator

		RT-PCR Comparator		Total
		Positive	Negative	
BinaxNOW COVID-19 Ag Card	Positive	186	6	192
	Negative	28	384	412
	Total	214	390	604

PPA: 86.92% (186/214; 95% CI: 81.7% - 90.8%)

NPA: 98.46% (384/390; 95% CI: 96.7% - 99.3%)

Table 13. Performance Metrics of BinaxNOW COVID-19 Ag Card stratified by Days Post-Symptom Onset (DPSO)

Days Post-Symptom Onset	PPA by DPSO	NPA by DPSO
Day 0	69.23% (9/13)	100.00% (24/24)
Day 1	89.71% (61/68)	98.92% (92/93)
Day 2	86.36% (57/66)	100.00% (97/97)
Day 3	86.67% (39/45)	97.78% (88/90)
Day 4	83.33% (10/12)	96.61% (57/59)
Day 5	100.00% (10/10)	96.30% (26/27)

Table 14. Performance of the BinaxNOW COVID-19 Ag Card stratified by sample collection timeframe.

Dominant Variant	Study Date Range	PPA	NPA
Pre-Omicron (n=295)	November 2020 – March 2021	81.61% (71/87)	98.56% (205/208)
Omicron (n=309)	February 2022 – July 2022	90.55% (115/127)	98.35% (179/182)

1. Clinical Sensitivity:

Refer to Section VII.C (Clinical Studies) above for the clinical validation, including test sensitivity/positive percent agreement (PPA). The PPA for the test is 86.916% (186/214; 95% CI: 81.7% - 90.8%).

2. Clinical Specificity:

Refer to Section VII.C (Clinical Studies) above for the clinical validation, including test specificity/negative percent agreement (NPA). The NPA for the test is 98.462% (384/390; 95% CI: 96.7% - 99.3%).

3. Serial Testing:

This clinical data set verifies the known lower sensitivity for samples collected on the day of symptom onset (i.e., Day 0) that was observed for test devices of similar technology and design across a multitude of clinical studies. As a mitigation, the Intended Use for this test device (and associated Instructions for Use) include recommendations for repeat testing (i.e., test at least twice over three days with at least 48 hours between tests). This mitigation is supported by data generated by the National Institutes for Health (NIH) and the University of Massachusetts Chan Medical School (in collaboration with the FDA) demonstrating that repeat testing over multiple days improves test performance and increases the likelihood that a COVID-19 antigen test will accurately detect an infection. These results have informed the FDA's general understanding that repeat testing after a negative result from a COVID-19

antigen test reduces the risk of a false negative result. Please refer to the following studies for additional details:

- Finding a Needle in the Haystack: Design and Implementation of a Digital Site-less Clinical Study of Serial Rapid Antigen Testing to Identify Asymptomatic SARS-CoV-2 Infection - <https://www.medrxiv.org/content/10.1101/2022.08.04.22278274v1>.
- Performance of Screening for SARS-CoV-2 using Rapid Antigen Tests to Detect Incidence of Symptomatic and Asymptomatic SARS-CoV-2 Infection: findings from the Test Us at Home prospective cohort study - <https://www.medrxiv.org/content/10.1101/2022.08.05.22278466v1>.

D Clinical Cut-Off:

The Clinical Cut off study is not applicable, as there is not clinical cutoff related to the presence of SARS-CoV-2 in patient samples.

E Expected Values/Reference Range:

A patient sample is expected to be negative for SARS-CoV-2.

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.

The submitted information in this CLIA waiver application supports a CLIA waiver approval decision.