510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY AND INSTRUMENT

I Background Information:

A 510(k) Number

K243872

B Applicant

Becton, Dickinson and Company

C Proprietary and Established Names

BD Veritor System for SARS-CoV-2

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 BD Veritor System for SARS-CoV-2

B Measurand:

SARS-CoV-2 nucleocapsid antigens

C Type of Test:

Lateral flow immunochromatography

III Intended Use/Indications for Use:

A Intended Use(s):

See Indications for Use below.

B Indication(s) for Use:

The BD Veritor System for SARS-CoV-2 is a chromatographic digital immunoassay for the rapid, qualitative detection of SARS-CoV-2 nucleocapsid protein antigens directly in anterior nasal swab specimens from individuals with signs and symptoms of upper respiratory 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 BD Veritor System for SARS-CoV-2 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.

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 between April 2024 and August 2024 when SARS-CoV-2 Omicron was the predominant SARS-CoV-2 variant in circulation. Performance characteristics may vary with newly emerging SARS-CoV-2 virus variants.

C Special Conditions for Use Statement(s):

Rx - For Prescription Use Only

IVD - For In Vitro Diagnostic Use Only

D Special Instrument Requirements:

The BD Veritor System for SARS-CoV-2 test is intended for use with the BD Veritor Plus Analyzer (hardware v2.00/firmware v6.10 or later).

IV Device/System Characteristics:

A Device Description:

The BD Veritor System for SARS-CoV-2 is a rapid (approximately 15 minutes) qualitative chromatographic digital immunoassay for the direct detection of nucleocapsid protein antigens from SARS-CoV-2 in direct anterior nasal swab specimens collected from patients with signs and symptoms of COVID-19 by a healthcare provider. The test is intended for interpretation in laboratory and near patient testing environments only with the BD Veritor Plus Analyzer Instrument. The test is not intended to be interpreted visually.

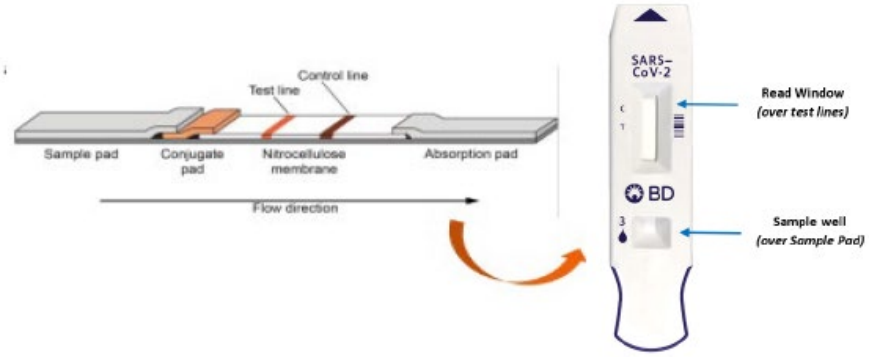

Figure 1: Test device

The test device is composed of a plastic housing, known as a cassette, that contains a test strip with the following parts: sample pad, conjugate pad, nitrocellulose membrane, and absorption pad. The patient sample is placed in the tube containing extraction buffer, where the virus particles in the sample are disrupted, exposing internal viral nucleoproteins. After disruption, the sample is dispensed into the sample well of the cassette.

When specimens are processed and added to the test device, SARS-CoV-2 antigens present in the specimen bind to biotinylated antibodies and antibodies conjugated to detector particles, colloidal gold nanoparticles, in the test strip. The biotinylated antibody-antigen-conjugate complexes migrate across the test strip to the reaction area and are captured by a line of streptavidin bound on the membrane.

The assay is only intended for use with an opto-electronic interpretation instrument, the BD Veritor Plus Analyzer Instrument and is not interpreted visually. The analyzer measures the amount of light reflected from various zones along the assay strip. The measurement of the assay background zone is an important factor during the test interpretation as the reflectance value is compared to that of the control and test zones. The instrument analyzes the reflectance data to provide the proper test interpretation.

The BD Veritor test devices are designed with four spatially distinct reaction zones (Figure 2).

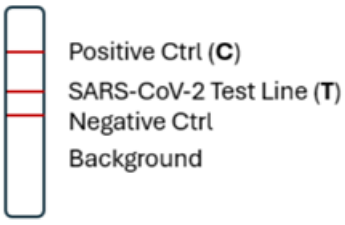

Figure 2: Reaction zones on the test device: positive control position (C), test line position for SARS-CoV-2 (T), negative control position, and a background zone.

A positive result is determined by the analyzer when antigen-conjugate is deposited at the Test "T" position and a control conjugate is deposited at the Control "C" position on the assay device. Two of the four distinct zones on the test device, negative control and background, are not labeled. The active negative control feature in each test identifies and compensates for specimen-related, nonspecific signal generation. The remaining zone is used to measure the assay background. The analyzer automatically scans the test strip, collects and analyzes the data, and then calculates and reports the result as either positive, negative, or invalid. The instrument

analyzes and corrects for non-specific binding and detects positives not recognized by the unaided eye to provide an objective result. The analyzer uses a proprietary algorithm which subtracts nonspecific signal at the negative control line from the signal present at the test line. If the resultant test line signal is below the cutoff, the specimen is scored as negative. Use of the active negative control feature allows the BD Veritor System to correctly interpret test results that cannot be scored visually because the human eye is unable to accurately perform the subtraction of the nonspecific signal.

The analyzer is a portable, electronic instrument that uses a reflectance-based measurement method to evaluate line signal intensities on the assay test device. It applies assay-specific firmware algorithms to determine the presence or absence of target analyte(s). The analyzer is powered by a rechargeable Li-ion battery and compact wall transformer, is intended for tabletop or benchtop use, and follows the original BD Veritor instrument model of a calibration-free limited lifetime based on the number of tests performed, the number of days from first use, and/or the maximum shelf life from the date of manufacture. By design, the analyzer has few external means for user input or output. Operation requires minimal operator interaction to complete testing and to report results. Analyzer workflow procedures depend on the instrument configuration selected by the user. In **Analyze Now** mode, the instrument evaluates test devices after the manual timing of the assay's development. In **Walk Away** mode, test devices are inserted into the analyzer immediately after the application of the specimen, and the timing of the assay development and the analysis is automated. In either case, assay results are provided to the operator on the liquid crystal display (LCD) display screen. Additional result documentation capabilities are possible with the use of a BD Veritor bar code scanning module, which can capture, display and/or integrate barcoded specimen, operator, or kit information in the test record.

B Principle of Operation:

Immunochromatographic SARS-CoV-2 antigen-antibody complexes detected via opto-electronic reader.

C Instrument Description Information:

1. Instrument Name:

   BD Veritor Plus Analyzer (hardware v.2.00/firmware v6.10)

2. Specimen Identification:

   Specimen IDs may be manually entered or scanned via the barcode scanner.

3. Specimen Sampling and Handling:

   Anterior nasal swab samples are manually transferred to test kit reagent tubes for elution and drop-wise addition to the test cassette. Freshly collected samples are processed in the extraction reagent vial.

4. Calibration:

   Not applicable

5. Quality Control:

   The test includes a positive control to ensure adequate migration of the reagents through the test membrane to the desired test line locations for the reader. The test also contains a negative control to test for non-specific binding and a background region to measure assay background when calculating test line signal strength. 1 positive and 1 negative control swab is provided per kit. Additional external controls may also be purchased separately (BD Veritor SARS-CoV-2 Control Swab Set). It is the manufacturer's recommendation that external quality controls be run after every new kit lot, when a new operator performs the test, a new shipment of test kits is received, and as required by local, state, and federal regulations. An analyzer verification cartridge is supplied to verify the BD Veritor Plus Analyzer is functioning within specifications.

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):	K243872	K231187
Device Trade Name	BD Veritor System for SARS-CoV-2	Nano-Check COVID-19 Antigen Test
General Device Characteristic Similarities		
Intended Use/Indications For Use	The BD Veritor System for SARS-CoV-2 is a chromatographic digital immunoassay for the rapid, qualitative detection of SARS-CoV-2 nucleocapsid protein antigens directly in anterior nasal swab specimens from individuals with signs and symptoms of upper respiratory 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	The Nano-Check COVID-19 Antigen Test is a lateral flow immunochromatographic assay for the rapid, qualitative detection of SARS-CoV-2 nucleocapsid 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

Device & Predicate Device(s):	K243872	K231187
	when either: tested at least twice over three days with at least 48 hours between tests; or when tested once, and negative by the BD Veritor System for SARS-CoV-2 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. 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 between April 2024 and August 2024 when SARS-CoV-2 Omicron was the predominant SARS-CoV-2 variant in circulation. Performance characteristics may vary with newly emerging SARS-CoV-2 virus variants.	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 up with a molecular test. The test does not differentiate between SARS-CoV and SARS-CoV-2. A negative test result is presumptive, and 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 during the 2022 SARS-CoV-2 pandemic when SARS-CoV-2 Omicron was the predominant SARS-CoV-2 variant in circulation. When other SARS-CoV- 2 virus variants are emerging, performance characteristics may vary. This test is intended for prescription use only and can be used in Point-of-Care settings.
Specimen type	Direct anterior nasal swab	Same
Analyte	SARS-CoV-2 nucleocapsid protein	Same
Test Type	Lateral flow immunochromatographic	Same
Test Result Type	Qualitative	Same
Test Time	15-20 minutes	Same
General Device Characteristic Differences		
Instrument	BD Veritor Plus Analyzer	None
Results Interpretation	Instrument read - BD Veritor Plus Analyzer scans the test strip and analyzes the reflectance data to provide the proper test interpretation.	Visually read - visual interpretation of the presence or absence of colored line(s) on the control and test line(s) of the test strip is used to determine Positive, Negative, or

Device & Predicate Device(s):	K243872	K231187
	The Analyzer displays the test results (Positive, Negative, or Invalid) on the screen.	Invalid results.

VI Standards/Guidance Documents Referenced:

Document number	Title	Publishing Organization
EP05-A3 (reaffirmed Sept. 2019)	Evaluation of Precision of Quantitative Measurement Procedures; Approved Guideline - Third Edition	CLSI
EP25 2nd edition	Evaluation of Stability of In Vitro Medical Laboratory Test Reagents	CLSI
62304 Edition 1.1	Medical Device Software- Software life cycle process	IEC
14971 3rd edition 2019-12	Medical devices- Application of risk management to medical devices	ISO
62366-1 Edition 1.1 2020-06	Medical devices-Part 1-Application of usability engineering to medical devices	IEC
15223-1 4th edition 2021-07	Medical devices- Symbols to be used with information to be supplied by the manufacturer- Part 1	ISO
11135:2014	Sterilization of health care products - Ethylene oxide - Requirements for development, validation, and routine control of a sterilization process for medical devices	ISO
10993-7	Biological Evaluation of Medical Devices – Part 7: Ethylene	ISO
10993-10:2010	Biological evaluation of medical devices Part 10: Tests for irritation and skin sensitization	ISO
10993-5:2009	Biological evaluation of medical devices Part 5: Tests for in vitro cytotoxicity	ISO

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:

a) Lot-to-Lot Precision and Repeatability:

The precision/repeatability studies evaluated negative samples [negative clinical matrix (NCM)] and two (2) concentrations of heat-inactivated SARS-CoV-2 (Omicron XBB) diluted in NCM: low positive (LP), and moderate positive (MP). Each operator tested two sample replicates per level twice daily for 10 days, resulting in a total of 80 replicates per sample level (2 operators x 2 sample replicates x 2 sample runs daily x 10 days). The first run of each day included three (3) independently manufactured lots of each kit component and the second run of each day included one (1) lot of each kit component. Testing was conducted in accordance with the Package Insert.

Table 1: Precision and Repeatability Study – Test Sample Panel

Level	Concentration (x LOD)	Concentration ($TCID_{50}$/mL)
Negative Sample	N/A	N/A
Low Positive	2 x LoD	1.19E+04
Moderate Positive	5 x LoD	2.98E+04

Data were analyzed by calculating percent agreement between the test results and the expected results for the sample. Results are summarized below and in Table 2:

- Negative samples produced 100% expected negative agreement (80/80)
- Low positive samples produced 100% expected positive agreement (80/80)
- Positive samples produced 100% expected positive agreement (80/80)
- Out of 480 replicates tested, there were zero (0) invalid results

Table 2: Precision and Repeatability Study Results

Level	MP (5x LoD)		LP (2x LoD)		N (NCM only)	
Operator	1	2	1	2	1	2
Run 1	60/60	60/60	60/60	60/60	60/60	60/60
Run 2	20/20	20/20	20/20	20/20	20/20	20/20
Total	80/80	80/80	80/80	80/80	80/80	80/80
% Agreement	100%	100%	100%	100%	100%	100%
95% CI	95.4%-100.0%	95.4%-100.0%	95.4%-100.0%	95.4%-100.0%	95.4%-100.0%	95.4%-100.0%
Total	160/160		160/160		160/160	
Total % Agreement	100%		100%		100%	
Total 95% CI	97.7% - 100%		97.7% - 100%		97.7% - 100%	

b) Reproducibility:

The study was designed to evaluate site-to-site, operator-to-operator, different concentrations of SARS-CoV-2, and demonstrate that the BD Veritor System for SARS-CoV-2 can be performed consistently and correctly. This study was conducted at three (3) distinct CLIA-waived sites, each with two (2) different untrained operators, testing one (1) test lot, using a panel of contrived samples consisting of the following sample concentrations: Negative (1:10 diluted nasal fluid, low positive (1x LoD), and moderate positive (5 x LoD). Each concentration was tested as follows: 2 operators x 3 sites x 5 days x 1 device lot x 3 replicates = 90 replicates for both analyte concentrations and negative samples for a total of 90 replicates per site. Samples were randomized and the operators were blinded to the samples before testing.

• Negative samples produced an overall 100.0% expected negative agreement (90/90).
• Low positive samples produced 100.0% expected positive agreement (90/90).
• Moderate positive samples produced 100.0% expected positive agreement (90/90).
• Out of 270 samples tested, there were zero (0) invalid test results obtained.

Table 3: Reproducibility Study Summary Results

Sample	Site 1 Agreement (Count)	Site 2 Agreement (Count)	Site 3 Agreement (Count)	All Sites	
				Agreement (Count)	95% CI
Negative	100% (30/30)	100% (30/30)	100% (30/30)	100% (90/90)	95.9% - 100.0%
1x LoD	100% (30/30)	100% (30/30)	100% (30/30)	100% (90/90)	95.9% - 100.0%
5x LoD	100% (30/30)	100% (30/30)	100% (30/30)	100% (90/90)	95.9% - 100.0%

2. Linearity:

This study is not applicable as this test device is a qualitive assay.

3. Analytical Specificity/Interference:

a) Cross-Reactivity and Microbial Interference Study

The cross-reactivity and potential interference were evaluated by testing various bacteria (10), viruses (20), fungus (1), and negative matrix (1) with the BD Veritor System for SARS-CoV-2. Each organism and virus were tested in three (3) replicates in the absence or presence of 3 x LoD of heat-inactivated SARS-CoV-2 (Omicron XBB). None of the organisms and viruses evaluated demonstrated cross-reactivity and interference in the assay at the concentrations tested.

Table 4: Summary of cross-reactivity and microbial interference study results

Microorganisms	Concentration Tested*	Without SARS-CoV-2 (Cross-Reactivity) Positive/ Tested	With SARS-CoV-2 (Microbial Interference) Positive/ Tested
Adenovirus Type 1	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Adenovirus Type 3	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Adenovirus Type 7	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Bordetella pertussis	1.00E+06 CFU/mL	0/3	3/3
Candida albicans	1.00E+06 CFU/mL	0/3	3/3
Chlamydia pneumonia	1.00E+06 IFU/mL	0/3	3/3
Enterovirus D68	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Haemophilus influenzae	1.00 x E+06 CFU/mL	0/3	3/3
Human coronavirus 229E (inactivated)	1.00E+05 $TCID_{50}$/mL	0/3	3/3

Microorganisms	Concentration Tested*	Without SARS-CoV-2 (Cross-Reactivity) Positive/ Tested	With SARS-CoV-2 (Microbial Interference) Positive/ Tested
Human coronavirus HKU1**	1.00E+05 copies/mL	0/15	15/15
Human coronavirus NL63	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Human coronavirus OC43	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Human Metapneumovirus (HMPV) A2	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Influenza A (H1N1) pdm90,A/Victoria/ 4897/2022 (heat inactivated)	1.00E+05 EID_{50}/mL	0/3	3/3
Influenza B (Victoria Lineage) B/Austria/1359417/2021	1.00E+05 EID_{50}/mL	0/3	3/3
Legionella pneumophila	1.00E+06 CFU/mL	0/3	3/3
MERS-coronavirus (inactivated)	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Mycoplasma pneumoniae	1.00E+06 CCU/mL	0/3	3/3
Parainfluenza virus 1	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Parainfluenza virus 2	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Parainfluenza virus 3	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Parainfluenza virus 4A	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Pooled human nasal wash	n/a	0/3	3/3
Respiratory syncytial virus, strain Long	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Rhinovirus 3	1.00E+05 PFU_{50}/mL	0/3	3/3
SARS-coronavirus	1.00E+05 $TCID_{50}$/mL	0/3	3/3
Staphylococcus aureus (MSSA)	1.00E+06 CFU_{50}/mL	0/3	3/3
Staphylococcus aureus (MRSA)	1.00E+06 CFU_{50}/mL	0/3	3/3
Staphylococcus epidermidis	1.00E+06 CFU_{50}/mL	0/3	3/3
Streptococcus pneumoniae	1.00E+06 CFU_{50}/mL	0/3	3/3

Microorganisms	Concentration Tested*	Without SARS-CoV-2 (Cross-Reactivity) Positive/ Tested	With SARS-CoV-2 (Microbial Interference) Positive/ Tested
Streptococcus pyogenes	1.00E+06 CFU_{50}/mL	0/3	3/3

*TCID: Tissue Culture Infectious Dose; CCU: Colony Changing Units; CFU: Colony-Forming Units; EID: Egg Infectious Dose; IFU: Inclusion-Forming Units; PFU: Plaque-Forming Units.
**Five different clinical samples were tested in replicates of three. Concentrations of each clinical sample were determined to be 1.00E+05 copies/mL based on standard curve/quantitative analysis targeting detection of the RDRP region.

b) Endogenous and Exogenous Interfering Substances Study

This study evaluated endogenous or exogenous substances that may potentially interfere with the performance of the BD Veritor System for SARS-CoV-2. Each potentially interfering substance was tested in triplicate in negative clinical matrix at targeted concentrations in the presence or absence of 3x LoD SARS-CoV-2 (heat-inactivated, Omicron XBB). None of the evaluated substances demonstrated interference with the assay at the tested concentrations. Results are summarized in table below.

Table 5: Interfering Substances Study Results

Interfering Substances Tested	Concentration Tested	In absence of SARS-CoV-2 Positive/ Tested	In presence of SARS-CoV-2 Positive/ Tested
Afrin (Oxymetazoline)	15% v/v	0/3	3/3
Alkalol	15% v/v	0/3	3/3
Bactroban (Mupirocin)	10 mg/mL	0/3	3/3
Beclomethasone	15% v/v	0/3	3/3
CVS Nasal spray (Cromolyn)	15% v/v	0/3	3/3
Dexamethasone	15% v/v	0/3	3/3
Flonase (Fluticasone)	15% v/v	0/3	3/3
Hand sanitizer (Ethyl alcohol)	1% v/v	0/3	3/3
Hand soap (Benzalkonium chloride)	1% v/v	0/3	3/3
Histaminum hydrochloricum	15% v/v	0/3	3/3
Leukocytes	2.5E+06 cells/mL	0/3	3/3
Molnupiravir	3µg/mL	0/3	3/3
Mucin	2.5 mg/mL	0/3	3/3
Nasacort (Triamcinolone)	15% v/v	0/3	3/3
Nasarel (Flunisolide)	15% v/v	0/3	3/3
NasoGel	1.25% v/v	0/3	3/3
Nasonex (Mometasone furoate)	15% v/v	0/3	3/3
Neo Synephrine (Phenylephrine)	15% v/v	0/3	3/3
Remdesivir	6 µg/mL	0/3	3/3
Rhinocort (Budesonide)	15% v/v	0/3	3/3

Interfering Substances Tested	Concentration Tested	In absence of SARS-CoV-2 Positive/ Tested	In presence of SARS-CoV-2 Positive/ Tested
Sodium chloride & Preservatives	15% v/v	0/3	3/3
Sore throat spray (Phenol)	5% w/v	0/3	3/3
Sore throat spray-Chloraseptic max (Benzocaine and Menthol)	3 mg/mL	0/3	3/3
Tamiflu (Oseltamivir Phosphate)	500 ng/mL	0/3	3/3
Whole Blood (human)	2.5% v/v	0/3	3/3
Zicam Cold Remedy (Galphimia glauca, Luffa opperculata, sulfur)	15% v/v	0/3	3/3

c) Biotin Interference Study

The BD Veritor System for SARS-CoV-2 is based on an assay format that utilizes a biotin-streptavidin complex. A biotin interference study was conducted to assess if free biotin (vitamin B7) in samples may compete with the biotinylated complex and impact assay results. Biotin was tested at 3500 ng/mL in triplicate in NCM in the presence and in the absence of SARS-CoV-2 (heat-inactivated, Omicron XBB) at 3x LoD. One test kit lot was used for biotin interference testing. Interference was not observed at the 3500 ng/mL biotin concentrations.

4. Assay Reportable Range:

This section is not applicable as this test device is a qualitative assay.

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

a. Internal Controls:

The test strip, enclosed in the test cassette, features an internal positive control, denoted on the test device as "C". The internal positive control line is comprised of decapeptide conjugated to bovine protein. The positive control line must be present for all valid test results to demonstrate that the test reagents are functional, and the test is correctly performed. The active negative control feature in each test strip identifies and compensates for specimen-related, nonspecific signal generation. The BD Veritor Plus Analyzer uses a proprietary algorithm which subtracts non-specific signal at the negative control line from the signal present at the test line. If the resultant test line signal is below the cutoff, the specimen is scored as negative. Use of the active negative control feature allows the BD Veritor System to correctly interpret test results that cannot be scored visually because the human eye is unable to accurately perform the subtraction of the non-specific signal. The test also contains a a background region to measure assay background when calculating test line signal strength.

b. External Controls:

The BD Veritor System for SARS-CoV-2 includes two external controls for this assay and an external control for the analyzer, the BD Veritor System Verification Cartridge.

External SARS-CoV-2 Positive and Negative Control Swabs:

The SARS-CoV-2 (+) Control Swab contains non-infectious recombinant SARS-CoV-2 nucleocapsid protein antigen (0.02 µg/mL). The external positive control swab is intended to mimic positive samples to ensure the test device is functioning as expected. The SARS-CoV-2 (-) Control Swab contains buffer and is intended to mimic negative samples to ensure the test device is functioning as expected.

Lot-to-lot precision of the external positive and negative control swabs was evaluated with three (3) test kit lots and two (2) blinded operators. Ten (10) external control replicates from each lot were tested. For each external control lot, all positive and negative controls produced 100% agreement with the expected results, as summarized in the table below.

Table 6: Validation of External Control Materials – Summary Results

Control	Test Kit Lot	# of Neg.	# of Pos.	% Expected Agreement
External Negative Control Swab	1	10	0	100
	2	10	0	100
	3	10	0	100
External Positive Control Swab	1	0	10	100
	2	0	10	100
	3	0	10	100

BD Veritor System Verification Cartridge:

A BD Veritor System Verification Cartridge is supplied to allow the user to perform a functional test on the BD Veritor Plus Analyzer. The frequency of verification testing is dictated by local site regulations or practices to verify that the analyzer is functioning within specifications.

c. Reagent Stability/Shelf-Life:

In order to determine the shelf-life of the BD Veritor System for SARS-CoV-2 in the intended storage conditions (2-30°C), a real-time stability study was conducted using three (3) lots of test kit stored at 4°C and 30°C after manufacturing. Test kits were assessed with negative samples and contrived positive samples prepared using inactivated SARS-CoV-2 (Omicron XBB) at 5x LoD in NCM. Five (5) replicates per timepoint per storage condition were analyzed. Three (3) lots of external control swabs were also stored in the same conditions and analyzed along with the contrived positive and negative samples. Data collected support a test kit and external control shelf-life of 12 months at the time of clearance.

d. Open Kit Stability Study:

In this study, the amount of time a test device can be left outside of its packaging was assessed using a test panel comprised of five (5) negative samples (NCM) and five (5) low positive samples (2x LoD). The device packaging was opened, and testing was performed at zero (0) hours to establish baseline. Thereafter, devices were stored for 5 min, 15 min, 30 min, 1 h, 2 h, 4 h, 6 h, and 24 h respectively at ambient temperature. All study data before and after storage of the open kits were 100% concordant with the expected results.

e. Specimen Stability:

Two (2) test samples were prepared for testing in the specimen stability study: a true negative (TN) in NCM and a low positive (LP) at 2x LoD. The low positive swabs were prepared by pipetting 50 µL of low positive sample onto the swab tip. The swabs were stored 30°C±1°C, 35°C±2°C, 4°C±1°C, and at -20°C±4°C for the duration of the study. Samples were tested at the time points indicated in the table below.

Five replicates of each concentration were tested in accordance with the package insert for each condition. Positive percent agreement summary results are included in the table below.

Table 7: Specimen Stability Study Results

Specimen Storage Parameters	Incubation time	Conc.	#Positive/# Total	% Expected Agreement
Room Temp. (Control)	0 hr.	TN	0/5	100
		LP	5/5	100
High Room Temp. 30±1°C	17 min	TN	0/5	100
		LP	5/5	100
	26.4 hrs.	TN	0/5	100
		LP	5/5	100
35±2°C	4.4 hrs.	TN	0/5	100
		LP	5/5	100
Refrigerated 4±1°C	26.4 hrs.	TN	0/5	100
		LP	5/5	100
Frozen -20±4°C	26.4 hrs.	TN	0/5	100
		LP	5/5	100

Based on the study results, specimens were given a 12-hour stability claim when stored at room temperature, refrigerated (4±1°C), or when stored frozen (-20±4°C)

6. Detection Limit:

The Limit of Detection (LoD) of BD Veritor System for SARS-CoV-2 was determined by evaluating different dilutions of heat inactivated SARS-CoV-2 (Omicron XBB) stocks in NCM.

For range finding preliminary LoD determination of SARS-CoV-2, four (4) 10-fold serial dilutions were made from viral stock into NCM. Three (3) replicates were tested for each of the dilutions to determine the preliminary LoD concentration on three (3) lots of the BD Veritor System for SARS-CoV-2 test kit.

Table 8: Preliminary LoD

Isolate/Lineage	SARS-CoV-2 ($TCID_{50}$/mL)	SARS-CoV-2 ($TCID_{50}$/Swab)	#Positive/# Total (All lots combined)
SARS-CoV-2, Omicron XBB (heat-inactivated)	5.95E+05	3.00E+04	9/9
	5.95E+04	3.00E+03	9/9
	5.95E+03	**3.00E+02**	**9/9**
	5.95E+02	3.00E+01	0/9

The preliminary LoD was further refined and confirmed using three (3) 10-fold serial dilutions and one (1) 0.3-fold dilution with 20 replicates each.

Table 9: Confirmatory LoD

Isolate/ Lineage	LoD Concentration ($TCID_{50}$/mL)	LoD Concentration ($TCID_{50}$/swab)	#Positive/# Total (All lots combined)
SARS-CoV-2, Omicron XBB (heat-inactivated)	5.95E+04	3.00E+03	60/60
	5.95E+03	**3.00E+02**	**60/60**
	1.98E+03	0.99E+02	4/60
	5.95E+02	3.00E+01	0/60

The LoD was determined to be 5.95E+03 $TCID_{50}$/mL (or 2.98E+02 $TCID_{50}$/swab).

Detection Limit with the NIBSC 21/368 - International Standard:

The sponsor tested the sensitivity of the test with the International Standard for SARS-CoV-2 antigen (NIBSC code: 21/368) spiked into NCM. A 2-fold dilution series was made to determine the preliminary LoD, which was measured using one device lot and triplicate measurements (n=3). The measurements were done by adding 50 µl of each dilution directly to the test swab and processing the sample per the test's package insert. The preliminary LoD was determined to be 250 IU/ml (or 12.5 IU/swab).

The confirmatory LoD study for the International Standard for SARS-CoV-2 antigen was performed using 20 replicates (n=20) per dilution. The lowest concentration at which a minimum of 95% of results were positive was confirmed to be 250 IU/ml or 12.5 IU/swab as shown below.

Table 10: LoD with the International Standard for SARS-CoV-2 Antigen (NIBSC code: 21/368)

Preliminary LoD			Confirmatory LoD		
Concentration (IU/ml)	IU/swab	Results	Concentration (IU/ml)	IU/swab	Results
4.00E+03	200	3/3			
2.00E+03	100	3/3			
1.00E+03	50	3/3			
5.00E+02	25	3/3	5.00E+02	25	20/20

Preliminary LoD			Confirmatory LoD		
Concentration (IU/ml)	**IU/swab**	**Results**	**Concentration (IU/ml)**	**IU/swab**	**Results**
2.50E+02	12.5	3/3	2.50E+02	12.5	20/20
1.25E+02	6.3	2/3	1.25E+02	6.3	2/20

7. High-Dose Hook Effect Study:

The hook effect study was conducted to evaluate if high levels of antigen present in the sample could result in a false negative test result. In this study, 50 µL of the highest concentration possible for heat inactivated SARS-CoV-2 virus stock (neat) was spiked onto sterile swabs for triplicate measurements, and swabs were tested on three (3) lots of the BD Veritor System for SARS-CoV-2 test kits per the IFU of the candidate device. Testing showed no hook effect for SARS-CoV-2 at the concentrations listed in the table below.

Table 11: Summary of High Dose Hook Effect Results

Strain/Lineage	Virus Concentration [$TCID_{50}$/mL]	Virus Concentration [$TCID_{50}$/swab]	# of positive/# Total tested (All lots combined)
SARS-CoV-2, Omicron XBB	5.95E+06	3.00E+05	9/9

8. Inclusivity (Analytical Reactivity):

An inclusivity study was performed to demonstrate that the BD Veritor System for SARS-CoV-2 can detect circulating SARS-CoV-2 strains/isolates. Four (4) stock strains were included. A preliminary study was conducted with ten-fold dilutions series to determine a near cutoff concentration for each strain/isolate tested in 5 replicates with one lot of test kit. Then, two-fold dilution series using the preliminary LoD were prepared, and five (5) replicates were tested to identify the dilution at which assay reactivity decreased for each strain. Results are summarized below. All tested viral strains were detected.

Table 12: Minimal Detectable Concentrations of SARS-CoV-2.

Variant / Lineage	Strain	1:10 Dilutions		1:2 Dilutions	
		Concentration ($TCID_{50}$/mL)	**Positive Agreement (#Pos. /#Total)**	**Concentration ($TCID_{50}$/mL)**	**Positive Agreement (#Pos. /#Total)**
Omicron BA.5	hCoV-19/USA/ COR-22-063113 /2022	2.4E+03	100% (5/5)	1.2 E+02	25% (1/5)
		2.4E+02	**100% (5/5)**	6.0E+01	50% (2/5)
		2.4E+01	0% (0/5)	3.0E+01	0% (0/5)
Omicron BQ.1.1	hCoV-19/USA/ MD-HP38861/ 2022	2.9E+04	100% (5/5)	1.45E+02	**100% (5/5)**
		2.9E+03	100% (5/5)	7.25E+01	0% (0/5)
		2.9E+02	100% (5/5)	3.63E+01	0% (0/5)
		2.9E+01	0% (0/5)		
Omicron BF.7	hCoV-19/USA/ MD-HP38288/2 022	2.4E+04	100% (5/5)	1.2E+02	25% (1/5)
		2.4E+03	100% (5/5)	6.0E+01	0% (0/5)
		2.4E+02	**100% (5/5)**	3.0E+01	0% (0/5)
		2.4E+01	0% (0/5)		
Omicron JN.1	hCoV-19/USA/ New York/ PV96109/2023	2.2E+04	100% (5/5)	1.1E+02	0% (0/5)
		2.2E+03	100% (5/5)	5.5E+01	0% (0/5)
		2.2E+02	**100% (5/5)**	2.75E+01	0% (0/5)

Variant / Lineage	Strain	1:10 Dilutions		1:2 Dilutions	
		Concentration ($TCID_{50}$/mL)	Positive Agreement (#Pos. /#Total)	Concentration ($TCID_{50}$/mL)	Positive Agreement (#Pos. /#Total)
		2.2E+01	0% (0/5)		

9. Assay Cut-Off:

   BD Veritor Plus Analyzer determines a positive or negative result based on predetermined, specific cutoff values, programmed into the software. Final cut-off values were further validated as part of the analytical and clinical studies.

10. Accuracy (Instrument):

    Please refer to Section VI.C (Clinical Studies) for the clinical evaluation study and data that establish clinical performance and accuracy of the test device.

11. Carry-Over:

    Carry-over contamination is not applicable to this test device as each sample uses an independent, new, single-use test cassette that is discarded after each run. No fluidic handling occurs in the instrument therefore the risk of carry-over was determined to be low.

B Comparison Studies:

1. Method Comparison with Predicate Device:

   Please refer to Section VI.C (Clinical Studies) below for the clinical validation, regarding the method comparison studies.

2. Matrix Comparison:

   The BD Veritor System for SARS-CoV-2 is only intended for qualitative detection of nucleocapsid protein antigen from SARS-CoV-2 in direct anterior nasal swab specimens. As no other specimen or 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 clinical performance of the BD Veritor System for SARS-CoV-2 was evaluated in a multi-center, prospective clinical study in the U.S. between April 2024 and August 2024, during a period when the SARS-CoV-2 Omicron variant was the predominant strain. The study only enrolled subjects with symptoms of respiratory infection consistent with a SARS-CoV-2 infection. A total of 1168 subjects were consecutively enrolled and tested by thirty-eight (38) operators across fifteen (15) different CLIA-waived sites. Of those, 136 specimens were excluded due to protocol deviations, shipping issues, sample leakage, and not meeting inclusion/exclusion criteria. Two anterior nasal (AN) swabs were collected from each study subject during the same visit. The first AN swab sample from both nostrils was collected by the operators and was then added into the Universal Viral Transport (UVT) media containing 1 mL

media and stored in dry ice until it was shipped to a reference laboratory and tested with an FDA cleared SARS-CoV-2 RT-PCR Test as comparator. The second AN swab sample was collected from both nostrils using the provided swab and was tested immediately using the BD Veritor System for SARS-CoV-2 by 38 users who are representative of a CLIA-waived operator (e.g., administrative personnel, medical assistants, nurses) across the 15 sites.

There were 1032 samples evaluated, 7.7% collected from patients aged 6 months - 5 years, 10.3% from patients aged 6 - 21 years, 13.5% from patients aged 22 - 59 years, and 18.5% from patients aged 60 years or older. Among the subjects, 61.5% were from female patients, while 38.5% were from male patients. Results obtained with the BD Veritor System for SARS-CoV-2 were compared to the results obtained with the RT-PCR comparator test to determine clinical sensitivity and specificity. The study cohort included 14.6% low-positive samples. The BD Veritor System for SARS-CoV-2 demonstrated a Positive Percent Agreement of 84.0% (C.I. 95%: 77.2%, 89.1%) and Negative Percent Agreement 99.7% (C.I. 95%: 99.0%, 99.9%).

Table 13: Clinical Performance of BD Veritor System for SARS-CoV-2 Compared to RT-PCR

BD Veritor System for SARS-CoV-2	**RT-PCR Comparator**		**Total**
	Positive	**Negative**	
Positive	121	3[a]	124
Negative	23[b]	885	908
Total	144	888	1032
Positive Percent Agreement (PPA) = 84.0% (77.2%, 89.1%)			
Negative Percent Agreement (NPA) = 99.7% (99.0%, 99.9%)			

[a] The three BD Veritor SARS-CoV-2 false positive results were retested with a second RT-PCR method and were confirmed negative.
[b] Of the 23 Veritor SARS-CoV-2 negatives, a second RT-PCR method agreed with the Veritor results in 9 cases, while it agreed with the primary RT-PCR method in 14 cases.

Table 14: Positive Results Stratified by Days Post-Symptom Onset

DPSO	**# Samples**	**BD Veritor System SARS-CoV-2 Positive Results**	**Reference RT-PCR SARS-CoV-2 Positives Results**	**PPA (%)**	**95% C.I. (%)**
Day 0	37	6	6	100.0	61.0 - 100.0
Day 1	84	12	14	85.7	60.1 – 96.0
Day 2	276	37	46	80.4	66.8 – 89.3
Day 3	286	31	38	81.6	66.6 – 90.8
Day 4	181	25	27	92.6	76.6 – 97.9
Day 5	125	7	10	70.0	39.7 – 89.2
Day 6	43	3	3	100.0	43.9 – 100.0

1. Clinical Sensitivity:

   PPA: 84.0% (121/144) - 95% CI: 77.2% - 89.1%

2. Clinical Specificity:

NPA: 99.7% (885/888) - 95% CI: 99.0% - 99.9%

3. Serial Testing:

As a mitigation, the Intended Use of 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:

This section is not applicable; there is no clinical cutoff related to the presence of SARS-CoV-2 in patient samples.

E Expected Values/Reference Range:

Not Applicable

F Other Supportive Instrument Performance Characteristics Data:

1. Flex Studies:

To assess the robustness of the BD Veritor System for SARS-CoV-2, flex studies were conducted that assessed all major aspects of the test procedure (sample volume, reading time, extraction buffer volume, bubbles in sample chamber, swab elution and procedure, use of incorrect specimen application) and variability of environmental test conditions that the test may be subjected to when in use (disturbance during use, temperature and humidity stress conditions). Testing was performed with contrived positive nasal swabs generated by diluting heat inactivated SARS-CoV-2 virus (Omicron variant, XBB) into NCM at 2x LoD. The studies support that the test is robust in the intended use condition with an insignificant risk of erroneous result (See the Decision Summary of CW240032).

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.