

Aptima[™] SARS-CoV-2 Assay (Panther[™] System)

This test has not been reviewed by the FDA. This test is being distributed in accordance with Section IV.C. of the FDA’s policy for diagnostic tests for Coronavirus disease – 2019 during the public health emergency at <https://www.fda.gov/media/135659/download> [fda.gov].

CONTENTS

- General Information 2**
 - Intended Use 2
 - Summary and Explanation of the Test 2
 - Principles of the Procedure 2
 - Warnings and Precautions 3
 - Reagent Storage and Handling Requirements 5
 - Specimen Collection and Storage 6
 - Specimen Transport 7
- Panther System 8**
 - Reagents and Materials Provided 8
 - Materials Required and Available Separately 9
 - Panther System Test Procedure 10
 - Procedural Notes 13
- Quality Control 14**
- Interpretation of Results 15**
- Limitations 15**
- Panther SARS-CoV-2 Assay Performance 16**
- Bibliography 19**

General Information

Intended Use

The Aptima™ SARS-CoV-2 assay is a nucleic acid amplification *in vitro* diagnostic test intended for the qualitative detection of RNA from SARS-CoV-2 isolated and purified from nasopharyngeal (NP), nasal, mid-turbinate and oropharyngeal (OP) swab specimens, nasopharyngeal wash/aspirate or nasal aspirates obtained from individuals meeting COVID-19 clinical and/or epidemiological criteria.

Results are for the identification of SARS-CoV-2 RNA. The SARS-CoV-2 RNA is generally detectable in upper respiratory specimens during the acute phase of infection. Positive results are indicative of the presence of SARS-CoV-2 RNA, clinical correlation with patient history and other diagnostic information is necessary to determine patient infection status. Positive results do not rule out bacterial infection or co-infection with other viruses.

Negative results do not preclude SARS-CoV-2 infection and should not be used as the sole basis for patient management decisions. Negative results must be combined with clinical observations, patient history, and epidemiological information.

The Aptima SARS-CoV-2 assay on the Panther™ and Panther Fusion™ system is intended for use by clinical laboratory personnel specifically instructed and trained in the operation of the Panther and Panther Fusion systems and *in vitro* diagnostic procedures.

Summary and Explanation of the Test

Coronaviruses are a large family of viruses which may cause illness in animals or humans. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The most recently discovered coronavirus, SARS-CoV-2, causes the associated coronavirus disease COVID-19. This new virus and disease were unknown before the outbreak began in Wuhan, China, in December 2019.¹

The most common symptoms of COVID-19 are fever, tiredness, and dry cough. Some patients may have aches and pains, nasal congestion, runny nose, sore throat, or diarrhea. These symptoms are usually mild and begin gradually. Some people become infected but don't develop any symptoms and don't feel unwell. The disease can spread through respiratory droplets produced when an infected person coughs or sneezes. These droplets land on objects and surfaces around the person. Other people may acquire SARS-CoV-2 by touching these objects or surfaces, then touching their eyes, nose, or mouth.

The virus that causes COVID-19 is infecting people and spreading easily from person to person. On March 11, 2020, the COVID-19 outbreak was characterized as a pandemic by the World Health Organization (WHO).^{3,4}

Principles of the Procedure

The Aptima SARS-CoV-2 assay combines the technologies of target capture, Transcription Mediated Amplification (TMA), and Dual Kinetic Assay (DKA).

Specimens are collected and transferred into their respective specimen transport tubes. The transport solutions in these tubes release the RNA target and protect them from degradation

during storage. When the Aptima SARS-CoV-2 assay is performed in the laboratory, the target RNA molecules are isolated from specimens by use of capture oligomers via target capture that utilizes magnetic microparticles. The capture oligomers contain sequences complementary to specific regions of the target molecules as well as a string of deoxyadenosine residues. A separate capture oligomer is used for each target. During the hybridization step, the sequence specific regions of the capture oligomers bind to specific regions of the target molecules. The capture oligomer:target complex is then captured out of solution by decreasing the temperature of the reaction to room temperature. This temperature reduction allows hybridization to occur between the deoxyadenosine region on the capture oligomer and the poly-deoxythymidine molecules that are covalently attached to the magnetic particles. The microparticles, including the captured target molecules bound to them, are pulled to the side of the reaction vessel using magnets and the supernatant is aspirated. The particles are washed to remove residual specimen matrix that may contain amplification reaction inhibitors. After the target capture steps are completed, the specimens are ready for amplification.

Target amplification assays are based on the ability of complementary oligonucleotide primers to specifically anneal and allow enzymatic amplification of the target nucleic acid strands. The Aptima SARS-CoV-2 assay replicates specific regions of the RNA from SARS-CoV-2 virus. Detection of the RNA amplification product sequences (amplicon) is achieved using nucleic acid hybridization. Single-stranded chemiluminescent nucleic acid probes, which are unique and complementary to a region of each target amplicon and Internal Control (IC) amplicon, are labeled with different acridinium ester (AE) molecules. The AE labeled probes combine with amplicon to form stable hybrids. The Selection Reagent differentiates hybridized from unhybridized probe, eliminating the generation of signal from unhybridized probe. During the detection step, light emitted from the labeled hybrids is measured as photon signals in a luminometer, and are reported as Relative Light Units (RLU). In DKA, differences in the kinetic profiles of the labeled probes allow for the differentiation of signal; kinetic profiles are derived from measurements of photon output during the detection read time. The chemiluminescent detection reaction for the IC signal has very rapid kinetics and has the “flasher” kinetic type. The chemiluminescent detection reaction for the SARS-CoV-2 signal is relatively slower and has the “glower” kinetic type. Assay results are determined by a cut-off based on the total RLU and the kinetic curve type.

Warnings and Precautions

- A. Carefully read this entire package insert and the *Panther/Panther Fusion System Operator's Manual*.
- B. Only personnel adequately trained on the use of this assay and in handling potentially infectious materials should perform these procedures. If a spill occurs, immediately disinfect using appropriate site procedures.
- C. Handle all specimens as if infectious using safe laboratory procedures. Refer to Interim Laboratory Biosafety Guidelines for Handling and Processing Specimens Associated with 2019-nCoV. <https://www.cdc.gov/coronavirus/2019-ncov/lab/lab-biosafety-guidelines.html>.
- D. Specimens may be infectious. Use Universal Precautions when performing this assay. Proper handling and disposal methods should be established by the laboratory director. Only personnel adequately trained in handling infectious materials should be permitted to perform this diagnostic procedure.⁵

- E. If infection with SARS-CoV-2 is suspected based on current clinical screening criteria recommended by public health authorities, specimens should be collected with appropriate infection control precautions.
- F. Use only supplied or specified disposable laboratory ware.
- G. Use appropriate personal protective equipment when collecting and handling specimens from individuals suspected of being infected with SARS-CoV-2 as outlined in CDC Interim Laboratory Biosafety Guidelines for Handling and Processing Specimens Associated with 2019 Novel Coronavirus (2019-nCoV).
- H. Wear disposable, powderless gloves, protective eye wear, and laboratory coats when handling specimens and reagents. Wash hands thoroughly after handling specimens and reagents.
- I. Dispose of all material that has come into contact with specimens and reagents in accordance with applicable national, international, and regional regulations.
- J. Expiration dates listed on the Panther Fusion Specimen Lysis Tubes and Multitest Collection Kit pertain to the transfer of sample into the tube and not to testing of the sample. Specimens collected/transferred any time prior to these expiration dates are valid for testing provided they are transported and stored in accordance with the appropriate package insert, even if these expiration dates have passed.
- K. Maintain proper storage conditions during specimen shipping to ensure the integrity of the specimen. Specimen stability under shipping conditions other than those recommended has not been evaluated.
- L. Avoid cross-contamination during the specimen handling steps. Specimens can contain extremely high levels of virus or other organisms. Ensure that specimen containers do not come in contact with one another, and discard used materials without passing them over any open containers. Change gloves if they come in contact with specimens.
- M. Do not use the reagents and controls after the expiration date.
- N. Store assay components at the recommended storage condition. See *Reagent Storage and Handling Requirements* (page 5), and *Panther System Test Procedure* (page 10) for more information.
- O. Do not combine any assay reagents or fluids. Do not top off reagents or fluids; the Panther system verifies reagent levels.
- P. Avoid microbial and ribonuclease contamination of reagents.
- Q. Quality control requirements must be performed in conformance with local, state, and/or federal regulations or accreditation requirements and your laboratory's standard quality control procedures.
- R. Do not use material that may contain Guanidinium thiocyanate or any guanidine-containing materials on the instrument. Highly reactive and/or toxic compounds may form if combined with sodium hypochlorite.
- S. A reagent in this kit is labeled with risk and safety symbols.

Note: For information on any hazard and precautionary statements that may be associated with reagents, refer to the Safety Data Sheet Library at www.hologicds.com.

**Selection Reagent****BORIC ACID 1-5%****WARNING**

H315 - Causes skin irritation

H319 - Causes serious eye irritation

P264 - Wash face, hands and any exposed skin thoroughly after handling

P280 - Wear protective gloves/protective clothing/eye protection/face protection

P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing

P337 + P313 - If eye irritation persists: Get medical advice/attention

P302 + P352 - IF ON SKIN: Wash with plenty of soap and water

P332 + P313 - If skin irritation occurs: Get medical advice/attention

P362 - Take off contaminated clothing and wash before reuse

Reagent Storage and Handling Requirements

A. The following reagents are stable when stored at 2°C to 8°C (refrigerated):

Aptima SARS-CoV-2 Amplification Reagent

Aptima SARS-CoV-2 Enzyme Reagent

Aptima SARS-CoV-2 Probe Reagent

Aptima SARS-CoV-2 Internal Control

Aptima SARS-CoV-2 Positive Control

Aptima SARS-CoV-2 Negative Control

B. The following reagents are stable when stored at 2°C to 30°C:

Aptima SARS-CoV-2 Amplification Reconstitution Solution

Aptima SARS-CoV-2 Enzyme Reconstitution Solution

Aptima SARS-CoV-2 Probe Reconstitution Solution

Aptima SARS-CoV-2 Selection Reagent

C. The following reagents are stable when stored at 15°C to 30°C (room temperature):

Aptima SARS-CoV-2 Target Capture Reagent

Aptima Wash Solution

Aptima Buffer for Deactivation Fluid

Aptima Oil Reagent

- D. Working Target Capture Reagent (wTCR) is stable for 30 days when stored at 15°C to 30°C. Do not refrigerate.
- E. After reconstitution, the Enzyme Reagent, Amplification Reagent, and Probe Reagent are stable for 30 days when stored at 2°C to 8°C.
- F. Discard any unused reconstituted reagents and wTCR after 30 days or after the Master Lot expiration date, whichever comes first.
- G. Controls are stable until the date indicated on the vials.
- H. Reagents stored on-board the Panther System have 72 hours of on-board stability.
- I. The Probe Reagent and Reconstituted Probe Reagent are photosensitive. Store the reagents protected from light. The specified reconstituted stability is based on 12 hours exposure of the Reconstituted Probe Reagent to two 60W fluorescent bulbs, at a distance of 17 inches (43 cm), and temperature less than 30°C. Light exposure of the Reconstituted Probe Reagent should be limited accordingly.
- J. Upon warming to room temperature, some control tubes may appear cloudy or contain precipitates. Cloudiness or precipitation associated with controls does not affect control performance. The controls may be used whether they are clear or cloudy/precipitated. If clear controls are desired, solubilization may be expedited by incubating them at the upper end of the room temperature range (15°C to 30°C).
- K. Do not freeze the reagents.**

Specimen Collection and Storage

Specimens - Clinical material collected from patient placed in an appropriate transport system. For the Aptima SARS-CoV-2 assay, this includes NP, nasal and OP swab specimens in viral transport medium (VTM/UTM), saline, Liquid Amies, or specimen transport medium (STM).

Samples - Represents a more generic term to describe any material for testing on the Panther System including specimens, specimens transferred into a Panther Fusion Specimen Lysis Tube and controls.

Note: Handle all specimens as if they contain potentially infectious agents. Use Universal Precautions.

Note: Take care to avoid cross-contamination during specimen handling steps. For example, discard used material without passing over open tubes.

A. Swab Specimen collection

Collect NP swab, nasal swab, and OP swab specimens according to standard technique using a polyester-, rayon-, or nylon-tipped swab. Immediately place the swab specimen into 3mL of VTM or UTM. Swab specimens may alternatively be added to saline, Liquid Amies or STM. The Aptima Multitest Swab Specimen Collection Kit may be used for the collection of OP and nasal swab samples.

The following types of VTM/UTM were verified for use.

- Remel MicroTest M4, M4RT, M5 or M6 formulations
 - Copan Universal Transport Medium
 - BD Universal Viral Transport Medium
- B. Specimen processing
1. Prior to testing on the Panther system, transfer specimen* to a Panther Fusion Specimen Lysis Tube, except for specimens collected in the Aptima Multitest Tube which require no additional processing.
 - Transfer 500 µL of the collected specimen to a Panther Fusion Specimen Lysis Tube.
***Note:** *When testing frozen specimen, allow specimen to reach room temperature prior to processing.*
 2. Storing specimens before testing
 - a. After collection, specimens collected in VTM/UTM can be stored at 2°C to 8°C up to 96 hours before transferred to the Panther Fusion Specimen Lysis Tube. Remaining specimen volumes can be stored at ≤-70°C. Refer to vendor instructions for specimen stability in Liquid Amies.
 - b. Specimens in the Panther Fusion Specimen Lysis Tube or Aptima Multitest Tube may be stored under one of the following conditions:
 - 15°C to 30°C up to 6 days or
 - 2°C to 8°C up to 3 months.**Note:** *It is recommended that specimens transferred to the Panther Fusion Specimen Lysis Tube and specimens in the Aptima Multitest Tube are stored capped and upright in a rack.*
- C. Samples on board the Panther system may be archived for additional testing at a later time.
- D. Storing samples after testing
1. Samples that have been assayed should be stored upright in the rack under one of the following conditions:
 - 15°C to 30°C up to 6 days or
 - 2°C to 8°C up to 3 months.
 2. The samples should be covered with a new, clean plastic film or foil barrier.
 3. If assayed samples need to be frozen or shipped, remove the penetrable cap and place a new non-penetrable cap on the specimen tubes. If samples need to be shipped for testing at another facility, recommended temperatures must be maintained. Prior to uncapping previously tested and recapped samples, specimen transport tubes must be centrifuged for 5 minutes at 420 Relative Centrifugal Force (RCF) to bring all of the liquid down to the bottom of the tube. Avoid splashing and cross-contamination.

Specimen Transport

Maintain specimen storage conditions as described in the *Specimen Collection and Storage section* on page 6.

Note: *Specimens must be shipped in accordance with applicable national, international, and regional transportation regulations.*

Panther System

Reagents for the Aptima SARS-CoV-2 assay are listed below for the Panther System. Reagent Identification Symbols are also listed next to the reagent name.

Reagents and Materials Provided

Aptima SARS-CoV-2 Assay Kit PRD-06495

250 tests (2 boxes)

Aptima SARS-CoV-2 Refrigerated Box (Box 1 of 2)
(store at 2°C to 8°C upon receipt)

Symbol	Component	Quantity 250 test kit
A	Aptima SARS-CoV-2 Amplification Reagent <i>Non-infectious nucleic acids dried in buffered solution containing < 5% bulking agent.</i>	1 vial
E	Aptima SARS-CoV-2 Enzyme Reagent <i>Reverse transcriptase and RNA polymerase dried in HEPES buffered solution containing < 10% bulking reagent.</i>	1 vial
P	Aptima SARS-CoV-2 Probe Reagent <i>Non-infectious chemiluminescent DNA probes dried in succinate buffered solution containing < 5% detergent.</i>	1 vial
IC	Aptima SARS-CoV-2 Internal Control	1 vial

Aptima SARS-CoV-2 Room Temperature Box (Box 2 of 2)
(store at 15°C to 30°C upon receipt)

Symbol	Component	Quantity 250 test kit
AR	Aptima SARS-CoV-2 Amplification Reconstitution Solution <i>Aqueous solution containing preservatives.</i>	1 x 27.7 mL
ER	Aptima SARS-CoV-2 Enzyme Reconstitution Solution <i>HEPES buffered solution containing a surfactant and glycerol.</i>	1 x 11.1 mL
PR	Aptima SARS-CoV-2 Probe Reconstitution Solution <i>Succinate buffered solution containing < 5% detergent.</i>	1 x 35.4 mL
S	Aptima SARS-CoV-2 Selection Reagent <i>600 mM borate buffered solution containing surfactant.</i>	1 x 108 mL
TCR	Aptima SARS-CoV-2 Target Capture Reagent <i>Buffered salt solution containing solid phase and capture oligomers.</i>	1 x 54 mL
	Reconstitution Collars	3
	Master Lot Barcode Sheet	1 sheet

Aptima SARS-CoV-2 Controls Kit (Cat. No. PRD-06496)
(store at 2°C to 8°C upon receipt)

Symbol	Component	Quantity
PC	Aptima SARS-CoV-2 Positive Control <i>Non-infectious nucleic acid in a buffered solution containing < 5% detergent.</i>	5 x 1.7 mL
NC	Aptima SARS-CoV-2 Negative Control <i>A buffered solution containing < 5% detergent.</i>	5 x 1.7 mL

Materials Required and Available Separately

Note: Materials available from Hologic have catalog numbers listed, unless otherwise specified.

	<u>Cat. No.</u>
Panther System	303095
Aptima Assay Fluids Kit <i>(Aptima Wash Solution, Aptima Buffer for Deactivation Fluid, and Aptima Oil Reagent)</i>	303014 (1000 tests)
Aptima Auto Detect Kit	303013 (1000 tests)
Multi-tube units (MTUs)	104772-02
Panther Waste Bag Kit	902731
Panther Waste Bin Cover	504405
Or Panther Run Kit <i>contains MTUs, waste bags, waste bin covers, assay fluids, and auto detects</i>	303096 (5000 tests)
Tips, 1000 µL conductive, liquid sensing	10612513 (Tecan)
Aptima Multitest Swab Specimen Collection Kit	PRD-03546
Panther Fusion Specimen Lysis Tubes, 100 per bag	PRD-04339
Bleach, 5% to 7% (0.7M to 1.0M) sodium hypochlorite solution	—
Disposable gloves	—
Aptima penetrable caps	105668
Replacement non-penetrable caps	103036A
Replacement Caps for the 250-test kits	—
<i>Amplification and Probe reagent reconstitution solutions</i> CL0041 (100 caps)	
<i>Enzyme Reagent reconstitution solution</i> 501616 (100 caps)	
<i>TCR and Selection reagent</i> CL0040 (100 caps)	

Optional Materials

	<u>Cat. No.</u>
Hologic Bleach Enhancer for Cleaning <i>for routine cleaning of surfaces and equipment</i>	302101
Tube rocker	—

Panther System Test Procedure

Note: Refer to the Panther/Panther System Operator's Manual for additional procedural information.

A. Work Area Preparation

Clean work surfaces where reagents and samples will be prepared. Wipe down work surfaces with 2.5% to 3.5% (0.35M to 0.5M) sodium hypochlorite solution. Allow the sodium hypochlorite solution to contact surfaces for at least 1 minute and then follow with a water rinse. Do not allow the sodium hypochlorite solution to dry. Cover the bench surface on which the reagents and samples will be prepared with clean, plastic-backed absorbent laboratory bench covers.

B. Reagent Reconstitution/Preparation of a New Kit

Note: Reagent reconstitution should be performed prior to beginning any work on the Panther System.

1. To reconstitute Amplification, Enzyme, and Probe Reagents, combine the bottles of lyophilized reagent with the reconstitution solution. If refrigerated, allow the reconstitution solutions to reach room temperature before use.
 - a. Pair each reconstitution solution with its lyophilized reagent. Ensure that the reconstitution solution and reagent have matching label colors before attaching the reconstitution collar.
 - b. Check the lot numbers on the Master Lot Barcode Sheet to ensure that the appropriate reagents are paired.
 - c. Open the lyophilized reagent vial and firmly insert the notched end of the reconstitution collar into the vial opening (Figure , Step 1).
 - d. Open the matching reconstitution solution, and set the cap on a clean, covered work surface.
 - e. While holding the reconstitution solution bottle on the bench, firmly insert the other end of the reconstitution collar into the bottle opening (Figure , Step 2).
 - f. Slowly invert the assembled bottles. Allow the solution to drain from the bottle into the glass vial (Figure , Step 3).
 - g. Thoroughly mix the solution in the glass vial by swirling (Figure , Step 4).
 - h. Wait for the lyophilized reagent to go into solution, then invert the assembled bottles again, tilting at a 45° angle to minimize foaming (Figure , Step 5). Allow all of the liquid to drain back into the plastic bottle.
 - i. Remove the reconstitution collar and glass vial (Figure , Step 6).

- j. Recap the plastic bottle. Record operator initials and reconstitution date on the label (Figure , Step 7).
- k. Discard the reconstitution collar and glass vial (Figure , Step 8).

Option: Additional mixing of the Amplification, Enzyme, and Probe Reagents using a tube rocker is allowed. The reagents may be mixed by placing the recapped plastic bottle on a tube rocker set to 20 RPM (or equivalent) for a minimum of 5 minutes.

Warning: Avoid creating foam when reconstituting reagents. Foam compromises the level-sensing in the Panther System.

Warning: Adequate mixing of the reagents is necessary to achieve expected assay results.

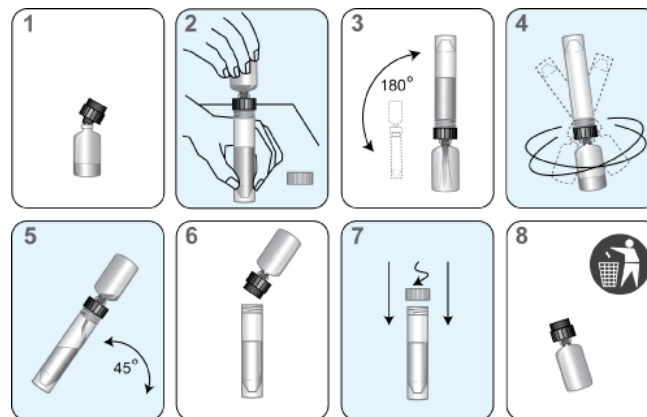


Figure 1. Panther System Reconstitution Process

2. Prepare Working Target Capture Reagent (wTCR)
 - a. Pair the appropriate bottles of TCR and IC.
 - b. Check the reagent lot numbers on the Master Lot Barcode Sheet to make sure that the appropriate reagents in the kit are paired.
 - c. Open the bottle of TCR, and set the cap on a clean, covered work surface.
 - d. Open the IC bottle and pour the entire contents into the bottle of TCR. Expect a small amount of liquid to remain in the IC bottle.
 - e. Cap the bottle of TCR and gently swirl the solution to mix the contents. Avoid creating foam during this step.
 - f. Record operator initials and the current date on the label.
 - g. Discard the IC bottle and cap.
3. Prepare Selection Reagent
 - a. Check the lot number on the reagent bottle to make sure it matches the lot number on the Master Lot Barcode Sheet.
 - b. Record operator initials and the current date on the label.

Note: Thoroughly mix by gently inverting all reagents prior to loading on the system. Avoid creating foam during inversion of reagents.

C. Reagent Preparation for Previously Reconstituted Reagents

1. Previously reconstituted Amplification, Enzyme, and Probe Reagents must reach room temperature (15°C to 30°C) prior to the start of the assay.

Option: The reagents may be brought to room temperature by placing the reconstituted Amplification, Enzyme, and Probe Reagents on a tube rocker set to 20 RPM (or equivalent) for a minimum of 25 minutes.

2. If reconstituted Probe Reagent contains precipitate that does not return to solution at room temperature, heat the capped bottle at a temperature that does not exceed 62°C for 1 to 2 minutes. After this heat step, the Probe Reagent may be used even if residual precipitate remains. Mix Probe Reagent by inversion, being careful not to induce foam, prior to loading onto the system.
3. Thoroughly mix each reagent by gently inverting prior to loading on the system. Avoid creating foam during inversion of reagents. This step is not required if reagents are loaded onto the system directly after mixing on the tube rocker.
4. Do not top off reagent bottles. The Panther System will recognize and reject bottles that have been topped off.
5. *Adequate mixing of the reagents is necessary to achieve expected assay results.*

D. Specimen Handling

Note: *Prepare specimens per the Specimen Processing instructions in the Specimen Collection and Storage section before loading specimens onto the Panther system.*

1. **Do not vortex samples.**
2. Inspect sample tubes before loading into the rack. If a sample tube contains bubbles or has a lower volume than is typically observed, gently tap the bottom of the tube to bring contents to the bottom.

Note: *To avoid a processing error, ensure adequate specimen volume is added to the Panther Fusion Specimen Lysis Tube. When 500 µL of collected specimen is added to the Panther Fusion Specimen Lysis Tube, there is sufficient volume to perform 3 nucleic acid extractions.*

E. System Preparation

1. Set up the system according to the instructions in the *Panther/Panther Fusion System Operator's Manual* and *Procedural Notes*. Make sure that the appropriately sized reagent racks and TCR adapters are used.
2. Load samples.

Procedural Notes

A. Controls

1. To work properly with the Aptima Assay software for the Panther System, one pair of controls is required. The Aptima SARS-CoV-2 positive and negative controls can be loaded in any rack position or in any Sample Bay Lane on the Panther System. Patient specimen pipetting will begin when one of the following two conditions has been met:
 - a. A pair of controls is currently being processed by the system.
 - b. Valid results for the controls are registered on the system.
2. Once the control tubes have been pipetted and are processing for a specific reagent kit, patient specimens can be run with the associated kit up to 24 hours unless:
 - a. Controls results are invalid.
 - b. The associated assay reagent kit is removed from the system.
 - c. The associated assay reagent kit has exceeded stability limits.
3. Each Aptima control tube can be tested once. Attempts to pipette more than once from the tube can lead to processing errors.
4. Patient specimen pipetting begins when one of the following two conditions is met:
 - a. Valid results for the controls are registered on the system.
 - b. A pair of controls is currently in process on the system.

B. Temperature

Room temperature is defined as 15°C to 30°C.

C. Glove Powder

As in any reagent system, excess powder on some gloves may cause contamination of opened tubes. Powderless gloves are recommended.

D. Lab Contamination Monitoring Protocol for the Panther System

There are many laboratory-specific factors that may contribute to contamination, including testing volume, workflow, disease prevalence and various other laboratory activities. These factors should be taken into consideration when contamination monitoring frequency is being established. Intervals for contamination monitoring should be established based on each laboratory's practices and procedures.

To monitor for laboratory contamination, the following procedure may be performed using the Aptima Unisex Swab Specimen Collection Kit for Endocervical and Male Urethral Swab Specimens:

1. Label swab transport tubes with numbers corresponding to the areas to be tested.
2. Remove the specimen collection swab (blue shaft swab with green printing) from its packaging, wet the swab in the specimen transport medium (STM), and swab the designated area using a circular motion.
3. Immediately insert the swab into transport tube.
4. Carefully break the swab shaft at the score line; use care to avoid splashing of the contents.
5. Recap the swab transport tube tightly.
6. Repeat Steps 2 to 5 for each area to be swabbed.

- E. If the results are positive, see *Interpretation of Results*. For additional Panther System-specific contamination monitoring information, contact Hologic Technical Support.

Quality Control

A run or specimen result may be invalidated by the Panther System if problems occur while performing the assay. Specimens with invalid results must be retested.

Negative and Positive Controls

To generate valid results, a set of assay controls must be tested. One replicate of the negative assay control and positive assay control must be tested each time a new kit lot is loaded on the Panther system or when the current set of valid controls have expired.

The Panther system is configured to require assay controls run at an administrator-specified interval of up to 24 hours. Software on the Panther system alerts the operator when assay controls are required and does not start new tests until the assay controls are loaded and have started processing.

During processing, criteria for acceptance of the assay controls are automatically verified by the Panther system. To generate valid results, the assay controls must pass a series of validity checks performed by the Panther system.

If the assay controls pass all validity checks, they are considered valid for the administrator-specified time interval. When the time interval has passed, the assay controls are expired by the Panther system which requires a new set of assay controls be tested prior to starting any new samples.

If any one of the assay controls fails the validity checks, the Panther system automatically invalidates the affected samples and requires a new set of assay controls be tested prior to starting any new samples.

Internal Control

An internal control is added to each sample with the wTCR. During processing, the internal control acceptance criteria are automatically verified by the Panther system software. Detection of the internal control is not required for samples that are positive for SARS-CoV-2. The internal control must be detected in all samples that are negative for SARS-CoV-2 targets; samples that fail to meet that criteria will be reported as Invalid. Each sample with an Invalid result must be retested.

The Panther system is designed to accurately verify processes when procedures are performed following the instructions provided in this package insert and the *Panther/Panther Fusion System Operator's Manual*.

Interpretation of Results

The Panther system automatically determines the test results for samples and controls. A test result may be negative, positive, or invalid.

Table 1 shows the possible results reported in a valid run with result interpretations.

Table 1: Result Interpretation

SARS-CoV-2 Result	IC Result	Interpretation
Neg	Valid	SARS-CoV-2 not detected.
POS	Valid	SARS-CoV-2 detected.
Invalid	Invalid	Invalid. There was an error in the generation of the result; retest sample.

Note: Detection of internal control is not required for samples that are positive for SARS-CoV-2.

Limitations

- A. Use of this assay is limited to personnel who are trained in the procedure. Failure to follow these instructions may result in erroneous results.
- B. Reliable results are dependent on adequate specimen collection, transport, storage, and processing.
- C. Avoid contamination by adhering to good laboratory practices and to the procedures specified in this package insert.
- D. A positive result indicates the detection of nucleic acid from the relevant virus. Nucleic acid may persist even after the virus is no longer viable.
- E. Nasopharyngeal wash/aspirate or nasal aspirates and self-collected or healthcare provider collected nasal and midturbinate nasal swabs are additional acceptable upper respiratory specimens that can be tested with the Aptima SARS-CoV-2 assay; however, performance with these specimen types have not been determined.

Panther SARS-CoV-2 Assay Performance

Analytical Sensitivity

The analytical sensitivity (limit of detection or LoD) of the Aptima SARS-CoV-2 assay was determined by testing serial dilutions of pooled negative clinical nasopharyngeal swab specimens spiked with inactivated cultured SARS-CoV-2 virus (USA-WA1/2020; BEI Resources; NR-52281). Ten replicates of each serial dilution were evaluated using each of two assay reagent lots across two Panther systems. The LoD was determined to be 0.01 TCID₅₀/mL and verified by testing an additional 20 replicates with one assay reagent lot. The LoD was also confirmed using saline, Liquid Amies and specimen transport medium (STM) swab collection media.

Inclusivity

The inclusivity of the Aptima SARS-CoV-2 assay was evaluated using *in silico* analysis of the assay target capture oligos, amplification primers, and detection probes in relation to 9,896 SARS-CoV-2 sequences available in the NCBI and GISAID gene databases. Any sequence with missing or ambiguous sequence information was removed from the analysis, resulting in 9,879 sequences evaluated for the first target region of the assay and 9,880 for the second target region. The *in silico* analysis showed 100% homology to the assay oligos of both target systems for 9,749 (98.5%) of the evaluated sequences and 100% homology to the assay oligos of at least one target system for all 9,896 sequences. There were no evaluated sequences with identified mismatches predicted to impact binding or performance of both target systems, indicating 100% inclusivity.

Analytical Specificity and Microbial Interference

The analytical specificity of the Aptima SARS-CoV-2 assay was evaluated by testing 30 microorganisms representing common respiratory pathogens or closely related species (Table 2). Bacteria were tested at 10⁶ CFU/mL and viruses were tested at 10⁵ TCID₅₀/mL, except where noted. Microorganisms were tested with and without the presence of SARS-CoV-2 inactivated virus at 3x LoD. Analytical specificity of the Aptima SARS-CoV-2 assay was 100% with no evidence of microbial interference.

In addition to microorganism testing, *in silico* analysis was performed to assess the specificity of the assay in relation to the microorganisms listed in Table 2. The *in silico* analysis showed no probable cross reactivity to any of the 112 GenBank sequences evaluated.

Table 2: Aptima SARS-CoV-2 Analytical Specificity and Microbial Interference Microorganisms

Microorganism	Concentration	Microorganism	Concentration
Human coronavirus 229E	1E+5 TCID ₅₀ /mL	Parainfluenza virus 1	1E+5 TCID ₅₀ /mL
Human coronavirus OC43	1E+5 TCID ₅₀ /mL	Parainfluenza virus 2	1E+5 TCID ₅₀ /mL
Human coronavirus HKU1 ¹	1E+6 copies/mL	Parainfluenza virus 3	1E+5 TCID ₅₀ /mL
Human coronavirus NL63	1E+4 TCID ₅₀ /mL	Parainfluenza virus 4	1E+3 TCID ₅₀ /mL
SARS-coronavirus ¹	1E+6 copies/mL	Influenza A	1E+5 TCID ₅₀ /mL
MERS-coronavirus	1E+4 TCID ₅₀ /mL	Influenza B	2E+3 TCID ₅₀ /mL
Adenovirus (e.g. C1 Ad. 71)	1E+5 TCID ₅₀ /mL	Enterovirus (e.g. EV68)	1E+5 TCID ₅₀ /mL
Human Metapneumovirus (hMPV)	1E+6 TCID ₅₀ /mL	Rhinovirus	1E+4 TCID ₅₀ /mL
Respiratory syncytial virus	1E+5 TCID ₅₀ /mL	<i>Legionella pneumophila</i>	1E+6 CFU/mL
<i>Chlamydia pneumoniae</i>	1E+6 IFU/mL	<i>Mycobacterium tuberculosis</i>	1E+6 TCID ₅₀ /mL
<i>Haemophilus influenzae</i>	1E+6 CFU/mL	<i>Streptococcus pneumoniae</i>	1E+6 CFU/mL
<i>Bordetella pertussis</i>	1E+6 CFU/mL	<i>Streptococcus pyogenes</i>	1E+6 CFU/mL
<i>Pneumocystis jirovecii</i> (PJP)	1E+6 nuc/mL	<i>Streptococcus salivarius</i>	1E+6 CFU/mL
<i>Candida albicans</i>	1E+6 CFU/mL	<i>Mycoplasma pneumoniae</i>	1E+6 CFU/mL
<i>Staphylococcus epidermidis</i>	1E+6 CFU/mL	<i>Pseudomonas aeruginosa</i>	1E+6 CFU/mL
Pooled human nasal wash ² - to represent diverse microbial flora in human respiratory tract	N/A		

¹ Cultured virus and whole genome purified nucleic acid for Human coronavirus HKU1 and SARS-coronavirus are not readily available. HKU1 and SARS-coronavirus IVTs corresponding to the ORF1ab gene regions targeted by the assay were used to evaluate cross-reactivity and microbial interference.

² In place of evaluating pooled human nasal wash, testing of 30 individual negative clinical NP swab specimens was performed to represent diverse microbial flora in the human respiratory tract.

Clinical Performance

The clinical performance of the Aptima SARS-CoV-2 assay was evaluated in comparison to the Panther Fusion SARS-CoV-2 assay (Hologic, Inc.) using a panel of remnant clinical specimens. For the study, 105 remnant clinical nasopharyngeal specimens were collected from US patients with signs and symptoms of respiratory infection. One replicate from 55 negative and 50 positive specimens for SARS-CoV-2 were tested with both the Aptima and Panther Fusion assays.

The Positive Percent Agreement (PPA) and Negative Percent Agreement (NPA) was calculated in relation to the Panther Fusion assay as the reference result, as shown in Table 3. The Aptima SARS-CoV-2 assay showed positive and negative agreements of 100% and 98.2%, respectively.

Table 3: Aptima SARS-CoV-2 Clinical Agreement

		Panther Fusion SARS-CoV-2 Assay	
		Positive	Negative
Aptima SARS-CoV-2 Assay	Positive	50	1
	Negative	0	54

Positive Percent Agreement: (95% CI): 100% (92.9% – 100%)

Negative Percent Agreement: (95% CI): 98.2% (90.4% – 99.7%)

Overall Agreement: (95% CI): 99.0% (94.8% – 99.8%)

Bibliography

1. **World Health Organization.** Q&A on coronaviruses (COVID-19). March 9, 2020. World Health Organization Web site <https://www.who.int/news-room/q-a-detail/q-a-coronaviruses>. Accessed March 10, 2020.
2. **Centers for Disease Control and Prevention.** Coronavirus Disease 2019-(COVID-19) in the U.S. Updated March 10, 2020. Centers for Disease Control and Prevention Web site <https://www.cdc.gov/coronavirus/2019-ncov/cases-in-us.html>. Accessed March 10, 2020.
3. **Centers for Disease Control and Prevention.** Coronavirus Disease 2019 Information for Travel. Page last reviewed March 8, 2020. Centers for Disease Control and Prevention Web site <https://www.cdc.gov/coronavirus/2019-ncov/travelers/index.html>. Accessed March 10, 2020.
4. **Centers for Disease Control and Prevention.** Coronavirus Disease 2019-(COVID-19) Situation Summary. Updated March 9, 2020. Centers for Disease Control and Prevention Web site <https://www.cdc.gov/coronavirus/2019-ncov/summary.html>. Accessed March 10, 2020.
5. **Clinical & Laboratory Standards Institute.** Document M29 Protection of Laboratory Workers from Occupationally Acquired Infections. CLSI Web site <https://clsi.org/standards/products/microbiology/documents/m29/>. Accessed September 2017.



Hologic, Inc.
10210 Genetic Center Drive
San Diego, CA 92121 USA

Customer Support: +1 800 442 9892
customersupport@hologic.com

Technical Support: +1 888 484 4747
molecularsupport@hologic.com

For more contact information visit www.hologic.com.

Hologic, Aptima, Panther, and Panther Fusion are trademarks and/or registered trademarks of Hologic, Inc. and/or its subsidiaries in the United States and/or other countries.

All other trademarks that may appear in this package insert are the property of their respective owners.

This product may be covered by one or more U.S. patents identified at www.hologic.com/patents.

©2020 Hologic, Inc. All rights reserved.

AW-21490-001 Rev. 002
2020-05