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

I Background Information:

A 510(k) Number

K243343

B Applicant

BD Integrated Diagnostic Solutions/Becton, Dickinson & Company

C Proprietary and Established Names

BD CTGCTV2

D Regulatory Information

Product Code(s)	Classification	Regulation Section	Panel
QEP	Class II	21 CFR 866.3393 - Device To Detect Nucleic Acids From Non-Viral Microorganism(S) Causing Sexually Transmitted Infections And Associated Resistance Marker(S)	MI - Microbiology

II Submission/Device Overview:

A Purpose for Submission:

To expand the Intended Use of the BD CTGCTV2 assay when performed on the BD COR system to include oropharyngeal and rectal swab specimens.

B Measurand:

- *Chlamydia trachomatis* (CT) DNA
- *Neisseria gonorrhoeae* (GC) DNA
- *Trichomonas vaginalis* (TV) DNA

C Type of Test:

Qualitative real-time PCR

III Intended Use/Indications for Use:

A Intended Use(s):
See Indications for Use below.

B Indication(s) for Use:
The BD CTGCTV2 assay incorporates automated DNA extraction and real-time polymerase chain reaction (PCR) for the direct, qualitative detection of DNA from:

Chlamydia trachomatis (CT)
Neisseria gonorrhoeae (GC)
Trichomonas vaginalis (TV)

The assay may be used for detection of CT, GC and/or TV DNA in patient- or clinician-collected vaginal swab specimens (in a clinical setting) and male and female urine specimens. The assay may also be used for the detection of CT and GC DNA in endocervical swab and Liquid-Based Cytology (LBC) specimens in ThinPrep PreservCyt Solution using an aliquot that is removed prior to processing for the ThinPrep Pap test. The assay may also be used for the detection of CT and GC DNA in clinician-collected rectal and oropharyngeal swab specimens.

The assay is indicated for use with asymptomatic and symptomatic individuals to aid in the diagnosis of chlamydial, gonococcal, and/or trichomoniasis urogenital disease and chlamydial and gonococcal extragenital infection.

The BD CTGCTV2 assay is available for use with the BD MAX System (urogenital specimens) or the BD COR System (urogenital and extragenital specimens), as described above.

C Special Conditions for Use Statement(s):
Rx - For Prescription Use Only

D Special Instrument Requirements:
BD COR System

IV Device/System Characteristics:

A Device Description:

The BD COR instrument was developed as a high volume molecular testing device to support the need of diagnostic laboratories for automated processing of large numbers of clinical samples with a concurrent reduction of manual user intervention to obtain test results. When performed on the BD COR system, the CTGCTV2 Assay has no changes to the PCR primer and probe sequences, reagent formulations, detection method, or result analysis algorithms as it compares to the BD MAX instrument. For more information regarding BD COR System and equivalency

between the BD COR and BD MAX instruments, please refer to K210585. For an overview of BD CTGCTV2 assay, please refer to K182692.

B Principle of Operation:

Once specimens are loaded into the PX, pre-analytical system of BD COR system, the PX performs all pre-analytical steps, including: sample transfer into SBTs (when required), pre-warming (when required) to homogenize matrix and lyse cells, vortexing, and cooling. Following the pre-processing steps, the PX loads samples into shuttles that transfer samples to the MX analyzer. After arriving at the MX, samples undergo extraction, amplification, and real-time detection of target DNA, which are the same as those performed by the BD MAX.

C Instrument Description Information:

1. Instrument Name:

   BD COR System

2. Specimen Identification:

   The BD COR System is designed to allow the users to place bar coded clinical specimens directly into designated transport racks to be loaded onto the PX. Once loaded onto the system, sample login will be performed automatically by PX and assay menu selection will be automatically made based on Laboratory Information System (LIS) order. Body site/specimen designation is entered into the LIS prior to sample loading. The software retrieves the specimen type and body site designation from the LIS and processes the specimen according to the appropriate workflow.

3. Specimen Sampling and Handling:

   Specimen handling is automatically performed by the PX Instrument of the BD COR.

4. Calibration:

   BD COR does not require user calibration. Annual preventative maintenance is required to be performed by BD authorized service personnel.

5. Quality Control:

   The Quality Control for the BD CTGCTV2 Assay remains the same for both BD MAX and BD COR.

   The assay includes a Specimen Processing Control (SPC) that is present in each Extraction Tube. The SPC monitors DNA extraction steps, thermal cycling steps, reagent integrity and the presence of inhibitory substances.

   External Control materials are not provided by BD. External positive and negative controls are not used by the BD COR system software for the purpose of test result interpretation. External controls are treated as patient samples. The external positive control is intended to

monitor for substantial reagent failure. The external negative control is intended to detect reagent or environmental contamination (or carry-over) by target nucleic acids. It is recommended that one external positive control and one external negative control be run at least daily until adequate process validation is achieved on the BD COR in each laboratory setting. Reduced frequency of control testing should be in accordance with applicable regulations as suggested in the package insert.

V Substantial Equivalence Information:

A Predicate Device Name(s):
BD CTGCTV2

B Predicate 510(k) Number(s):
K210585

C Comparison with Predicate(s):

Device & Predicate Device(s):	K243343	K210585
Device Trade Name	Same	BD CTGCTV2
General Device Characteristic Similarities		
Intended Use	The BD CTGCTV2 assay incorporates automated DNA extraction and real-time polymerase chain reaction (PCR) for the direct, qualitative detection of DNA from: *Chlamydia trachomatis* (CT) *Neisseria gonorrhoeae* (GC) *Trichomonas vaginalis* (TV) The assay may be used for detection of CT, GC and/or TV DNA in patient- or clinician-collected vaginal swab specimens (in a clinical setting) and male and female urine specimens. The assay may also be used for the detection of CT and GC DNA in endocervical swab and Liquid-Based Cytology (LBC) specimens in ThinPrep PreservCyt Solution using an aliquot that is removed prior to processing for	The BD CTGCTV2 assay incorporates automated DNA extraction and real-time polymerase chain reaction (PCR) for the direct, qualitative detection of DNA from: *Chlamydia trachomatis* (CT) *Neisseria gonorrhoeae* (GC) *Trichomonas vaginalis* (TV) The assay may be used for detection of CT, GC and/or TV DNA in patient- or clinician-collected vaginal swab specimens (in a clinical setting) and male and female urine specimens. The assay may also be used for the detection of CT and GC DNA in endocervical swab and Liquid-Based Cytology (LBC) specimens in ThinPrep PreservCyt Solution using an aliquot that is removed prior to

<table>
<tr><td></td><td>the ThinPrep Pap test. The assay may also be used for the detection of CT and GC DNA in clinician-collected rectal and oropharyngeal swab specimens.

The assay is indicated for use with asymptomatic and symptomatic individuals to aid in the diagnosis of chlamydial, gonococcal, and/or trichomoniasis urogenital disease and chlamydial and gonococcal extragenital infection.

The BD CTGCTV2 assay is available for use with the BD MAX System (urogenital specimens) or the BD COR System (urogenital and extragenital specimens), as described above.</td><td>processing for the ThinPrep Pap test.

The assay is indicated for use with asymptomatic and symptomatic individuals to aid in the diagnosis of chlamydial urogenital disease, gonococcal urogenital disease and/or trichomoniasis.

The BD CTGCTV2 assay is available for use with the BD MAX System or the BD COR System.</td></tr>
<tr><td>Regulation</td><td>Same</td><td>21 CFR 866.3393</td></tr>
<tr><td>Device Classification</td><td>Same</td><td>Class II</td></tr>
<tr><td>Indications For Use</td><td>Same</td><td>Symptomatic and Asymptomatic</td></tr>
<tr><td>Organisms Detected</td><td>Same</td><td>Chlamydia trachomatis (CT)
Neisseria gonorrhoeae (GC)
Trichomonas vaginalis (TV)</td></tr>
<tr><td>Assay Controls</td><td>Same</td><td>Sample Processing Control</td></tr>
<tr><td>Target Detection</td><td>Same</td><td><table><tr><td>Target</td><td>Dye</td><td>Channel</td></tr><tr><td>CT</td><td>FAM</td><td>FAM</td></tr><tr><td>CT</td><td>FAM</td><td>FAM</td></tr><tr><td>GC (GC1)</td><td>CFO</td><td>VIC</td></tr><tr><td>GC (GC2)</td><td>Q705</td><td>CY5.5</td></tr><tr><td>TV</td><td>Q670</td><td>Cy5</td></tr></table></td></tr>
<tr><td>Collection/Transport Device</td><td>Same (oropharyngeal and rectal specimens utilize swab sample buffer tube)</td><td>Swab sample buffer tube
Urine sample buffer tube
LBC sample buffer tube</td></tr>
<tr><td>General Device Characteristic Differences</td><td></td><td></td></tr>
<tr><td>Instrumentation</td><td>BD COR (urogenital and extragenital specimens)</td><td>BD COR or BD MAX</td></tr>
</table>

	BD MAX (urogenital specimens only)	
On-Board Lysis (OBL)	30’ OBL Urogenital specimens 10’ OBL LBC specimens 10’ Extragenital specimens	30’ OBL Urogenital specimens 10’ OBL LBC specimens
Specimens	Vaginal swab Urine Endocervical swab LBC in PreservCyt Oropharyngeal swab Rectal swab	Vaginal swab Urine Endocervical swab LBC in PreservCyt

VI Standards/Guidance Documents Referenced:

1. Molecular Diagnostic Methods for Infectious Diseases; Approved Guideline; CLSI MM03; 3rd Edition

2. Collection Transport Preparation and Storage of Specimens for Molecular Methods; CLSI MM13; 2nd Edition

3. Evaluation of Precision of Quantitative Measurement Procedures; CLSI EP05-A3; September 2019

4. Evaluation of Stability of In Vitro Diagnostic Reagents; Approved Guideline; CLSI EP-25A

5. Medical device software - Software life cycle processes; IEC 62304; 2015-06

6. Medical devices - Application of risk management to medical devices; ISO 14971; 3rd Edition; 2019-12

7. Medical devices - Part 1: Application of usability engineering to medical devices; IEC 62366-1; Edition 1.1; 2020-06

8. Clinical investigation of medical devices for human subjects - Good clinical practice; ISO 14155; 3rd Edition; 2020-07

9. Medical devices - Symbols to be used with information to be supplied by the manufacturer - Part 1: General requirements; ISO 15223-1; 4th Edition; 2021-07

10. Medical devices - Information to be supplied by the manufacturer; ISO 20417; 1st Edition; 2021-12

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:
   Please refer to K182692 and K210585.

2. Linearity:
   Not applicable.

3. Analytical Specificity/Interference:
   a. Cross-reactivity
   Cross-reactivity for urogenital and LBC specimens was previously tested and reported in K182692. A separate cross-reactivity study was performed to test for potential false positive results from non-CT and non-GC organisms that may be present in rectal and oropharyngeal specimens. The new cross-reactivity study utilized the 10 minute OBL time specific to extragenital specimen processing. Potential cross-reacting microorganisms were diluted in pooled oropharyngeal or rectal swab clinical matrix at clinically challenging concentrations (see table headings for relevant matrix-organism testing). Organisms were tested at $\geq 1x10^6$ cells/mL, cysts/mL or CFU/mL. Viruses were tested at $\geq 1x10^5$ PFU/mL, copies/mL, genomic equivalents/mL or $TCID_{50}$/mL, except *Entamoeba histolytica*, Enterovirus, *Giardia lamblia*, Human metapneumovirus, and Rhinovirus. Three replicates were tested for each potential cross-reactant as listed in the table. Each cross-reactant tested was expected to provide a negative CT and GC result. Three replicates were tested for each test condition.

Table 1. Cross-reactivity Results for BD CTGCTV2 for Extragenital Specimens

Microorganism	CT Positive results	GC Positive results	Pass/Fail
Oropharyngeal Sample Testing			
Arcanobacterium haemolyticum	0	0	Pass
Porphyromonas gingivalis	0	0	Pass
Adenovirus 41	0	0	Pass
Prevotella bivia	0	0	Pass
Aggregatibacter actinomycetemcomitans	0	0	Pass
Hoylesella oralis	0	0	Pass
Pseudomonas aeruginosa	0	0	Pass
Bordetella pertussis	0	0	Pass
Respiratory syncytial virus	0	0	Pass
Campylobacter rectus	0	0	Pass
Rhinovirus[e]	0	0	Pass
Candida albicans	0	0	Pass
Saccharomyces cerevisiae	0	0	Pass
Coronavirus	0	0	Pass
Corynebacterium diphtheriae	0	0	Pass
Staphylococcus aureus	0	0	Pass
Streptococcus dysgalactiae	0	0	Pass
Streptococcus anginosus	0	0	Pass

Tannerella forsythus	0	0	Pass
Treponema denticola	0	0	Pass
Fusobacterium necrophorum	0	0	Pass
Veillonella parvula	0	0	Pass
Herpes simplex virus 1	0	0	Pass
Human influenza virus B	0	0	Pass
Human influenza virus A	0	0	Pass
Human metapneumovirus[d]	0	0	Pass
Klebsiella pneumoniae	0	0	Pass
Lactobacillus acidophilus	0	0	Pass
Moraxella catarrhalis	0	0	Pass
Mycoplasma pneumoniae	0	0	Pass
Parvimonas micros	0	0	Pass
Rectal Sample Testing			
Acinetobacter baumannii	0	0	Pass
Anaerococcus tetradius	0	0	Pass
Bifidobacterium adolescentis	0	0	Pass
Clostridium difficile	0	0	Pass
Entamoeba histolytica[a]	0	0	Pass
Enterococcus faecalis	0	0	Pass
Enterobacter cloacae	0	0	Pass
Enterovirus Type 68[b]	0	0	Pass
Giardia lamblia[c]	0	0	Pass
Vibrio cholerae	0	0	Pass
Helicobacter pylori	0	0	Pass
Yersinia enterocolitica	0	0	Pass
Streptococcus dysgalactiae	0	0	Pass
Lactobacillus acidophilus	0	0	Pass
Listeria monocytogenes	0	0	Pass
Morganella morganii	0	0	Pass
Norovirus Group 2	0	0	Pass
Prevotella bivia	0	0	Pass
Proteus mirabilis	0	0	Pass
Providencia stuartii	0	0	Pass
Pseudomonas aeruginosa	0	0	Pass
Salmonella enterica	0	0	Pass
Shigella sonnei	0	0	Pass
Staphylococcus aureus	0	0	Pass
Streptococcus agalactiae	0	0	Pass

[a]*Entamoeba histolytica* tested at $5x10^3$ cells/mL.
[b]Enterovirus tested at $1x10^4$ $TCID_{50}$/mL.
[c]*Giardia lamblia* tested at $1x10^5$ cysts/mL.
[d]Human metapneumovirus tested at $5x10^3$ cp/mL.
[e]Rhinovirus tested at $3x10^3$ $TCID_{50}$/mL.

b. Microbial Interference

Microbial Interference for urogenital and LBC specimens was previously tested and reported in K182692. A separate microbial interference study was performed to test for potential false negative results when interfering microorganisms are present in high concentration. The organisms chosen for testing were a subset of organisms tested in K182692. The new microbial interference study utilized the 10 minute OBL time specific to extragenital specimen processing. Potentially interfering microorganisms were spiked at high concentrations into either simulated oropharyngeal samples (oropharyngeal clinical matrix containing 3x LOD of CT and 3x LOD of GC organisms) or simulated rectal swab samples (rectal swab clinical matrix containing 3x LOD of CT and 3x LOD of GC organisms). The bacterial cells, parasite and yeasts were tested with both Oropharyngeal and Rectal matrix at $\geq 1x10^6$ cells/mL, cysts/mL or CFU/mL. Viruses were tested at $\geq 1x10^5$ PFU/mL, copies/mL, genomic equivalents/mL or $TCID_{50}$/mL, except *Entamoeba histolytica*, Enterovirus, *Giardia lamblia*, Human metapneumovirus, and Rhinovirus. Three replicates were tested for each potential cross-reactant as listed in the table. Each sample was expected to provide a positive result for both CT and GC in the presence of the tested interferent. Three replicates were tested for each test condition.

Table 2. Microbial Interference Results for BD CTGCTV2 for Extragenital Specimens

Microorganism	CT Positive results	GC Positive results	Pass/Fail
Oropharyngeal Sample Testing			
Arcanobacterium haemolyticum	3	3	Pass
Porphyromonas gingivalis	3	3	Pass
Adenovirus 41	3	3	Pass
Prevotella bivia	3	3	Pass
Aggregatibacter actinomycetemcomitans	3	3	Pass
Hoylesella oralis	3	3	Pass
Pseudomonas aeruginosa	3	3	Pass
Bordetella pertussis	3	3	Pass
Respiratory syncytial virus	3	3	Pass
Campylobacter rectus	3	3	Pass
Rhinovirus[e]	3	3	Pass
Candida albicans	3	3	Pass
Saccharomyces cerevisiae	3	3	Pass
Coronavirus	3	3	Pass
Corynebacterium diphtheriae	3	3	Pass
Staphylococcus aureus	3	3	Pass
Streptococcus dysgalactiae	3	3	Pass
Streptococcus anginosus	3	3	Pass
Tannerella forsythus	3	3	Pass
Treponema denticola	3	3	Pass
Fusobacterium necrophorum	3	3	Pass
Veillonella parvula	3	3	Pass
Herpes simplex virus 1	3	3	Pass
Human influenza virus B	3	3	Pass
Human influenza virus A	3	3	Pass

Human metapneumovirus[d]	3	3	Pass
Klebsiella pneumoniae	3	3	Pass
Lactobacillus acidophilus	3	3	Pass
Moraxella catarrhalis	3	3	Pass
Mycoplasma pneumoniae	3	3	Pass
Parvimonas micros	3	3	Pass
Rectal Sample Testing			
Acinetobacter baumannii	3	3	Pass
Anaerococcus tetradius	3	3	Pass
Bifidobacterium adolescentis	3	3	Pass
Clostridium difficile	3	3	Pass
Entamoeba histolytica[a]	3	3	Pass
Enterococcus faecalis	3	3	Pass
Enterobacter cloacae	3	3	Pass
Enterovirus Type 68[b]	3	3	Pass
Giardia lamblia[c]	3	3	Pass
Vibrio cholerae	3	3	Pass
Helicobacter pylori	3	3	Pass
Yersinia enterocolitica	3	3	Pass
Streptococcus dysgalactiae	3	3	Pass
Lactobacillus acidophilus	3	3	Pass
Listeria monocytogenes	3	3	Pass
Morganella morganii	3	3	Pass
Norovirus Group 2	3	3	Pass
Prevotella bivia	3	3	Pass
Proteus mirabilis	3	3	Pass
Providencia stuartii	3	3	Pass
Pseudomonas aeruginosa	3	3	Pass
Salmonella enterica	3	3	Pass
Shigella sonnei	3	3	Pass
Staphylococcus aureus	3	3	Pass
Streptococcus agalactiae	3	3	Pass

[a]*Entamoeba histolytica* tested at $5x10^3$ cells/mL.
[b]Enterovirus tested at $1x10^4$ $TCID_{50}$/mL.
[c]*Giardia lamblia* tested at $1x10^5$ cysts/mL.
[d]Human metapneumovirus tested at $5x10^3$ cp/mL.
[e]Rhinovirus tested at $3x10^3$ $TCID_{50}$/mL.

c. Interfering Substances

Exogenous over-the-counter and prescription medications and household substances were tested for their potential to interfere with the BD CTGCTV2 assay when performed using rectal or oropharyngeal specimens. One strain each of CT and GC were diluted in each clinical matrix to 3x the LOD and tested in three replicates per test condition. The following interferents tested in the rectal specimen category (listed in the footnote below Table 3) showed interference at the initial concentrations and had to be titrated down to obtain 3/3 results: Stearic acid, Feces, Zinc Oxide. The following interferents tested in the

oropharyngeal specimen category showed interference at the initial concentrations and had to be titrated down to obtain 3/3 results: Beconase AQ, Prilosec, Toothpaste.

Table 3. Chemical Interference in Rectal Swab Specimens

Interfering Substance	Concentration Tested
Vaseline	5%
Miconazole Nitrate Cream	2% w/v
*Zinc Oxide	10% w/w paste
Phenylephrine HCL	2% w/v
Witch Hazel	3.75%
Mupirocin	3.75%
Mineral Oil	2% v/v
Imodium	0.00667 mg/mL
Nonoxynol-9	7% v/v
Ex-Lax	0.1 mg/mL
Benzalkonium Chloride	0.12% w/v
Al Hydroxide Carbonate	0.1 mg/mL
*Feces	1.75%
Palmitic acid	2 mg/mL
*Stearic acid	1 mg/mL

* Original testing concentrations that showed interference were: Zinc oxide – 40%; Feces – 3.75%; Stearic acid – 4mg/mL

Table 4. Chemical Interference in Oropharyngeal Swab Specimens

Interfering Substance	Concentration Tested
Neo-synephrine	3.75%
Afrin Nasal Spray	7.5 mg/mL
Zicam Nasal Gel	20%
Saline Nasal Spray	15%
Relenza	45% v/v
Tobramycin	9% v/v
Ribavrin	5 ng/mL
Oseltamivir	7.5 mg/mL
*Beconase AQ	1.75%
Calcium Carbonate	0.5 mg/mL
Pepto Bismol	0.87 mg/mL
Tagamet	0.5 mg/mL
*Prilosec	0.25 mg/mL
Vancomycin HCl	12.5 mg/mL
Sucrets lozenges	10 mg/mL
Barium Sulfate	5 mg/mL
Chloraseptic Spray	10 mg/mL
*Toothpaste	10 mg/mL
Mouthwash	25% v/v
Lip Balm	5 mg/mL
Docosanol	10 mg/mL

* Original testing concentrations that showed interference were: Prilosec – 0.5 mg/mL; Beconase AQ – 3.75%; Toothpaste – 50mg/mL

An additional interference study was performed to assess the potentially interfering effects of Blood, Mucus, and KY Jelly on detection of CT or GC in rectal or oropharyngeal swabs at challenging levels (3X LOD for each organism). Blood and Mucus were assessed for both specimen types while KY Jelly was tested only in rectal swab specimens. Potential interferents were tested at biologically relevant concentrations in three replicates per sample using co-spiked organisms diluted in clinical matrix. If interference was observed (i.e.; false positive or false negative results), the interferent was diluted two-fold and additional replicates were tested until no interference was observed. Results of the interference testing with blood, mucus, and KY Jelly is shown in the tables below.

Table 5. Interference of Whole Blood or Mucus in Oropharyngeal Swab Specimens

Interferent	Concentration	CT+GC Sample Positive/Negative	# Positive Results[1] / Total Replicates	Pass / Fail
Mucus (Bovine Cervical)	5% v/v	Negative	0 / 3	Pass
		Positive	3 / 3	Pass
Whole Blood	20 µL/mL	Negative	3 / 3	Fail
		Positive	0 / 3	Fail
	10 µL/mL	Negative	0 / 3	Pass
		Positive	3 / 3	Pass

[1] "Positive Result" is defined as detection of both CT and GC in the replicate sample

Table 6. Interference of Whole Blood, Mucus, or KY Jelly in Rectal Swab Specimens

Interferent	Concentration	CT+GC Sample Positive/Negative	# Positive Results[1] / Total Replicates	Pass / Fail
KY Jelly	137.5 mg/mL	Negative	0 / 3	Pass
		Positive	3 / 3	Pass
Mucus (Bovine Cervical)	5% v/v	Negative	0 / 3	Pass
		Positive	3 / 3	Pass
Whole Blood	20 µL/mL	Negative	1 / 3	Fail
		Positive	0 / 3	Fail
	10 µL/mL	Negative	3 / 3	Fail
		Positive	0 / 3	Fail
	5 µL/mL	Negative	0 / 3	Pass
		Positive	3 / 3	Pass

[1] "Positive Result" is defined as detection of both CT and GC in the replicate sample

False positive and false negative results were observed for whole blood in oropharyngeal and rectal swab specimens at the 20 µL/mL level and also at the 10 µL/mL for rectal swab specimens.

d. Competitive Interference

Potential interference with mixed organisms was tested by creating samples with alternating high/low levels of CT or GC organisms. Samples were created with CT or GC near 1.5X the LOD while the other organism was present at a high level (≥ $1x10^6$ organisms / mL). For this experiment, *Trichomonas vaginalis* was also present at high concentration in all test samples. Samples were created using pooled clinical matrix (oropharyngeal or rectal) and tested in 20 replicates per test condition. Results of the mixed organism interference study are shown in the tables below.

Table 7. Competitive Interference in Oropharyngeal Swab Mixed Infection

Test Condition	Organism	Concentration	# Positive / # Tested	False Negatives	Pass / Fail
1	CT	$1x10^6$ EB/mL	20 / 20	0	Pass
	GC	15 CFU/mL	20 / 20	0	Pass
	TV	$1x10^6$ TV/mL	20 / 20	0	Pass
2	CT	1.875 EB/mL	20 / 20	0	Pass
	GC	$1x10^6$ CFU/mL	20 / 20	0	Pass
	TV	$1x10^6$ TV/mL	20 / 20	0	Pass

Table 8. Competitive Interference in Rectal Swab Mixed Infection

Test Condition	Organism	Concentration	# Positive / # Tested	False Negatives	Pass / Fail
1	CT	$1x10^6$ EB/mL	20 / 20	0	Pass
	GC	30 CFU/mL	20 / 20	0	Pass
	TV	$1x10^6$ TV/mL	20 / 20	0	Pass
2	CT	3.75 EB/mL	20 / 20	0	Pass
	GC	$1x10^6$ CFU/mL	20 / 20	0	Pass
	TV	$1x10^6$ TV/mL	20 / 20	0	Pass

The results demonstrate there is no competitive interference between CT and GC in oropharyngeal or rectal swab specimens at the concentrations tested.

4. Assay Reportable Range:
   Not applicable.

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

   Specimen Stability
   Specimen Stability remains unchanged for urogenital and LBC specimens since the previous clearance. Please refer to K210585.

   Extragenital specimen stability
   Clinical matrix pools (rectal and oropharyngeal) were split into two aliquots, one aliquot remained negative matrix and the other was spiked with CT and GC organisms at 3x the LOD. Individual test samples were then placed into sample buffer tubes (SBT) sealed with reclosing septum caps (RSC) and stored at the appropriate test temperature until testing. For

negative samples, four replicates were tested at each of the seven timepoints. Positive specimens were tested with twenty replicates for each timepoint and test condition. Samples were tested immediately with the samples at room temperature for baseline, or were stored at 2-8°C or 33°C until the appropriate testing timepoint. The RSC caps allow for samples to be re-tested after puncture. In order to test stability of both punctured and unpunctured samples, all stored samples were punctured at day 17 following the day 17 test point. Additional testing timepoints of day 21 and day 24 were performed on punctured samples to simulate 4 days and 7 days of 'in-use' samples, respectively. The results of the study demonstrate that rectal and oropharyngeal swab specimens are stable at refrigerated and elevated temperatures beyond day 21, including in-use specimens with punctured RSCs.

6. Analytical Sensitivity:

a. Limit of Detection

Limit of detection was performed using two strains of CT and two strains of GC in pooled clinical matrix. For CT, Serovar D and Serovar H were serially diluted two-fold in concentrations of elementary bodies per milliliter (EB/mL). For GC, strains ATCC 19424 and ATCC 49226 were serially diluted two-fold in concentrations of colony-forming units per milliliter (CFU/mL). Initial LOD screening was performed with twenty replicates per concentration and a minimum of three dilutions in the series using 2 reagent lots and performed on two BD COR instruments. The lowest target level in which at least 95% detection was met was further confirmed in a separate LOD confirmation experiment using 40 replicates per concentration. In experiments in which 100% detection in the LOD confirmation study was observed, an additional half or full dilution was tested with 40 replicates. The table below show the LODs results for CT and GC in Rectal and Oropharyngeal specimens.

Table 11. LOD Summary

Organism	Strain	Specimen	LOD concentration
Chlamydia trachomatis	Serovar H	Rectal Swab	2.5 EB/mL
		Oropharyngeal Swab	1.875 EB/mL
	Serovar D	Rectal Swab	2.5 EB/mL
		Oropharyngeal Swab	1.25 EB/mL
Neisseria gonorrhoeae	ATCC 19424	Rectal Swab	25 CFU/mL
		Oropharyngeal Swab	20 CFU/mL
	ATCC 49226	Rectal Swab	20 CFU/mL
		Oropharyngeal Swab	10 CFU/mL

b. Inclusivity

The reactivity of the BD CTGCTV2 assay was evaluated with additional clinically relevant and geographically diverse serovars and/or strains of Chlamydia trachomatis (CT), *Neisseria gonorrhoeae* (GC), and *Trichomonas vaginalis* (TV). The study included 12 serovars of *Chlamydia trachomatis* (A, B, C, E, F, G, I, J, K, LGV1, LGV2, and Swedish variant), 30 strains of *Neisseria gonorrhoeae* in oropharyngeal and rectal swab samples. A separate study tested inclusivity of CT serovar LGV3 alone due to logistical challenges regarding organism availability. Organism stocks were obtained from ATCC either as lyophilized or frozen cultures. Each organism was grown on/in the appropriate media designated for that organism

and quantified. Each organism was evaluated in rectal or oropharyngeal clinical matrix at 2X the LOD and tested in replicates of at least three using the 10 minute OBL procedure for extragenital specimens. If fewer than 3/3 positive results were determined, the concentration was increased incrementally until 3/3 positive results for CT or GC. The results of the analytical reactivity testing are shown in the tables below.

Table 12a. Inclusivity for CT Serovars in Extragenital Samples

CT Serovar	Matrix Type	LOD Level	Concentration	Detected/Tested
Serovar A	Oropharyngeal	2X LOD	3.75 EB/mL	3/3
	Rectal	2X LOD	5.00 EB/mL	3/3
Serovar B	Oropharyngeal	2X LOD	3.75 EB/mL	3/3
	Rectal	2X LOD	5.00 EB/mL	3/3
Serovar C	Oropharyngeal	2X LOD	3.75 EB/mL	3/3
	Rectal	2X LOD	5.00 EB/mL	3/3
Serovar E	Oropharyngeal	2X LOD	3.75 EB/mL	3/3
	Rectal	2X LOD	5.00 EB/mL	3/3
Serovar F	Oropharyngeal	2X LOD	3.75 EB/mL	3/3
	Rectal	2X LOD	5.00 EB/mL	3/3
Serovar G	Oropharyngeal	2X LOD	3.75 EB/mL	3/3
	Rectal	2X LOD	5.00 EB/mL	3/3
Serovar I	Oropharyngeal	4X LOD	7.5 EB/mL	3/3
	Rectal	4X LOD	10 EB/mL	3/3
Serovar J	Oropharyngeal	2X LOD	3.75 EB/mL	3/3
	Rectal	2X LOD	5.00 EB/mL	3/3
Serovar K	Oropharyngeal	2X LOD	3.75 EB/mL	3/3
	Rectal	2X LOD	5.00 EB/mL	3/3
Swedish Variant	Oropharyngeal	2X LOD	3.75 EB/mL	3/3
	Rectal	2X LOD	5.00 EB/mL	3/3
Serovar LGV1	Oropharyngeal	2X LOD	62.76 copies/mL	3/3
	Rectal	2X LOD	36.98 copies/mL	3/3
Serovar LGV2	Oropharyngeal	2X LOD	40.00 copies/mL	3/3
	Rectal	2X LOD	32.02 copies/mL	3/3

Table 12b. Inclusivity for CT Serovar LGV3 in Extragenital Samples

CT Serovar	Matrix Type	LOD Level	Concentration	Detected/Tested
Serovar LGV3	Oropharyngeal	2X LOD	79 copies/mL	3/3
	Rectal	2X LOD	40 copies/mL	3/3

Table 13. Inclusivity for GC Strains in Extragenital Samples

No. of GC strains	Matrix Type	LOD Level	Detected/Tested
27	Oropharyngeal	2X LOD	3/3
27	Rectal	2X LOD	3/3
3	Oropharyngeal	3X LOD	3/3
3	Rectal	3X LOD	3/3

7. Assay Cut-Off:

Please refer to K182692. The Cut-off values of the BD CTGCTV2 Assay have not changed.

8. Accuracy (Instrument):

Not applicable.

9. Carry-Over:

Please refer to K182692 and K210585.

B Comparison Studies:

1. Method Comparison with Predicate Device:

Not applicable.

2. Matrix Comparison:

Prospective extragenital specimens were collected as part of a unique, multi-site, collaborative collection as described in Section C, below. The collaborative collection study utilized a "common collection device" (CCD) in the form of the Abbott multi-collect vial containing 10 mL PreservCyt medium. BD performed a bridging study to demonstrate that there is no significant difference in the BD CTGCTV2 assay's ability to detect *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (GC) targets in specimens processed on BD COR using the standard workflow for the 3-in-1 swabs (BD Molecular Swab) versus the workflow intended for PreservCyt medium diluted in the common collection device.

A dilution series of rectal or oropharyngeal matrix co-spiked with CT and GC was performed to obtain a dilution level that will not yield 100% detection. The CCD swab and 3-in-1 swab were used to absorb the various spiked rectal and oropharyngeal matrix concentrations and then expressed in the appropriate media type (PreservCyt for CCD, BD Molecular Swab media for 3-in-1 tube). All samples were tested using the BD CTGCTV2 on the BD COR instrument. One strain of CT Serovar D and GC 49226 was assessed. Resulting data with CCD swab and 3-in-1 swab was compared to determine the impact, if any, of the absorption and expression of each swab type on the assay. The study demonstrated that the BD CTGCTV2 assay was able to detect similar concentrations of analytes using either the CCD or the BD 3-in-1 swab for both oropharyngeal and rectal swab specimens.

C Clinical Studies:

Clinical performance with Urogenital and LBC specimens can be found in K182692.

The clinical performance of the BD CTGCTV2 assay on the BD COR System for the detection of C. trachomatis and N. gonorrhoeae in oropharyngeal and anorectal (rectal) swab specimens was established in a multi-site, prospective collection. The clinical study was uniquely designed, in collaboration and agreement between academic institutions and FDA, to facilitate the evaluation of assay performance for the detection of CT and NG infections in extragenital

specimens by simultaneous comparison of the performance among four previously FDA-cleared NAATs for the detection of CT and NG in urogenital specimens. Eight diverse clinic sites (STD, HIV, Family Planning, and STD Research), located at geographically distributed locations, were utilized for sample collection. There were 2390 subjects available for testing, representing sexually active men and women, ranging in age from 15 to 77 years old. Both symptomatic and asymptomatic individuals were included in the study population following informed consent. Specimens were tested for CT and NG using BD CTGCTV2 on BD COR and three commercially available NAATs. All tests were run according to the respective manufacturers' Instructions for Use. For each subject enrolled in the study, three swab specimens were collected from each anatomic site (rectum and oropharynx) and placed into a common collection vial containing 10 mL PreservCyt medium. Samples were sent to a central aliquoting laboratory, where they were vortexed and transferred into each of the four manufacturer's collection/transport tube prior to being transported to a testing laboratory. The clinical performance of the BD CTGCTV2 assay testing oropharyngeal and rectal specimens was determined by comparing the results obtained with the subject device to a site-specific infection derived by algorithm of results from the three comparator NAATs. The composite algorithm was considered positive if at least two of the three comparator assays, were positive (2/3 rule).

Three US sites (2 external and 1 internal) were used to perform testing of the residual specimens. There were 2343 Oropharyngeal (OP) and 2309 rectal swab specimens available for testing. There were 25 low volume OP specimens not available for testing with the BD CTGCTV2 assay, leaving 2318 OP specimens. Of the 2318 OP specimens, 20 CT specimens and 15 GC specimens were removed due to control failures, lack of reference method result, improper storage conditions, or failure to receive the sample at the testing site. The remaining 2298 and 2303 CT and GC OP specimens, respectively, were included in the calculation of performance estimates. There were 17 low volume rectal specimens not available for testing with the BD CTGCTV2 assay, leaving 2292 rectal swab specimens. Of the 2292 rectal swab specimens, 18 CT specimens and 16 GC specimens were removed due to control failures, lack of reference method result, improper storage conditions, or failure to receive the sample at the testing site. As a result, 2274 and 2276 CT and GC rectal swab specimens, respectively, were included in the calculation of performance estimates. Results of the clinical performance testing for CT and GC in OP and rectal swab specimens are in the tables below.

Table 14. OP and Rectal Swab Clinical Performance for CT by Symptomatic Status on the BD CTGCTV2 Assay on the BD COR

Symptomatic Status	Specimen Type	Sensitivity (95% C.I.)	Specificity (95% C.I.)
Asymptomatic	Oropharyngeal	17/17 100% (81.6-100%)	1526/1529 99.8% (99.4-99.9%)
	Rectal	81/83 97.6% (91.6-99.3%)	1446/1453 99.5% (99.0-99.8%)
Symptomatic	Oropharyngeal	7/7 100% (64.6-100	726/728 99.7% (99.0-99.9%)
	Rectal	48/49	667/672

		98.0% (89.3-99.6%)	99.3% (98.3-99.7%)
Unknown	Oropharyngeal	N/A	17/17 100% (81.6-100%)
	Rectal	N/A	17/17 100% (81.6-100%)
Total	Oropharyngeal	24/24 100% (86.2-100%)	2269/2274 99.8% (99.5-99.9%)
	Rectal	129/132 97.7% (93.5-99.2%)	2130/2142 99.4% (99.0-99.7%)

N/A = not available

Table 15. OP and Rectal Swab Clinical Performance for GC by Symptomatic Status on the BD CTGCTV2 Assay on the BD COR

Symptomatic Status	Specimen Type	Sensitivity (95% C.I.)	Specificity (95% C.I.)
Asymptomatic	Oropharyngeal	43/46 93.5% (82.5-97.8%)	1498/1507 99.4% (98.9-99.7%)
	Rectal	50/50 100% (92.9-100%)	1486/1487 99.9% (99.6-100%)
Symptomatic	Oropharyngeal	47/51 92.2% (81.5-96.9%)	679/682 99.6% (98.7-99.9%)
	Rectal	40/44 90.9% (78.8-96.4%)	675/678 99.6% (98.7-99.8%)
Unknown	Oropharyngeal	N/A	17/17 100% (81.6-100%)
	Rectal	1/1 100% (20.7-100%)	16/16 100% (80.6-100%)
Total	Oropharyngeal	90/97 92.8% (85.9-96.5%)	2194/2206 99.5% (99.1-99.7%)
	Rectal	91/95 95.8% (89.7-98.4%)	2177/2181 99.8% (99.5-99.9%)

N/A = not available

The initial invalid rate for oropharyngeal specimens tested in the prospective clinical study was 16/2307 = 0.7%. After retesting, the final invalid rate was 1/2306 = 0.0%. The initial invalid rate

for rectal swab specimens tested in the prospective clinical study was 11/2279 = 0.5%. After retesting, the final invalid rate was 1/2278 = 0.0%. The overall invalid rate for extragenital specimens in the clinical study was 0.6%.

D Clinical Cut-Off:

Not applicable.

E Expected Values/Reference Range:

The positivity rate was calculated from the testing results from the BD COR System, and only specimens with valid subject test results were included. The positivity rate of CT was 6.2% (142/2,277) among rectal samples and 1.3% (30/2,305) among oropharyngeal samples, and the positivity rate of GC was 4.2% (96/2,277) among rectal samples and 4.5% (103/2,305) among oropharyngeal samples. The Table below provides the positivity rate per target per specimen type stratified by symptomatic status, target, and specimen type.

Table 16. Positivity Rate with BD COR System by Symptomatic Status, Target, and Specimen Type

Symptomatic Status	Specimen Type	Positivity Rate	
		CT	GC
Asymptomatic	Oropharyngeal	21/1553 (1.4%)	52/1553 (3.3%)
	Rectal	88/1537 (5.7%)	51/1537 (3.3%)
Symptomatic	Oropharyngeal	9/735 (1.2%)	51/735 (6.9%)
	Rectal	54/723 (7.5%)	44/723 (6.1%)
Unknown	Oropharyngeal	0/17 (0%)	0/17 (0%)
	Rectal	0/17 (0%)	1/17 (5.9%)
Total	Oropharyngeal	30/2305 (1.3%)	103/2305 (4.5%)
	Rectal	142/2277 (6.2%)	96/2277 (4.2%)

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.