



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

I Background Information:

A 510(k) Number

K251501

B Applicant

Visby Medical, Inc.

C Proprietary and Established Names

Visby Medical Men's Sexual Health Test

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 obtain market clearance for a new diagnostic device.

B Measurand:

Chlamydia trachomatis DNA
Neisseria gonorrhoeae DNA

C Type of Test:

III Intended Use/Indications for Use:

A Intended Use(s):

See Indications for Use below.

B Indication(s) for Use:

The Visby Medical Men's Sexual Health Test is a single-use (disposable), fully integrated, automated Polymerase Chain Reaction (PCR) in vitro diagnostic test intended for the rapid detection and differentiation of DNA from *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in male urine specimens. The test results are to aid in the diagnosis of symptomatic or asymptomatic infections with *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in males.

C Special Conditions for Use Statement(s):

Rx - For Prescription Use Only

D Special Instrument Requirements:

Self-contained

IV Device/System Characteristics:

A Device Description:

The Visby Medical Men's Sexual Health Test is a single-use (disposable), fully automated, rapid, compact device that contains PCR assays for qualitative detection of *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) DNA in male urine samples from symptomatic or asymptomatic individuals. The device automatically performs all steps required to complete lysis, PCR amplification, and detection.

The Visby Medical Men's Sexual Health Test contains the test cartridge, a fixed volume pipette to transfer the specimen to the dropper tube, and a dropper tube containing sample buffer solution. The test is designed to be simple to use. The patient collects a first catch urine sample in a standard urine collection cup (not provided). The operator starts the test by using a provided fixed-volume disposable transfer pipette to transfer ~ 450 µL of urine from the collection cup into a dropper tube containing ~900 µL of Visby Medical Men's Sexual Health Buffer. The operator transfers the entire volume (~1.35 mL) of the sample (urine in buffer) into the sample port of the device by squeezing the dropper tube to release all of the sample into the device sample port. The operator then slides a purple switch on the front of the device to both close the sample port and initiate the fully automated testing process. At this point, blinking white lights on the front of the device indicate the test is in progress. Test results are available in just under 30 minutes at which time a green "READY" status light will appear at the bottom of the device,

and a purple color will appear in the “RESULTS VALID” spot, indicating a valid test. A purple spot adjacent to “CHLAMYDIA” and/or “GONORRHEA” signifies the presence of amplified CT and/or NG DNA in the sample.



B Principle of Operation:

When the sample is added to the sample port, it rehydrates a lyophilized internal process control. The sample enters a lysis module, where the DNA in the sample and the internal process control are extracted using a combination of chemical lysis and high temperature. The extracted DNA enters a mixing chamber where it rehydrates lyophilized PCR reagents, followed by thermocycling to amplify target DNA. If present, the amplified pathogen target (CT and/or NG) and internal process control hybridize to specific probes located on a flow channel. Detection of the target-specific PCR product is accomplished via an enzyme-linked colorimetric assay using streptavidin-bound horseradish peroxidase (HRP) and a colorimetric substrate that forms a purple precipitate. Test results can be expected in approximately 30 minutes. A green “Ready” light will appear indicating the test has completed and a purple color will appear in the “Control” spot, indicating a successful internal process control. A purple spot adjacent to “Chlamydia,” “Gonorrhoeae,” signifies the presence of amplified CT or NG DNA in the sample. In the rare case of a hardware failure, the power light, progress light bar or the green “Ready” light will be off or flashing indicating an error has occurred and the test result window will indicate an invalid test. In the case of an invalid test, the operator is instructed to run a new test.

C Instrument Description Information:

1. Instrument Name:

Visby Medical Men's Sexual Health Test - the instrument is integrated into the reaction cartridge.

2. Specimen Identification:

Manual

3. Specimen Sampling and Handling:

The specimen is self-collected by the patient and placed in the Visby collection media. Thus, a liquid sample is available for transfer onto the device. All further sample processing takes place within the device.

4. Calibration:

No calibration is required.

5. Quality Control:

Each Visby Medical Men's Sexual Health Test includes both built-in electronic controls and an internal process control. These controls are designed to ensure that the device is operating within specification.

The electronic control uses firmware to monitor the device during the run and illuminates a green circle LED next to "READY" at the completion of a run. The firmware also generates errors when, (1) the device experiences a power interruption, (2) the device is operated outside of its operating temperature range, or (3) a hardware or firmware failure is detected. Electronic controls are communicated to the operator via status lights on the bottom of the device. If an error occurs, the status lights will communicate the error to the operator.

The internal process control is comprised of a PCR assay to a control organism (*Neisseria subflava*) that is contained in the device. The process control is designed to ensure that all steps in the testing process including lysis, amplification of target sequences, and amplicon detection are working properly. A purple spot adjacent to "RESULTS VALID" in the results window indicates a successful internal process control. If a purple spot is not present in the "RESULTS VALID" window, then the test result is invalid.

External controls:

Positive and negative external controls manufactured by ZeptoMetrix Corporation, Buffalo, NY. The labeling states that the external controls must be tested with each new lot or shipment received and once for each untrained operator.

V Substantial Equivalence Information:

A Predicate Device Name(s):

Visby Medical Sexual Health Test

B Predicate 510(k) Number(s):

K220407

C Comparison with Predicate(s):

Device & Predicate Device(s):	<u>K251501</u>	<u>K220407</u>
Device Trade Name	Visby Medical Men's	Visby Medical Sexual

	Sexual Health Test	Health Test
General Device Characteristic Similarities		
Intended Use/Indications For Use	<p>The Visby Medical Men's Sexual Health Test is a single-use (disposable), fully integrated, automated Polymerase Chain Reaction (PCR) in vitro diagnostic test intended for the rapid detection and differentiation of DNA from <i>Chlamydia trachomatis</i> and <i>Neisseria gonorrhoeae</i> in male urine specimens. The test results are to aid in the diagnosis of symptomatic or asymptomatic infections with <i>Chlamydia trachomatis</i> and <i>Neisseria gonorrhoeae</i> in males.</p>	<p>The Visby Medical Sexual Health Test is a single-use (disposable), fully integrated, automated Polymerase Chain Reaction (PCR) in vitro diagnostic test intended for use in point-of-care or clinical laboratory settings for the rapid detection and differentiation of DNA from <i>Chlamydia trachomatis</i>, <i>Neisseria gonorrhoeae</i>, and <i>Trichomonas vaginalis</i> in self-collected female vaginal swab specimens using the Visby Medical Sexual Health Vaginal Specimen Collection Kit in a health care setting. The test results are to aid in the diagnosis of symptomatic or asymptomatic infections with <i>Chlamydia trachomatis</i>, <i>Neisseria gonorrhoeae</i>, and <i>Trichomonas vaginalis</i>.</p>
General Device Characteristic Differences		
Specimen Type	Patient-collected male Urine	Patient-collected vaginal swab
Collection kit	Urine cup (not provided)	Swab collection kit
Organisms Detected	<p><i>Chlamydia trachomatis</i> (CT) <i>Neisseria gonorrhoeae</i> (NG)</p>	<p><i>Chlamydia trachomatis</i> (CT) <i>Neisseria gonorrhoeae</i> (NG) <i>Trichomonas vaginalis</i></p>

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VI Standards/Guidance Documents Referenced:

1. IEC 62304 Edition 1.1 2015-06 Consolidated Version 13-79 Medical device software – Software life cycle processes.
2. Class II Special Controls as per 21 CFR 866.3393.

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:

A reproducibility study of the Visby Medical Men's Sexual Health Test was conducted by untrained operators from three external sites representative of CLIA waived settings. Six untrained operators (two untrained operators per site) performed the study using panels of blind coded specimens containing low (1X LOD) or moderate (4X LOD) positive CT or NG, or negative samples. Samples were prepared in pooled negative clinical matrix (male urine). Operators tested multiple samples of each panel member over six days. The percent positive results for the CT moderate and CT low positive samples were 100% (108/108) and 98.1% (106/108), respectively. The percent positive results for the NG moderate and NG low positive samples were 100% (108/108) and 100% (108/108), respectively. The Reproducibility Study site-to-site qualitative results (percent positive results) are presented in the table below.

Table 1. Reproducibility

Panel Member	Site 1	Site 2	Site 3	Overall Agreement	95% Confidence Interval
	% Agreement ¹ (count)	% Agreement (count)	% Agreement (count)	% Agreement (count)	
Moderate Positive CT	100% (36/36)	100% (36/36)	100% (36/36)	100% (108/108)	96.6-100%
Low Positive	97.2% (35/36)	97.2% (35/36)	100% (36/36)	98.1% (106/108)	93.5-99.5%
Moderate Positive NG	100% (36/36)	100% (36/36)	100% (36/36)	100% (108/108)	96.6-100%
Low Positive	100% (36/36) ²	100% (36/36)	100% (36/36)	100% (108/108)	96.6-100%
Negative	100% (36/36)	100% (36/36)	100% (36/36)	100% (108/108)	96.6-100%

¹ Agreement = agreement with expected results

² One test was unexpectedly positive for CT

2. Linearity:

Not applicable.

3. Analytical Specificity/Interference:

Cross-reactivity

The Visby Medical Men's Sexual Health Test analytical specificity was evaluated in a study testing samples containing organisms that are closely related to the target organisms or that are present as normal flora in urine specimens. Eight-three different organisms were included in the study (3 of which were tested *in silico*), with each organism tested in three replicates. There was one false positive CT results (out of 3 replicates) with inactivated HIV-1 (ZeptoMetrix NATHIV1-LIN). Additional HIV-1 organism testing with ten replicates in the absence of the inactivation fluid did not replicate the cross-reactivity. A warning was added to labeling indicating the possibility of HIV-1 cross-reactivity with the device. No other cross reactivity was observed with the organisms at the concentrations tested. The following organisms were tested for possible cross-reactivity:

Acinetobacter lwoffii
Actinomyces israelii
Atopobium vaginae
Bacteroides fragilis
Bacteroides ureolyticus
Bifidobacterium adolescentis
Bifidobacterium longum
*Candida albicans**
Candida glabrata
Candida parapsilosis
Candida tropicalis
*Chlamydomphila pneumoniae**
Clostridium difficile
*Chlamydomphila psittaci**
Clostridium perfringens
Corynebacterium genitalium
Corynebacterium xerosis
Cryptococcus neoformans
Cutibacterium acnes
Enterobacter cloacae
*Enterococcus faecalis**
*Escherichia coli**
Fusobacterium nucleatum
Haemophilus ducreyi
Kingella dentrificans
Klebsiella aerogenes
Klebsiella oxytoca
Lactobacillus acidophilus
Lactobacillus brevis
Lactobacillus jensenii
Lactococcus lactis
Lactobacillus vaginalis
Listeria monocytogenes

Mobiluncus curtisii
Mobiluncus mulieris
*Mycoplasma genitalium**
Mycoplasma hominis
Neisseria cinerea
Neisseria elongata (3 strains)
Neisseria flava
Neisseria flavescens (2 strains)
Neisseria lactamica (4 strains)
*Neisseria meningitidis serogroup a**
Neisseria meningitidis serogroup b
Neisseria meningitidis serogroup c
Neisseria meningitidis serogroup d
Neisseria meningitidis serogroup w-135
Neisseria meningitidis serogroup y
Neisseria mucosa (3 strains)
Neisseria perflava
Neisseria polysaccharea
Neisseria sicca (3 strains)
Neisseria subflava
Pentatrichomonis hominis
Peptostreptococcus anaerobius
Prevotella bivia
Proteus mirabilis
Staphylococcus aureus
Staphylococcus epidermidis
Streptococcus agalactiae
Streptococcus pyogenes
*Trichomonas tenax**
Ureaplasma urealyticum
 Herpes simplex virus I*
 Herpes simplex virus II
 Human papilloma virus 16 E6/E7 (Transformed cells)
 HIV-1 (inactivated)*
 HIV-1 (culture fluid)
Gardnerella vaginalis
Klebsiella pneumoniae
Pseudomonas aeruginosa
Ureaplasma parvum
*Trichomonas vaginalis**

Microbial Interference

The performance of the Visby Medical Men's Sexual Health Test was evaluated for its ability to accurately detect CT and NG in the presence of other clinically relevant pathogens. This study tested a total of 11 organisms (denoted by * in the list above) spiked into positive samples containing 3x LOD concentrations of CT and NG in pooled urine in three replicates. The organisms were chosen based on the likelihood of their presence in a urine sample or genetic similarities to the target organisms. No microbial interference was observed with any of the organisms tested.

Competitive Interference

A competitive interference study was performed to evaluate the performance of the Visby Medical Men's Sexual Health Test when CT and NG are present in samples at varying concentrations and combinations to simulate mixed infection conditions (presence of multiple target organisms). Each of the target organisms (CT and NG) were spiked into pooled urine at varying concentrations and tested in triplicate. Low concentrations were prepared at 3x LOD for the respective organisms, and high concentrations were prepared at 1×10^6 units/mL. An additional double-positive sample was tested at 1x LOD for both organisms (Sample #10). A total of 10 mixed infection combinations were tested. All 10 mixed infection combinations returned 3/3 valid devices with the expected results, demonstrating that the presence of high concentration of one organism (1×10^6 units/mL) does not interfere with the detection of low levels (3x LOD) of an alternate organism or cause false positive results for an organism that is not present in the sample.

Table 2: Competitive Interference

Organisms and Concentration		CT (# Positive / # Tested)	NG (# Positive / # Tested)
CT	NG		
Low	High	3/3	3/3
Low	Low	3/3	3/3
Low	Negative	3/3	0/3
High	High	3/3	3/3
High	Low	3/3	3/3
High	Negative	3/3	0/3
Negative	High	0/3	3/3
Negative	Low	0/3	3/3
Negative	Negative	0/3	0/3
1x LOD	1x LOD	3/3	3/3

Interfering Substances

The performance of the Visby Men's Sexual Health Test was evaluated with potentially interfering substances that may be present in clinical urine specimens. A total of 30 potentially interfering substances were individually spiked into urine samples and tested in the absence or presence of CT and NG at a concentration of 3x LOD. Positive and negative samples were tested in triplicate. All 30 substances tested provided the expected results (both positive and negative tests) when tested at the specified concentration. The table below shows the interferents and concentrations used in this study.

Table 3: Interfering Substances

Interfering Substance	Concentration Tested
Acidic Urine	pH 4
Alkaline Urine	pH 9
Albumin (BSA)	500 µg/mL
Beta Estradiol	0.07 mg/mL
Bilirubin	100 µg/mL
Glucose	1 mg/mL

Leukocytes	1x10 ⁶ cells/mL
Mucin (Bovine)	0.80% w/v
Progesterone	0.07 mg/mL
Seminal Fluid	5% v/v
Whole Blood	1% v/v
Acetaminophen	2200 µg/mL
Amoxicillin Trihydrate	6900 µg/mL
Aspirin	1200 µg/mL
Azithromycin	2900 µg/mL
Biotin	10 µg/mL
Ceftriaxone	1200 µg/mL L
Doxycycline	500 µg/mL
Erythromycin	900 µg/mL
Ibuprofen	1200 µg/mL
Metronidazole	1500 µg/mL
Naproxen	1200 µg/mL
Phenazopyridine Hydrochloride	500 µg/mL
Tetracycline Hydrochloride	1700 µg/mL
Trimethoprim	250 µg/mL
Sulfamethoxazole	1800 µg/mL
Abreva Cold Sore Cream	0.25% w/v
KY Jelly Lubricant	0.25% w/v
Preparation H Hemorrhoidal Ointment	0.25% w/v
Talcum Powder	0.25% w/v

4. Assay Reportable Range:

Not applicable.

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

Specimen Stability

A specimen stability study was performed to determine how long a urine specimen can be stored in various conditions before being tested with the Visby Medical Men's Sexual Health Test. Low positive (2x LOD) and negative samples of CT and NG were created in clinical urine matrix and stored at room temperature (15-30 °C) or at refrigerated temperature (2-8 °C). Ten samples were tested at baseline and ten or twenty samples tested at various timepoints throughout the study duration. The study results demonstrated that the specimen can be stored up to 28 hours at 2-8 °C (refrigerated temperature) or up to 3 hours at 15-30 °C (room temperature).

6. Detection Limit:

Limit of Detection

The Limit of Detection (LOD) for the Visby Medical Men's Sexual Health Test was determined for CT in elementary bodies per mL (EB/mL) and NG in colony forming units per mL (CFU/mL), from two distinct serovars or strains, spiked into negative urine. dilutions. The LOD values for each strain were estimated by probit analysis of the results from a range-finding study of five different concentrations (2-fold dilution series) in replicates of ten per concentration. LOD is defined as the lowest concentration per sample that can be detected 95% of the time during confirmation testing for each of the strains. The probit-calculated

LODs were confirmed by testing 20 replicates demonstrating that at least 19 out of 20 replicates were positive empirically. The LOD of the Visby Medical Men's Sexual Health Test for each organism are summarized in the Tables below.

Table 4: Limit of detection for CT Serovar D

CT Serovar D	Concentration (EB/mL)	Detection Rate (# Positive / # Tested)
LOD	32.5	20/20
	10.8	13/20

Table 5: Limit of detection for CT Serovar H

CT Serovar H	Concentration (EB/mL)	Detection Rate (# Positive / # Tested)
LOD	14.0	20/20
	4.7	17/20

Table 6: Limit of detection for NG strain ATCC 49226

NG (ATCC 49226)	Concentration (CFU/mL)	Detection Rate (# Positive / # Tested)
LOD	2.5	20/20
	0.8	16/20 ¹

¹ Two samples returned an initial invalid result; the samples were positive upon retest

Table 7: Limit of detection for NG strain ATCC 19424

NG (ATCC 19424)	Concentration (CFU/mL)	Detection Rate (# Positive / # Tested)
LOD Confirmation	32.0	19/20 ¹

¹ One sample returned an initial invalid result; the sample was positive upon retest

Inclusivity

The analytical reactivity of the Visby Medical Men's Sexual Health Test was evaluated by testing dilutions of quantified stocks of CT and NG strains prepared by spiking into pooled negative clinical urine matrix at concentrations at 3x LOD. A total of 14 CT serovars and 30 NG strains were tested in three replicates. Samples that were not detected in all three replicates at the initially contrived concentrations were retested at a higher concentration. For *C. trachomatis*, 13 of the 14 serovars were detected at 3x LOD (97.5 EB/mL). One serovar (CT LGV II VR-902B) had a detectable minimum concentration of 6x LOD (195.0 EB/mL). For *N. gonorrhoeae*, 30 of the 30 strains were detected at 3x LOD (96.0 CFU/mL). Tables 2 and 3 show the strains that were positive in all three replicates at the concentrations shown.

Table 8: Inclusivity for *C. trachomatis*

Organism	Serovar
<i>C. trachomatis</i>	Serovar F
	Serovar Ba
	Serovar E
	Serovar A
	Serovar B
	Serovar G
	Serovar I
	Serovar J
	Serovar K
	Serovar LGV I

	Serovar LGV II
	Serovar LGV III
	Serovar C
	Serovar E, Swedish variant (nvCT)

Table 9: Inclusivity for *N. gonorrhoeae*

Organism	Strain (ATCC designation)	
<i>N. gonorrhoeae</i>	BAA-1833	27632
	BAA-1839	27633
	BAA-1847	31148
	9826	31149
	9827	31151
	9830	31356
	10874	31397
	11688	31398
	11689	31401
	19088	31402
	23050	31403
	23051	31406
	27628	35541
	27629	43069
	27631	49981

7. Assay Cut-Off:

Not applicable.

8. Accuracy (Instrument):

Not applicable.

9. Carry-Over:

Not applicable.

B Comparison Studies:

1. Method Comparison with Predicate Device:

See Clinical Study section below.

2. Matrix Comparison:

Not applicable.

C Clinical Studies:

Clinical Performance

Clinical performance for the Visby Medical Men's Sexual Health Test was established through a prospective study enrolling individuals at seven geographically diverse clinical sites. The study

was designed to enroll sexually active users aged 14 and above. A total of 16 untrained operators, representative of CLIA waived users, participated in the study. Participants were provided a collection cup and instructions to collect a first-catch urine specimen. An operator, untrained in the use of the subject device, immediately collected the specimen cup and performed the Visby Medical Men's Sexual Health Test according to the quick reference guide. The remaining specimen was aliquoted and sent to two reference laboratories for comparator testing. The samples were first tested by reference labs using two FDA-cleared nucleic acid amplification tests (NAATs). If the two test results were discordant, a third FDA-cleared NAAT was used as a tie-breaker. The study consisted of 1289 prospectively subjects enrolled from October 2024 through March 2025. Seventeen (17) study specimens were excluded from the performance evaluation due to procedural errors by site study staff or incomplete study procedures (n=8), withdrawal of consent (n=4), lack of a valid Visby test result (n=3), or for the subject not meeting inclusion criteria (n=2), leaving 1272 Visby Men's Sexual Health Test results with paired valid comparator results. There were 55 initial invalids out of 1276 evaluable specimens obtained during the clinical study. After retesting, the final invalid rate was $3/1276 = 0.2\%$. The clinical performance for the Visby Medical Men's Sexual Health Test is shown below:

Table 10: Clinical performance for CT by Symptom Status

Symptom Status	N	TP	FP	TN	FN	Sensitivity (95% CI)	Specificity (95% CI)
Symptomatic	310	57	2	249	2	96.6% (88.5-99.1%)	99.2% (97.1-99.8%)
Asymptomatic	962	88	6	863	5	94.6% (88.0-97.7%)	99.3% (98.5-99.7%)
Overall	1272	145	8	1112	7	95.4% (90.8-97.8%)	99.3% (98.6-99.6%)

TP=true positive; FP=false positive; TN=true negative; FN=false negative

Table 11: Clinical performance for NG by Symptom Status

Symptom Status	N	TP	FP	TN	FN	Sensitivity (95% CI)	Specificity (95% CI)
Symptomatic	310	48	1	261	0	100.0% (92.6-100.0%)	99.6% (97.9-99.9%)
Asymptomatic	962	7	7	948	0	100.0% (64.6-100.0%)	99.3% (98.5-99.6%)
Overall	1272	55	8	1209	0	100.0% (93.5-100.0%)	99.3% (98.7-99.7%)

TP=true positive; FP=false positive; TN=true negative; FN=false negative

D Clinical Cut-Off:

Not applicable.

E Expected Values/Reference Range:

During the clinical evaluation, the following positivity rate for detection of CT and NG in males was observed for the Visby Medical Men's Sexual Health Test:

Table 13: Expected Values

	CT Positive	NG Positive	CT + NG Positive
Total	139/1272 (10.9%)	49/1272 (3.9%)	14/1272 (1.1%)

F Other Supportive Instrument Performance Characteristics Data:

Not applicable

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.