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

A. 510(k) Number:

k123891

B. Purpose for Submission:

New device

C. Measurand:

Genotype of Cytochrome P450 2C19 (CYP2C19)

D. Type of Test:

Genotyping microarray

E. Applicant:

Spartan Bioscience Inc.

F. Proprietary and Established Names:

Spartan RX CYP2C19 Test System

G. Regulatory Information:

1. Regulation section:

   21 CFR 862.3360; Drug Metabolizing Enzyme Genotyping Systems
   21 CFR 862.2570; Instrumentation for Clinical Multiplex Test Systems

2. Classification:

   Class II

3. Product code:

   NTI; Drug metabolizing enzyme genotyping systems
   NSU; Instrumentation for Clinical Multiplex Test Systems

4. Panel:
   Toxicology (91)
   Clinical Chemistry (75)

H. Intended Use:

1. Intended use(s):

   See indication(s) for use below.

2. Indication(s) for use:

   Assay - The Spartan RX CYP2C19 System is indicated for use as an aid to clinicians in determining therapeutic strategies for therapeutics that are metabolized by the Cytochrome P450 2C19 gene product, and that are specifically affected by the *2, *3, and *17 alleles. The Spartan RX CYP2C19 Assay will be run on the Spartan RX CYP2C19 Platform from the buccal sample collected with a buccal swab. The Spartan RX CYP2C19 Assay is not indicated to be used to predict drug response or non-response.

   Platform - The Spartan RX CYP2C19 System is indicated for use as an aid to clinicians in determining therapeutic strategies for therapeutics that are metabolized by the Cytochrome P450 2C19 gene product, and that are specifically affected by the *2, *3, and *17 alleles. The Spartan RX CYP2C19 Platform will be used to run the Spartan RX CYP2C19 Assay.

3. Special conditions for use statement(s):

   For prescription use only

   The information provided from this test may supplement decision making and should only be used in conjunction with routine monitoring by a physician. Because of the variability in the knowledge of clinical utility with specific drugs that are metabolized by CYP2C19, clinicians should use professional judgment in the interpretation of results from this test. Results from this type of assay should not be used in predicting a patient's response to drugs for which the drug metabolizing enzyme activity of that allele, or drug metabolic pathway, has not been clearly established.

4. Special instrument requirements:

   Spartan RX Platform

I. Device Description:

The Spartan RX CYP2C19 Test System is a sample-to-result DNA testing system with integrated DNA extraction and amplification. Genotypes are determined using PCR and fluorescent probe detection. The Spartan RX CYP2C19 Test System is comprised of the

Spartan RX Platform, Spartan transport system, and Spartan RX Assays (sample collection kit and external control kit). The Spartan RX CYP2C19 Assays are run on the Spartan RX Platform.

The Spartan RX CYP2C19 Test System uses a sample obtained with a buccal swab. The operator collects the buccal swab samples from a patient, inserts each sample into a reagent tube, places the reagent tube into the transport system until the reagent tubes are ready to be inserted into an Analyzer instrument. The test system then integrates and automates DNA extraction, PCR-based amplification of the target gene, detection of the *2, *3, and *17 alleles using fluorescent-probes v. fluorescent signal detection and analysis, and genotype determination. Results are presented to the end user as genotype calls. The system has integrated controls that monitor performance of a run and automatically inform the user of any anomalies in the instrument or reagents. The system detects the CYP2C19 *2, *3, and *17 genotypes in separate reagent tubes.

The Spartan RX CYP2C19 Test System uses the Spartan RX Platform which has four components:

1. The Spartan RX Analyzer is a thermal cycling instrument that automates polymerase chain reaction (PCR) amplification of the target gene, fluorescence-based detection of CYP2C19 alleles, and genotype calling.

2. The Netbook serves as the user interface for logging into the Spartan RX Platform, inputting patient information, and starting a test.

3. The Printer automatically prints the genotype results after the Spartan RX Platform finishes performing the Spartan RX CYP2C19 Assay.

4. The Barcode Scanner is used to automatically enter SCK and ECK lot numbers into the Spartan RX Platform.

The Spartan RX CYP2C19 Test System uses Spartan RX Assays (Sample collection kit and external control kit). The Spartan RX Assays are the consumable components of the Spartan RX CYP2C19 Test System.

Sample collection kits (SCKs) contain the consumables required to determine a patient's CYP2C19 *2, *3, or *17 genotype. There are three types of SCKs, specific for the *2, *3, or *17 allele. Each SCK consists of a pouch, buccal swab, and a reagent tube. The pouch contains labeling information to ensure traceability (lot number, manufacturing date, and expiry date) and two compartments (for the buccal swab and reagent tube). The pouch also includes a barcode that is compatible with a standard reader. The buccal swab is used to collect a buccal sample from the inside of a patient's cheek and transfer it into the reagent tube. The reagent tube contains chemicals for DNA extraction, PCR amplification, and fluorescent detection of the specific CYP2C19 allele. The SCKs are color-coded to indicate which CYP2C19 allele they are designed to detect.

The External control kits (ECKs) contain the consumables required to determine if the Spartan RX Platform and reagents are performing correctly. Each ECK consists of a pouch and reagent tube. The pouch contains labeling information to ensure traceability (lot number, manufacturing date, and expiry date). The reagent tube contains synthetic nucleic acid control and chemicals for PCR amplification and fluorescent detection of the specific CYP2C19 allele. The ECKs are color-coded to indicate which reagent they control for (blue = *2, white = *3, and black = *17). The ECKs are always produced from the same lot of reagents for which they are designed to control.

The Transport System is designed to keep the sample collection kits and collected samples cold as they are moved from the freezer to the patient and from the patient to the Spartan RX Analyzer. The sample transport system is an insulated transport bag that contains a polystyrene box and a Cold Block.

J. Substantial Equivalence Information:

1. Predicate device name(s):

   Infiniti CYP2C19 Assay

2. Predicate 510(k) number(s):

   K101683

3. Comparison with predicate:

   Assay:

Similarities		
Item	Spartan RX CYP2C19 Test System	Infiniti CYP2C19 Assay k101683 (Predicate)
Indication(s) for Use	The Assay is indicated for use as an aid to clinicians in determining therapeutic strategies for therapeutics that are metabolized by the Cytochrome P450 2C19 gene product, and that are specifically affected by the *2, *3, and *17 alleles..	Same
Target Gene	CYP4502C19 *2, *3, and *17.	Same
Limitations	Not intended to be used to predict drug response or non-response.	Same
DNA Sequencing	Detects specific DNA sequences through	Same

Similarities		
Item	Spartan RX CYP2C19 Test System	Infiniti CYP2C19 Assay k101683 (Predicate)
	recognition of DNA targets.	
Assay Results	Assay signal results are interpreted by a software program. Assay results are provided as genotype calls reported to the end user in a report format.	Same

Differences		
Item	Spartan RX CYP2C19 Test System	Infiniti CYP2C19 Assay k101683(Predicate)
Specimen Type	Buccal swab sample.	Purified DNA from EDTA-anti-coagulated whole blood sample.

Platform:

Similarities		
Item	Spartan RX CYP2C19 Test Platform	AutoGenomics INFINITI Analyzer (Predicate)
Indication(s) for Use	The Platform runs the assay for Cytochrome P450 2C19 gene product. .	Same
Technology	Utilizes thermal cycling and target DNA amplification.	Same

Differences		
Item	Spartan RX CYP2C19 Test Platform	AutoGenomics INFINITI Analyzer (Predicate)
Description	Fluorescent probe PCR-based genotyping test for multiplex analysis of DNA sequences.	Microarray-based genotyping test for simultaneous (multiplex system) of DNA sequences.
Sample preparation	Automated	Off-line

K. Standard/Guidance Document Referenced (if applicable):

None

L. Test Principle:

The Spartan RX CYP2C19 Test System utilizes PCR amplification of target DNA and detection of the presence or absence of specific CYP2C19 alleles (*2, *3, *17) using molecular beacon probes. The Spartan RX CYP2C19 Test System makes use of a two-temperature PCR cycling program which combines the annealing and extension steps.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

a. Precision/Reproducibility:

Site-to-Site Reproducibility

The reproducibility study was conducted at three sites (two external and one internal). The three sites are designated, site 1, site 3, and site 4. Samples used for the study were buccal scrapes collected from *1/*17, *2/*3, *1/*1, *17/*17,*1/*3, *2/*17, *2/*2, and *1/*2 individuals (one individual per genotype); samples were collected from eight individuals at each site. Genotypes of the individuals included in the study were confirmed by bi-directional DNA sequencing prior to initiation of the study. Reproducibility was evaluated at each site in two sessions each day. During each session the following was performed twice: Eight individuals were tested by two operators. If the result of the first test performed using the Spartan RX CYP2C19 System for a particular individual was inconclusive, the test was repeated (second pass), as per the RX System's Instructions For Use. External control tests were performed on each system, as per the RX System's Instructions For Use, and testing proceeded if the results passed.

A total of 960 tests were performed; 10 second pass tests were performed due to inconclusive calls on the first pass test. After second pass testing of inconclusive genotype results, the Spartan RX CYP2C19 Test System produced a correct call rate of 99.8%, with a 95% one-sided lower confidence limit of 99%. There was one incorrect call. The root cause of the incorrect call could not conclusively be determined.

Reproducibility – First set of testing:

Sample Type	Site	Samples tested	No calls	Incorrect calls	Correct calls	Correct call rate	95% Confidence Limit
*1/*1	1	40	0	0	40	100.0%	94%
	3	40	1	0	39	97.5%	90%
	4	40	0	1	39	97.5%	90%
	Total	120	1	1	118	98.3%	95%

*1/*2	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	0	0	40	100.0%	94%
	Total	120	0	0	120	100.0%	98%
Sample Type	**Site**	**Samples tested**	**No calls**	**Incorrect calls**	**Correct calls**	**Correct call rate**	**95% Confidence Limit**
*2/*2	1	40	2	0	38	95.0%	86%
	3	40	0	0	40	100.0%	94%
	4	40	0	0	40	100.0%	94%
	Total	120	2	0	118	98.3%	95%
*1/*3	1	40	1	0	39	97.5%	90%
	3	40	1	0	39	97.5%	90%
	4	40	0	0	40	100.0%	94%
	Total	120	2	0	118	98.3%	95%
*2/*3	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	3	0	37	92.5%	83%
	Total	120	3	0	117	97.5%	94%
*1/*17	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	0	0	40	100.0%	94%
	Total	120	0	0	120	100.0%	98%
*17/*17	1	40	0	0	40	100.0%	94%
	3	40	1	0	39	97.5%	90%
	4	40	1	0	39	97.5%	90%
	Total	120	2	0	118	98.3%	95%
*2/*17	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	0	0	40	100.0%	94%
	Total	120	0	0	120	100.0%	98%
TOTAL	1	320	3	0	317	99.1%	98%
	3	320	3	0	317	99.1%	98%
	4	320	4	1	315	98.4%	97%
	Total	960	10	1	949	98.9%	98%

After re-testing those samples that gave inconclusive results in the first set of testing:

Sample Type	Site	Samples tested	No calls	Incorrect calls	Correct calls	Correct call rate	95% Confidence Limit
*1/*1	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	0	1	39	97.5%	90%
	Total	120	0	1	119	99.2%	96%
*1/*2	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	0	0	40	100.0%	94%
	Total	120	0	0	120	100.0%	98%
*2/*2	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	0	0	40	100.0%	94%
	Total	120	0	0	120	100.0%	98%
*1/*3	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	0	0	40	100.0%	94%
	Total	120	0	0	120	100.0%	98%
*2/*3	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	1	0	39	97.5%	90%
	Total	120	1	0	119	99.2%	96%
*1/*17	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	0	0	40	100.0%	94%
	Total	120	0	0	120	100.0%	98%
*17/*17	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	0	0	40	100.0%	94%
	Total	120	0	0	120	100.0%	98%
*2/*17	1	40	0	0	40	100.0%	94%
	3	40	0	0	40	100.0%	94%
	4	40	0	0	40	100.0%	94%
	Total	120	0	0	120	100.0%	98%
TOTAL	1	320	0	0	320	100.0%	99%
	3	320	0	0	320	100.0%	99%
	4	320	1	1	318	99.4%	99%
	Total	960	1	1	958	99.8%	99%

Lot-to-lot Reproducibility

The Spartan FRX CYP2C19 Test System uses independent reagents for detection of each of the three CYP2C19 mutations (*2, *3, *17). Lot-to-lot reproducibility was assessed using three independent lots of each reagent type. Samples used for the study were buccal scrapes collected from *1/*1, *1/*17, *2/*17, *17/*17, *2/*3, and *2/*2 individuals. After second pass testing of inconclusive genotype results, the Spartan RX CYP2C19 Test System produced a correct call rate of 99.0%, with a 95% one-sided lower confidence limit of 98%.

b. Linearity/assay reportable range:

Not applicable

c. Traceability, Stability, Expected values (controls, calibrators, or methods):

Controls:

External Controls: The system contains an External Control kit. The External Control reagent has two synthetic target nucleic acids that contain binding sites for the primers and wild-type or mutant probe are added. The external control kit contains a reagent for each of the three CYP2C19 loci (*2, *3 and *17) tested in the assay. At each locus under investigation, there is control material that is specific for the recessive (positive control) and dominant (negative control) genotype. PCR amplification and bi-directional DNA sequencing of each of the 6 control materials is used to confirm the sequence of the 6 oligonucleotides. External Controls result in a pass or fail and do not provide a genotype result.

Previously characterized genomic DNA can be tested by 1 µl of purified genomic DNA at 0.1 ng/µl using a pipette. The acceptable range of genomic DNA is 0.03 ng to 0.5 ng. The recommended amount is 0.1 ng because this has been determined to be just above the limit of detection of the assay (see 1d below). The acceptable A_{260}/A_{280} ratio is 1.5 to 1.9. As a control, a buccal sample from a person with a known genotype may also be run.

Stability

The Sample Collection Kits and External Control kits are shipped frozen on dry ice. The kits contain a Timestip Plus disposable temperature indicator to inform the user if the package has remained frozen during shipping. Sample Collection Kits and External Control kits must be stored in a manual defrost freezer (one that does not say "frost-free") at a temperature between -20°C to -80°C. When stored under these conditions, Sample Collection Kits and External Control kits are stable until the expiry date marked on the product label.

Sample stability

Sample stability was tested using 52 samples on 9 systems. Samples were stored in the transport system for up to 2 hours and run on the CYP2C19 Test System.

Protocols and acceptance criteria were reviewed and deemed acceptable. Information submitted supports the sponsor's claims that 1) the Sample Collection Kits must be used within 45 minutes of being removed from the freezer and 2) the buccal swab sample inserted into the reagent tube is stable for 1 hour if contained in the sample transport system.

d. Detection limit:

The input material for the Spartan RX CYP2C19 Test System is a buccal swab collected from an individual, which is inserted directly into the reagent tube without any requirement for the user to extract or purify DNA. The end user can only use one buccal swab per test. 40 individuals had buccal swabs taken in the following range: 5 pooled swabs, 2 pooled swabs, 1 normal swab, one stroke swab, and buccal touch. The detection limit was assessed by analysis of buccal swab samples collected from *1/*1, *2/*17, *17/*17, and *2/*3 individuals. Genotypes of all individuals were confirmed by bi-directional sequencing prior to initiation of the study. The concentration of genomic DNA isolated from each individual was determined using absorbance of DNA at 260 nm. For each individual and each genomic DNA sample, PCR performance was assessed using 4 replicates. The DNA concentration was determined using a genomic standard curve. The quantity and quality was determined using absorbance at 260nm and 280 nm, respectively. The following is the determined amount of DNA on a swab:

Swabbing condition	Average DNA Amount (ng)
5 pooled swabs	3.3
2 pooled swabs	1.6
Normal swab	1.3
One stroke	0.6
Inside mouth touch	0.1

Results are summarized below:

First set of testing							
Test Condition	**Genotype**	**# Samples tested**	**# Correct calls**	**# Incorrect calls**	**# Inconclusive calls**	**% Correct calls**	**95% One-sided confidence lower limit)**
5 Pooled swabs	*1/*1	13	11	0	2	84.6%	63%
	*17/*17	13	12	0	1	92.3%	72%
	*2/*3	13	8	0	5	61.5%	40%
	*2/*17	13	13	0	0	100.0%	83%
	Total	52	44	0	8	84.6%	75%
2 Pooled swabs	*1/*1	13	13	0	0	100.0%	83%
	*17/*17	13	13	0	0	100.0%	83%
	*2/*3	13	13	0	0	100.0%	83%
	*2/*17	13	13	0	0	100.0%	83%
	Total	52	52	0	0	100.0%	95%
Normal Swab	*1/*1	13	13	0	0	100.0%	83%
	*17/*17	13	13	0	0	100.0%	83%
	*2/*3	13	12	0	1	92.3%	72%
	*2/*17	13	13	0	0	100.0%	83%
	Total	52	51	0	1	98.1%	92%
1 Half Stroke	*1/*1	13	12	0	1	92.3%	72%
	*17/*17	13	13	0	0	100.0%	83%
	*2/*3	13	13	0	0	100.0%	83%
	*2/*17	13	13	0	0	100.0%	83%
	Total	52	51	0	1	98.1%	92%
Inside Mouth Touch	*1/*1	13	10	0	3	76.9%	54%
	*17/*17	13	12	0	1	92.3%	72%
	*2/*3	13	9	0	4	69.2%	46%
	*2/*17	13	13	0	0	100.0%	83%
	Total	52	44	0	8	84.6%	75%

e. Analytical specificity:

Effect of Oral Rinse

Buccal swab samples were collected from *1/*1,*2/*17, *17/*17, and *2/*3 individuals. Genotypes of all individuals were confirmed by bi-directional sequencing prior to initiation of the study.

The following three different rinse procedures were evaluated:
- No rinse before swab collection
- 10 seconds rinse prior to collection
- 60 seconds rinse prior to collection

A total of 58 samples were tested under a no rinse condition. 56 samples were tested by rinsing with 15 ml water for at least 10 seconds immediately prior to swab collection. 56 samples were tested by rinsing with 30 ml water for at least 60 seconds immediately prior to swab collection. If the result of the first test performed using the Spartan RX CYP2C19 Test System for a particular individual was inconclusive; the test was repeated (second pass). Five samples produced inconclusive results; after second pass repeats of these samples, the system produced a 100% correct call rate for all rinse conditions tested. A water rinse is recommended to mitigate the risk that substances in the mouth that may interfere with performance of the Spartan RX CYP2C19 Test System.

Interference (Exogenous Substances):

Interference from potential exogenous interfering substances was evaluated using buccal swab samples collected from *1/*1, *2/*17, *17/*17, and *2/*3 individuals. Genotypes of all individuals were confirmed by bi-directional sequencing prior to initiation of the study. To test the impact of exogenous substances on performance of the Spartan RX CYP2C19 Test System, buccal samples were collected from individuals immediately after exposure to the substance followed by a water rinse, which was performed as per the RX CYP2C19 Test System's instructions for use. A total of 16 samples were tested for each potential exogenous interfering substance (n=4 per genotype tested). If the result of the first test performed using the Spartan RX CYP2C19 Test System for a particular individual was inconclusive, the test was repeated (second pass).The following exogenous substances and amounts were tested:

- Antiseptic mouthwash - 20 ml -Rinse around mouth for 30 seconds
- Toothpaste - 3/4” strip- Brush teeth for 2 min, spit
- Baking soda solution - 30 ml (0.1 g /ml)- Rinse around mouth for 10 seconds
- Cough syrup - 30 ml - Rinse around mouth for 10 seconds
- Cranberry juice - 30 ml -Rinse around mouth for 10 seconds
- Salt water - 30 ml (0.01 g/ml)- Rinse around mouth for 10 seconds
- Sugar water - 30 ml (0.01 g/ml)- Rinse around mouth for 10 seconds
- Meat - 15 g- Chew for 10 seconds
- Chewing gum - 1 standard piece- Chew for 1 min
- Hard candy - 1 standard piece - Suck until fully dissolved
- Tobacco smoking - 1 cigar - 5 puffs
- Denture paste - Apply 3 strips to roof of mouth, leave for 5 min, remove

Mouthwash and tobacco smoke produced one inconclusive call each; these samples all produced correct calls for the second pass test. Baking soda, and chewing gum, produced two inconclusive calls; these samples also produced correct calls for the second pass test. Chewing gum produced 11 inconclusive calls, with 1 inconclusive call remaining in the second pass. After first and second pass analysis, the overall correct call rates were 91.5% and 99.55%, respectively. All substances tested met the acceptance criteria.

Interference (Endogenous Substances):

Interference from potential endogenous interfering substances was evaluated using buccal swab samples collected from *1/*1, *2/*17, *17/*17, and *2/*3 individuals. Genotypes of all individuals were confirmed by bi-directional sequencing prior to initiation of the study. A total of 16 samples were tested for each potential endogenous interfering substance (n=4 per genotype tested). Each of the following substances were added directly to the reagent tube immediately prior to insertion of the buccal swab sample.

- Whole blood - 3.5 -µl of 0.5% blood
- Human oral bacteria - 9 x 10^4 cells

Substance	# Samples tested	# Correct Calls	# Incorrect calls (all three mutations)	Inconclusive calls (all three mutations)	% Correct calls
Whole blood	16	15	0	1	93.8%
Oral bacteria	16	15	0	1	93.8%
Total	32	30	0	2	93.8%

f. Assay cut-off:

Not applicable

2. Comparison studies:

a. Method comparison with predicate device:

Method comparison testing was evaluated by technicians at three sites, Ottawa Hospital Research Institute, Ottawa, ON, Children's Hospital of Eastern Ontario, Ottawa, ON, and Mount Sinai Hospital, Toronto, ON. 325 samples of genomic DNA were extracted from saliva samples for bi-directional sequencing. These samples were compared to results from the Spartan RX CYP2C19 System for precision and reproducibility testing. 5 samples gave an inconclusive result on the first pass test and were re-tested; after the second pass, all samples were called correctly. No samples were called incorrectly. The overall correct call rate for the first pass and second pass tests was 98.5% and 100%, respectively. The agreement between the RX CYP2C19 system and bi-directional sequencing is summarized below.

First set of testing:

Genotype	# **Samples tested**	# **Correct Calls**	# **Incorrect calls**	# **Inconclusive calls**	% **Correct calls**	**95% One-sided confidence**
*1/*1	130	128	0	2	98.5%	95%
*1/*2	95	94	0	1	98.9%	95%
*2/*2	19	19	0	0	100.0%	88%
*1/*3	7	7	0	0	100.0%	72%
*3/*3	1	1	0	0	100.0%	27%
*1/*17	40	39	0	1	97.5%	90%
*17/*17	11	11	0	0	100.0%	80%
*2/*3	6	6	0	0	100.0%	69%
*2/*17	15	15	0	0	100.0%	85%
*3/*17	1	1	0	0	100.0%	27%
Total	325	321	0	4	98.8%	97%

After re-testing those samples that gave inconclusive results in the first set of testing:

Genotype	# **Samples tested**	# **Correct Calls**	# **Incorrect calls**	# **Inconclusive calls**	% **Correct calls**	**95% One-sided confidence**
*1/*1	130	130	0	0	100.0%	98%
*1/*2	95	95	0	0	100.0%	97%
*2/*2	19	19	0	0	100.0%	88%
*1/*3	7	7	0	0	100.0%	72%
*3/*3	1	1	0	0	100.0%	27%
*1/*17	40	30	0	0	100.0%	94%
*17/*17	11	11	0	0	100.0%	80%
*2/*3	6	6	0	0	100.0%	69%
*2/*17	15	15	0	0	100.0%	85%
*3/*17	1	1	0	0	100.0%	27%
Total	325	325	0	0	100.0%	99%

b. Matrix comparison:

Not applicable

3. Clinical studies:

   a. Clinical Sensitivity:

   Not applicable

   b. Clinical specificity:

   Not applicable

   c. Other clinical supportive data (when a. and b. are not applicable):

   Not applicable

4. Clinical cut-off:

   Not applicable

5. Expected values/Reference range:

   The product insert lists the following information:

   The Spartan RX CYP2C19 identifies the CYP2C19*2, CYP2C19*3, and CYP2C19*17 alleles. The following table lists the alleles recognized by the Spartan RX CYP2C19 Assay; the polymorphism for each allele; enzyme activity; and references.

CYP2C19 Allele	**Polymorphism Recognized by Spartan RX CYP2C19 Assay**	**Enzyme Activity**	**References**
*1	None *1 genotype for the Spartan RX CYP2C19 Assay indicates only the absence of *2, *3, and *17 alleles.	Normal	Romkes (1991), Richardson (1995), Blaisdell (2002)
*2	19154G>A	None	de Morais (1994), Ibeanu (1998), Fukushima-Uesaka (2005), Lee (2009)
*3	17948G>A	None	de Morais (1994), Fukushima-Uesaka (2005)
*17	-806C>T	Increased	Sim (2006), Rudberg (2008)

CYP2C19*4, *5, *6, *7, *8, and other alleles may be associated with absent or reduced enzyme activity, but are significantly less frequent than the CYP2C19*2 and *3 alleles. The Spartan RX CYP2C19 Assay provides no information for these alleles.

Samples with the CYP2C19*10 genotype may be miscalled by the Spartan RX CYP2C19 Assay. Both CYP2C19*2 and CYP2C19*10 are poor metabolizers.

References

1. Desta Z et al. (2002). Clinical significance of the cytochrome P450 2C19 genetic polymorphism. *Clin Pharmacokinet*. 41(12): 913–958.

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N. Instrument Name:

Spartan RX CYP2C19 Platform

O. System Descriptions:

1. Modes of Operation:

   The Spartan RX CYP2C19 Platform is a multi-well thermal cycler with optical detection capability. The unit has two optical detection channels (labeled as green and red).

   The system is comprised of:

   - Spartan RX Analyzer
   - Power adapter for Spartan RX Analyzer
   - Netbook computer
   - Power adapter for netbook
   - Printer
   - Power adapter for printer
   - USB cable for connecting netbook and printer
   - Ethernet cable for connecting netbook and Spartan RX Analyzer
   - Barcode scanner and stand

2. Software:

   The Spartan RX user interface has been pre-loaded on the netbook. It will automatically run when the user logs into the notebook. The Hazard Analysis and Software Documentation was reviewed and deemed acceptable.

3. Specimen Identification:

   The specimens are identified by a barcode, and the tubes are color coded.

4. Specimen Sampling and Handling:

   The system is automated. After a buccal swab is taken, it is directly placed into the assay color coded tube (closing the tube),and loaded into the platform.

5. Calibration:

   Not applicable.

6. Quality Control (QC):

   The device has an External Control Kit which consists of a reagent tube containing synthetic nucleic acid control material, PCR amplification chemicals, and fluorescent oligonucleotide probes. The reagent tube is removed from the packaging and placed directly into the Spartan RX Analyzer according to the External Control procedure. The reagent tube is never opened.

P. Other Supportive Instrument Performance Characteristics Data Not Covered In The "Performance Characteristics" Section above:

None

Q. Proposed Labeling

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

R. Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.