

**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION  
DECISION SUMMARY  
ASSAY ONLY TEMPLATE**

**A. 510(k) Number:**

k122539

**B. Purpose for Submission:**

Addition of using pleural fluid sample for pH measurements to the RAPIDPoint 400/405/500 analyzers previously cleared for whole blood gases, pH, electrolytes, co-oximetry, and expired air for the parameters pO<sub>2</sub> and pCO<sub>2</sub>.

**C. Measurand:**

pH in Pleural Fluid

**D. Type of Test:**

Quantitative, Ion Selective Electrode

**E. Applicant:**

Siemens Healthcare Diagnostics, Inc.

**F. Proprietary and Established Names:**

RAPIDPoint® 400/405/500 Systems

**G. Regulatory Information:**

<b>Product Code</b>	<b>Classification</b>	<b>Regulation Section</b>	<b>Panel</b>
CHL Electrode measurement, blood- gases (PCO <sub>2</sub> ,PO <sub>2</sub> ) and blood pH	Class II	21 CFR § 862.1120	Clinical Chemistry (75)

## **H. Intended Use:**

1. Intended use(s):

See Indications for use below.

2. Indication(s) for use:

RAPIDPoint® 400/405/500 systems are intended for in vitro testing of pleural fluid samples for the pH parameter. Test systems are intended for use in point of care or laboratory settings.

The pH measurement of pleural fluid can be a clinically useful tool in the management of patients with parapneumonic effusions.

The following critical value applies to pleural fluid pH: pH > 7.3 is measured in uncomplicated parapneumonic effusions. All pleural fluids with a pH measurement < 7.3 are referred to as complicated parapneumonic, and exudative in nature.

3. Special conditions for use statement(s):

This device is intended for prescription use only.

4. Special instrument requirements:

Performance data was provided for the RAPIDPoint® 400/405/500 systems

## **I. Device Description:**

The RP400/405/500 system is a point-of-care and laboratory testing blood gas analyzer and measures a variety of blood gas parameters.

The pleural fluid pH measurement provides important information for the diagnosis of exudative pleural effusions. The RAPIDPoint® 400/405/500 systems are intended for in vitro testing of pleural fluid samples for the pH parameter. This test system is intended for use in point of care or laboratory settings.

## **J. Substantial Equivalence Information:**

1. Predicate device name(s):

ABL835 FLEX Analyzer

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

k110416

3. Comparison with predicate:

<b>Similarities and Differences</b>		
<b>Item</b>	<b>Device RAPIDPoint® 400/405/500 Pleural Fluid pH</b>	<b>Predicate ABL835 Flex Analyzer with Pleural Fluid (k110416)</b>
Indications for Use/Intended Use	RAPIDPoint® 400/405/500 systems are intended for in vitro testing of pleural fluid samples for the pH parameter. Test systems are intended for use in point of care or laboratory settings. The pH measurement of pleural fluid can be a clinically useful tool in the management of patients with parapneumonic effusions. The following critical value applies to pleural fluid pH: pH > 7.3 is measured in uncomplicated parapneumonic effusions. All pleural fluids with a pH measurement < 7.3 are referred to as complicated parapneumonic, and exudative in nature.	Same without point of care testing.
Principle of Operation	Blood Gas Analyzer	Same
Test Principle	Potentiometric	Same
Measured Parameter	pH in Pleural Fluid	Same
Specimen Type	Pleural Fluid	Same
Reporting Range	7.000 – 7.500	Same
Calibration	2 point calibration using automated on-board reagent	2 point liquid calibration

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

None referenced

**L. Test Principle:**

The notation of pH expresses the hydrogen ion activity in a solution as the negative logarithm of the hydrogen ion concentration. The pleural fluid pH measurement uses the potentiometric method using ion selective electrode (ISE) technology.

**M. Performance Characteristics (if/when applicable):**

1. Analytical performance:

a. *Precision/Reproducibility:*

A Precision study was conducted to evaluate pleural fluid precision on the RAPIDPoint® 400/405/500 systems. The precision study consisted of two runs per day, an n=2 per sample run on the RP400/405/500 and performed over the course of 20 days for an n=80. Pleural fluid samples were adjusted to three levels of pH within 7.0 to 7.5 units. All samples were stored frozen until the time of use. Each run was performed in Pleural Fluid mode and spaced a minimum of to hours apart, contained Calibration Verification Material (CVM) and pleural fluid samples. Results for CVM controls and pleural fluid pH are contained in the tables below:

**In-house Precision with Controls**

Level	n	Mean	Within Run SD	Within Run %CV	Total SD	Total %CV
<u>RP400</u>						
CVM-2	80	7.091	0.003	0.001	0.004	0.100
CVM-3	80	7.312	0.002	0.001	0.002	0.001
<u>RP405</u>						
CVM-2	80	7.102	0.004	0.100	0.004	0.100
CVM-3	80	7.327	0.002	0.001	0.003	0.001
<u>RP500</u>						
CVM-2	80	7.098	0.002	0.001	0.004	0.100
CVM-3	80	7.324	0.002	0.001	0.004	0.001

**In-house Precision with Pleural Fluid**

Level	n	Mean	Within Run SD	Within Run %CV	Total SD	Total %CV
<u>RP400</u>						
Sample 1	80	7.102	0.010	0.100	0.011	0.200
Sample 2	80	7.284	0.010	0.100	0.011	0.200
Sample 3	80	7.469	0.007	0.100	0.008	0.100
<u>RP405</u>						
Sample 1	80	7.102	0.009	0.100	0.011	0.200
Sample 2	80	7.289	0.012	0.200	0.012	0.200
Sample 3	80	7.473	0.007	0.100	0.007	0.100
<u>RP500</u>						
Sample 1	80	7.08	0.006	0.100	0.016	0.200
Sample 2	80	7.26	0.011	0.200	0.018	0.200
Sample 3	80	7.45	0.011	0.100	0.019	0.300

An additional precision study using typical point of care (POC) operators was

conducted at three sites using the RAPIDPoint® 400/405/500 systems. The testing was performed in pleural fluid mode over a minimum of 1 day, 3 runs per day, with each run separated by two hours, and 5 replicates per run for each of three levels (low, med, high) across the reportable range for a total of n=45. All pleural fluid samples were frozen and thawed prior testing. Results are stated below:

POC Precision Study- RP 400 Pleural Fluid pH

Analyte	level	Site	N	Mean pH units	WR SD pH units	WR CV %	Between Run SD pH units	Between Run CV %	Total SD pH units	Total CV %
pH	High	1	15	7.466	0.016	0.22	0.000	0.00	0.02	0.22
		2	15	7.470	0.020	0.27	0.000	0.00	0.02	0.27
		3	15	7.456	0.019	0.26	0.015	0.21	0.02	0.33
		<b>All</b>	<b>45</b>	<b>7.464</b>	<b>0.019</b>	<b>0.26</b>	<b>0.006</b>	<b>0.09</b>	<b>0.02</b>	<b>0.28</b>
pH	Low	1	15	7.119	0.007	0.10	0.002	0.03	0.01	0.10
		2	15	7.133	0.016	0.23	0.014	0.19	0.02	0.30
		3	15	7.110	0.016	0.22	0.038	0.53	0.04	0.57
		<b>All</b>	<b>45</b>	<b>7.121</b>	<b>0.014</b>	<b>0.19</b>	<b>0.022</b>	<b>0.31</b>	<b>0.03</b>	<b>0.37</b>
pH	Medium	1	15	7.289	0.012	0.16	0.005	0.07	0.01	0.17
		2	15	7.304	0.014	0.19	0.011	0.14	0.02	0.24
		3	15	7.292	0.010	0.14	0.006	0.08	0.01	0.16
		<b>All</b>	<b>45</b>	<b>7.295</b>	<b>0.012</b>	<b>0.16</b>	<b>0.008</b>	<b>0.10</b>	<b>0.02</b>	<b>0.21</b>

POC Precision Study- RP405 Pleural Fluid pH

Analyte	level	Site	N	Mean pH units	WR SD pH units	WR CV %	Between Run SD pH units	Between Run CV %	Total SD pH units	Total CV %
pH	High	1	15	7.472	0.014	0.18	0.002	0.03	0.01	0.19
		2	15	7.464	0.018	0.25	0.004	0.05	0.02	0.25
		3	15	7.452	0.019	0.26	0.017	0.23	0.03	0.35
		<b>All</b>	<b>45</b>	<b>7.463</b>	<b>0.017</b>	<b>0.23</b>	<b>0.010</b>	<b>0.14</b>	<b>0.02</b>	<b>0.28</b>
pH	Low	1	15	7.113	0.011	0.15	0.000	0.00	0.01	0.15
		2	15	7.125	0.023	0.32	0.015	0.21	0.03	0.38
		3	15	7.092	0.019	0.27	0.032	0.45	0.04	0.52
		<b>All</b>	<b>45</b>	<b>7.110</b>	<b>0.019</b>	<b>0.26</b>	<b>0.020</b>	<b>0.28</b>	<b>0.03</b>	<b>0.42</b>
pH	Medium	1	15	7.288	0.009	0.13	0.000	0.00	0.01	0.13
		2	15	7.298	0.010	0.13	0.009	0.13	0.01	0.18
		3	15	7.281	0.013	0.18	0.013	0.18	0.02	0.26
		<b>All</b>	<b>45</b>	<b>7.289</b>	<b>0.011</b>	<b>0.15</b>	<b>0.009</b>	<b>0.13</b>	<b>0.02</b>	<b>0.21</b>

POC Precision Study -RP 500 Pleural Fluid pH

Analyte	level	Site	N	Mean pH units	WR SD pH units	WR CV %	Between Run SD pH units	Between Run CV %	Tota I S	Total CV %
pH	High	1	15	7.466	0.013	0.17	0.006	0.08	0.01	0.19
		2	15	7.461	0.008	0.11	0.003	0.04	0.01	0.12
		3	15	7.460	0.018	0.24	0.017	0.23	0.03	0.34
		<b>All</b>	<b>45</b>	<b>7.463</b>	<b>0.014</b>	<b>0.18</b>	<b>0.009</b>	<b>0.12</b>	<b>0.02</b>	<b>0.22</b>
pH	Low	1	15	7.108	0.010	0.14	0.005	0.07	0.01	0.16
		2	15	7.119	0.014	0.20	0.025	0.35	0.03	0.40
		3	15	7.100	0.015	0.21	0.030	0.43	0.03	0.47
		<b>All</b>	<b>45</b>	<b>7.109</b>	<b>0.013</b>	<b>0.19</b>	<b>0.021</b>	<b>0.30</b>	<b>0.02</b>	<b>0.35</b>
pH	Medium	1	15	7.286	0.013	0.18	0.012	0.16	0.02	0.24
		2	15	7.284	0.007	0.10	0.016	0.22	0.02	0.25
		3	15	7.285	0.017	0.24	0.011	0.15	0.02	0.28
		<b>All</b>	<b>45</b>	<b>7.285</b>	<b>0.013</b>	<b>0.18</b>	<b>0.011</b>	<b>0.15</b>	<b>0.02</b>	<b>0.24</b>

b. *Linearity/assay reportable range:*

Linearity data for pleural fluid collected in the method comparison study (see Section M.2a. below) was used to demonstrate linearity on the RAPIDPoint® 400/405/500 systems. Linear regression analysis of the results yielded the following:

$$\text{RP400: } y=1.066x (-0.437), r^2=0.99$$

$$\text{RP405: } y=1.008x (-0.09), r^2=0.95$$

$$\text{RP500: } y=1.059x (-0.373), r^2=0.99$$

The measuring range for pleural fluid samples is pH 7.0 to 7.5.

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

There is no unique calibration measurement for pleural fluid pH. The pH calibration measurement is used for pleural fluid pH.

The traceability, stability and expected value of the RAPID QC Complete were previously cleared in k970956.

d. *Detection limit:*

Detection limit for pleural fluid pH established in the method comparison study M. 2a. below and for whole blood pH in the previously cleared submission k002738.

The measuring range for pleural fluid samples 7.0 to 7.5.

e. *Analytical specificity:*

Analytical specificity was established in the previously cleared submission k002738.

f. *Assay cut-off:*

Not applicable

2. Comparison studies:

a. *Method comparison with predicate device:*

A method comparison study was conducted at 3 POC sites and one RP405 system per site vs. the ABL835 FLEX analyzer (predicate device). The pleural fluid pH sample range tested was 7.000 – 7.466. Less than 20% of the 142 samples tested were altered. The linear regression analysis is presented in the table below:

**RP405 vs. ABL 835 FLEX analyzer**

Site	n	Range	Slope	Intercept	r <sup>2</sup>
1	43	7.008-7.466	0.969	0.274	0.919
2	44	7.000-7.454	1.022	-0.113	0.955
3	55	7.002-7.453	1.051	-0.311	0.968
All sites combined	142	7.000-7.466	1.008	-0.009	0.948

An additional method comparison study was conducted at three POC sites using typical POC operators with a minimum of 40 pleural fluid samples per site with pH values ranging from 7.011-7.458. Samples were analyzed on the RP400 and RP500 vs. the ABL835 FLEX (predicate device). Linear regression is as follows:

**RP400 vs. ABL 835 FLEX analyzer**

Site	n	Range	Slope	Intercept	r <sup>2</sup>
1	41	7.022-7.452	1.081	-0.554	0.996
2	40	7.011-7.443	1.042	-0.268	0.996
3	41	7.039-7.458	1.082	-0.549	0.991
All sites combined	122	7.011-7.458	1.066	-0.437	0.994

**RP500 vs. ABL 835 FLEX analyzer**

Site	n	Range	Slope	Intercept	r <sup>2</sup>
1	41	7.022-7.452	1.081	-0.541	0.993
2	40	7.011-7.443	1.050	-0.316	0.995
3	41	7.039-7.458	1.057	-0.351	0.993
All sites combined	122	7.011-7.458	1.059	-0.373	0.993

*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:

Critical values: pH > 7.3 is measured in uncomplicated parapneumonic effusions. All pleural effusions with a pH < 7.3 are referred as complicated parapneumonic effusions; they are exudative in nature<sup>1,2,3</sup>

<sup>1</sup> Lesho EP, Roth BJ. Chest (1997) 5, 1291-1292.

<sup>2</sup> Chandler TM, McCoskey EH, Byrd RP, Roy TM. Southern Medical Journal (1999) 92, 214-217.

<sup>3</sup> Hooper C, Lee YC, Maskell N. BTS Pleural Guideline Group, Thorax (2010) 65:Suppl 2: ii4-17.

**N. Proposed Labeling:**

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

**O. Conclusion:**

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