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

A. 510(k) Number:

k102993

B. Purpose for Submission:

New devices

C. Measurand:

Cholesterol and Triglyceride

D. Type of Test:

Quantitative, enzymatic colorimetric

E. Applicant:

SEPPIM S.A.S.

F. Proprietary and Established Names:

ELITech Clinical Systems CHOLESTEROL SL

ELITech Clinical Systems TRIGLYCERIDES SL

ELITech Clinical Systems ELICAL 2

ELITech Clinical Systems ELITROL I and II

G. Regulatory Information:

Regulation Section	Product Code	Classification	Panel
862.1175 (Cholesterol test system)	CHH	Class I meets the limitations to exemptions 21 CFR §862.9 (c) (4)	Chemistry (75)
862.1705 (Triglyceride test system)	CDT	Class I meets the limitations to exemptions 21 CFR §862.9 (c) (4)	Chemistry (75)

862.1150 (Calibrator)	JIX	Class II	Chemistry (75)
862.1660 (Quality control materials)	JJY	Class I, reserved	Chemistry (75)

H. Intended Use:

1. Intended use(s):

   See Indications for Use below

2. Indication(s) for use:

   ELITech Clinical Systems CHOLESTEROL SL is intended for the quantitative *in vitro* diagnostic determination of cholesterol in human serum and plasma on the ELITech Vital Scientific Selectra/Flexor analyzers. It is not intended for use in Point of Care settings. Cholesterol measurements are used in the diagnosis and treatment of disorders involving excess cholesterol in the blood and lipid and lipoprotein metabolism disorders.

   ELITech Clinical Systems TRIGLYCERIDES SL is intended for the quantitative *in vitro* diagnostic determination of triglycerides in human serum and plasma on the ELITech Vital Scientific Selectra/Flexor analyzers. It is not intended for use in Point of Care settings. Triglycerides measurements are used in the diagnosis and treatment of patients with diabetes mellitus, nephrosis, liver obstruction, other diseases involving lipid metabolism, or various endocrine disorders.

   ELITech Clinical Systems ELICAL 2 is a multi-parameter calibrator for *in vitro* diagnostic use in the calibration of quantitative ELITech Clinical Systems methods on the ELITech Vital Scientific Selectra/Flexor analyzers.

   ELITech Clinical Systems ELITROL I and II are multi-parameter control sera for use in quality control of ELITech Clinical Systems methods on the ELITech Vital Scientific Selectra/Flexor analyzers.

3. Special conditions for use statement(s):

   For Prescription Use

   It is not intended for use in Point of Care settings.

4. Special instrument requirements:

   For use with the Vital Scientific Selectra Junior analyzer which is also trademarked as the Vital Scientific Flexor Junior analyzer.

I. Device Description:

ELITech Clinical Systems Cholesterol SL is a one (1) reagent system with reagent R. Reagent R is supplied in liquid ready-to-use form and contains Pipes buffer, 4-Aminoantipyrine (4-AAP), Cholesterol esterase (CHE bacterial), Cholesterol oxidase (CHO microorganims), Peroxidase (POD horseradish), Sodium cholate, Phenol and Sodium azide.

ELITech Clinical Systems Triglycerides SL is a one (1) reagent system with reagent R. Reagent R is supplied in liquid ready-to use form and contains Pipes buffer, *p*-chlorophenol, ATP, Amino-4-antipyrine (4-AAP), Lipoprotein lipase (bacterial), Glycerol kinase (bacterial), Glycerol-3-phosphate oxidase (microorganisms), Peroxidase (horseradish), Potassium ferrocyanide, Magnesium (Mg2+) and Sodium azide.

ELITech Clinical Systems Elical 2 is a lyophilized calibrator prepared from human serum which contains chemical additives and material of biological origin, and stabilizers.

ELITech Clinical Systems Elitrol I and Elitrol II are lyophilized control serum prepared from human serum which contains chemical additives and material of biological origin.

All human source materials were tested with FDA-approved methods and found to be negative for HbsAG and to antibodies to HCV and HIV 1/2.

J. Substantial Equivalence Information:

1. Predicate device name(s)

   Horiba ABX PENTRA Cholesterol CP

   Horiba ABX PENTRA Triglycerides CP

   Roche Diagnostics Calibrator for Automated Systems (C.f.a.s)

   Roche Diagnostics Precinorm U and Precipath U

2. Predicate K number(s):

   k060854 (cholesterol and triglyceride reagents)

   k033501 (calibrator)

   k041227 (control)

3. Comparison with predicate:

Similarities and Differences		
Item	Predicate Device ABX PENTRA cholesterol reagent (k060854)	Candidate device ELITech Clinical Systems Cholesterol SL
Intended Use	For in vitro diagnostic use in the quantitative determination of cholesterol in human serum and plasma.	Same
Indications for use	Cholesterol measurements are used in the diagnosis and treatment of disorders involving excess cholesterol in the blood and lipid and lipoprotein metabolism disorders.	Same
Test Method	Enzymatic colorimetric method using cholesterol esterase/cholesterol oxidase coupled with peroxidase (Trinder method)	Same
Sample type	Serum and plasma	Same
Reagent	Liquid form, ready to use	Same
Instrument	ABX Pentra 400 Analyzer	The Vital Scientific Selectra Junior Analyzer (also trademarked as the Vital Scientific Flexor Junior Analyzer)
Calibration Frequency	8 days	28 days
Measuring range	2.55 to 580 mg/dL	20-600 mg/dL

Similarities and Differences		
Item	Predicate Device ABX PENTRA triglyceride reagent (k060854)	Candidate device ELITech Clinical Systems Triglyceride SL
Intended Use	For in vitro diagnostic use in the quantitative determination of triglyceride in human serum and plasma.	Same
Indications for use	Measurements obtained by this device are used in the diagnosis and treatment of patients with diabetes mellitus, nephrosis, liver obstruction, other diseases involving lipid metabolism, or various endocrine disorders.	Same
Test Method	Enzymatic colorimetric method	Same
Sample type	Serum and plasma	Same

Similarities and Differences		
Item	Predicate Device ABX PENTRA triglyceride reagent (k060854)	Candidate device ELITech Clinical Systems Triglyceride SL
Reagent	Liquid form, ready to use	Same
Instrument	ABX Pentra 400 Analyzer	The Vital Scientific Selectra Junior Analyzer (also trademarked as the Vital Scientific Flexor Junior Analyzer)
Calibration Frequency	14 days	same
Measuring range	3.1-1470 mg/dL	30-1000 mg/dL

Similarities and Differences		
Item	Predicate device Roche Calibrator (C.f.a.s) (k033501)	Candidate device ELITech Clinical Systems Elical 2
Intended Use/Indications for Use	For *in vitro* diagnostic use in the calibration of quantitative method	Same
Format	Lyophilized calibrator based on human serum with constituents added as required to obtain desired components levels.	Same
Level	Single level	Same
Stability	Lyophilized: store at 2-8˚C and protect from light until the expiry date After reconstitution*:8 hours between 15-25˚C, 2 days between 2-8˚C, 4 weeks between -25 and -15 ˚C (when frozen once)	Same
Instrument	Roche Analyzers	The Vital Scientific Selectra Junior Analyzer (also trademarked as the Vital Scientific Flexor Junior Analyzer)

Similarities and Differences		
Item	Predicate device Roche Precinorm U/ Precipath U (k041227)	Candidate device ELITech Clinical Systems Elitrol I/Elitrol II
Intended Use/ Indications for Use	For *in vitro* diagnostic use in accuracy control of quantitative method	Same
Format	Lyophilized human sera with constituents added as required to obtain defined components levels	Same
Levels	Two levels	Same
Stability	Lyophilized: Store at 2-8˚C and protected from light until the expiry date. After Reconstitution*: 12 hours between 15-25˚C, 5 days between 2-8˚C ,4 weeks between -25 and -15˚C (when frozen once)	Same

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

EP05-A2-Evaluation of precision performance of quantitative measurement methods; Approved guideline Second-Edition

EP06-A-Evaluation of the linearity of the measurement of quantitative procedures: a statistical approach-First Edition

EP07-A2-Interference Testing in Clinical Chemistry-Second Edition

EP09-A2-Method comparison and bias estimate using patient samples-Second Edition

L. Test Principle:

Cholesterol: Cholesterol esters are hydrolyzed to cholesterol and fatty acids by cholesterol esterase (CHE). Then the cholesterol is oxidized by cholesterol oxidase (CHO) to produce cholest-4-en-3-one and hydrogen peroxide (H_2O_2). H_2O_2 reacts with 4-aminoantipyrine (4-AAP) and phenol under the catalytic action of peroxidase to form a colored quinoneimine complex. The absorbance of the quinoneimine complex at 505 nm is proportional to the concentration of cholesterol in the sample.

Triglycerides: Triglycerides are hydrolyzed to glycerol and fatty acids by a lipoprotein lipase. In the presence of ATP and glycerol kinase, the glycerol is phosphorylated to glycerol-3-phopshate, which is then oxidized by glycerol-3-phosphate-oxidase to produce hydrogen peroxide (H2O2). H2O2 reacts with 4-amino-antipyrine (4-AAP) and *p*-chlorophenol under

the catalytic action of peroxidase to form a colored quinoneimine complex. The absorbance of the quinoneimine complex at 505 nm is proportional to the concentration of triglycerides in the sample.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

a. Precision/Reproducibility:

Precision was evaluated with one serum control and two human serum pool samples according to the CLSI EP5-A2 guideline. All samples were assayed on the Vital Scientific Selectra Junior analyzer in duplicate, twice a day for 20 days. The mean, SD, and %CV were calculated for within-run and total imprecision. Results are summarized in the table below:

Precision for cholesterol assay:

Material	n	Mean (U/L)	Within-run		Total	
			SD	CV (%)	SD	CV (%)
Serum Pool (low)	80	116	2.8	2.4	3.1	2.6
Serum Control (medium)	80	190	3.6	1.9	5.1	2.7
Spiked Serum Pool (high)	80	298	5.1	1.7	7.9	2.7

Precision for triglycerides assay:

Material	n	Mean (U/L)	Within-run		Total	
			SD	CV (%)	SD	CV (%)
Serum Pool (low)	80	48	0.7	1.5	1.9	3.9
Serum Control (medium)	80	142	1.5	1.0	3.8	2.7
Spiked Serum Pool (high)	80	273	2.0	0.7	12.2	4.5

b. Linearity/assay reportable range:

Cholesterol assay:

A linearity study was performed according to the CLSI EP6-A guideline. Linearity across the assay range was determined by using two pools of patient serum, one at a low concentration (20 mg/dL) and one at a high concentration (618 mg/dL). The low sample was prepared by diluting the serum sample pool with saline and the high sample was prepared by spiking the serum sample pool. Admixtures were prepared by mixing different proportions of low and high pool samples. All samples (11 samples) were assayed in triplicate. The expected values were plotted against the observed values and a linear regression line was fitted with the following regression equation: $Y = 0.9854X + 2.5152$, $R^2 = 0.9994$.

Results of the study support the sponsor's claim that the cholesterol assay is linear from 20-600 mg/dL.

Triglycerides assay:

Similarly, linearity across the assay range was determined by using two pools of patient serum, one at a low concentration (26 mg/dL) and one at a high concentration (1072 mg/dL). The low sample was prepared by diluting the serum sample pool with saline and the high sample was prepared by spiking the serum sample pool. Admixtures were prepared by mixing different proportions of low and high pool samples. All samples (11 samples) were assayed in triplicate. The expected values were plotted against the observed values and a linear regression line was fitted with the following regression equation: $Y = 0.9932X – 1.4687$, $R^2 = 0.9997$.

Results of the study support the sponsor's claim that the triglyceride assay is linear from is 30-1000 mg/dL

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

Traceability:

The ELITech Clinical Systems Elical 2 has both cholesterol and triglycerides assays traceable to the ID-MS (Isotope Dilution- Mass Spectrometry) reference method.

Traceability to the National Reference System for Cholesterol was established by performing a direct comparison with the cholesterol reference method using human specimens that cover the National Cholesterol Education Program (NCEP) medical decision points. The ability to meet the NCEP's performance criteria for accuracy was demonstrated through testing and certification by the Cholesterol Reference Method Laboratory Network (CRMLN). The comparison study was performed using SEPPIM Cholesterol SL reagent and SEPPIM ELICAL 2 calibrator. A certificate from CRMLN was provided by the sponsor. The certificate will expire in 2 years and

a list of the certified methods can be found at the following link:
http://www.cdc.gov/labstandards/crmln.htm

Stability:

Calibrator material is purchased from a commercial vendor (previously cleared under k033501). Calibrator assigned value was verified by testing on one Selectra Junior analyzer. The sponsor claimed the following for stability: Elical 2 is stable until the expiration date printed on the label when stored at 2-8˚C prior to reconstitution. After reconstitution the stability is 8 hours when stored at 15-25˚C, 2 days at 2-8˚C or 4 weeks (when frozen once) at -25˚and -15˚C.

Protocols and acceptance criteria were provided to support on-board calibration stability for 28 days for cholesterol and 14 days for triglyceride.

Control material is purchased from a commercial vendor (previously cleared under k041227). Control assigned value was verified by testing on one Selectra Junior analyzer. The sponsor claimed the following for stability: Before reconstitution, the shelf-life of the ELITech Clinical Systems Elitrol 1 and Elitrol II is 30 months at 2-8˚C. After reconstitution the stability is 12 hours when stored at 15-25˚C, 5 days when stored at 2-8˚C or 4 weeks (when frozen once) at -25˚ and -15˚ C.

Value assignment of Elical 2:

Elical 2 is tested against predetermined values on multiple Vital Scientific analyzers using the cholesterol and triglyceride reagents. The mean analyte value is calculated and a target value is assigned.

Value assignment of Elitrol I and II controls:

For both cholesterol and triglyceride assays, assignments are based on two Vital Scientific analyzers with two lot of reagents. A total of 36 measurements were obtained and the mean, SD and %CV were calculated. The control ranges were established by calculating the mean ± 15% for cholesterol and mean ± 16% for triglyceride.

d. Detection limit:

Cholesterol assay:

A detection limit study was evaluated according to CLSI EP17-A guideline. LoB was determined by running a blank sample 60 times on the Vital Scientific Selectra Junior analyzer. The limit of detection (LoD) was determined by assaying 4 low (3.6 U/L) diluted sample pools 60 times on the Selectra Junior analyzer. Limit of Quantitation (LoQ) was determined by running 4 low (5 U/L) diluted sample pools 60 times on the Vital Scientific Selectra Junior analyzer. LoB is calculated to be 0.1 mg/dL, LoD is

0.2 mg/dL. LoQ is calculated to be 10 mg/dL based on a total error of 8.6%.

Triglycerides assay:

A detection limit study was evaluated according to CLSI EP17-A guideline. LoB was determined by running a blank sample 60 times on the Vital Scientific Selectra Junior analyzer. The limit of detection (LoD) was determined by assaying 4 low (3.6 U/L) diluted sample pools 60 times on the Selectra Junior analyzer. Limit of Quantitation (LoQ) was determined by running 4 low (5 U/L) diluted sample pools 60 times on the Vital Scientific Selectra Junior analyzer. LoB is calculated to be 1 mg/dL, LoD is 2 mg/dL. LoQ is calculated to be 10 mg/dL based on a total error of 9.8%.

The sponsor claimed that the cholesterol's measuring range is 20-600 mg/dL and triglyceride's measuring range is 30-1000 mg/dL.

e. *Analytical specificity:*

Cholesterol assay:

Testing for interfering substances was based on CLSI EP-7A. Testing was performed on a minimum of five concentrations for each interfering substance. Two different concentrations of cholesterol (116 and 309 mg/dL) were used for evaluation. Samples with increasing amounts of triglycerides (Intralipid®), Unconjugated bilirubin, Conjugated bilirubin, Hemoglobin, Uric Acid, Methyl dopa and Ascorbic Acid were tested in triplicate and compared to the same sample without the interferent. The sponsor defined no significant interference as < 6.6 % for cholesterol. Results are summarized in the table below:

	Highest concentration tested that showing no significant interference (mg/dL) (≤6.6%)
Triglyceride	614
Unconjugated Bilirubin	6.0
Conjugated Bilirubin	5.9
Hemoglobin	250
Ascorbic Acid	2.0
Methyl dopa	0.8
Uric acid	23.0

The sponsor has the following in their limitations in their labeling:

Ascorbic acid concentrations above therapeutic levels (>2.0 mg/dL) will interferent with the cholesterol level.

Do not use hemolyzed samples.

Do not use icteric samples.

Triglycerides assay:

Testing for interfering substances was based on CLSI EP-7A. Testing was performed on a minimum of six concentrations for each interfering substances. Two different concentrations of triglycerides (133 and 266 mg/dL) were used for evaluation. Samples with increasing amounts of Unconjugated bilirubin, Conjugated bilirubin, Hemoglobin, Uric Acid, Methyl dopa and Ascorbic Acid were tested in triplicate and compared to the same sample without the interferent. The sponsor defined no significant interference as < 10 % for triglycerides. Results are summarized in the table below:

	Highest concentration tested that showing no significant interference (mg/dL) (≤10%)
Unconjugated Bilirubin	15.0
Conjugated Bilirubin	5.9
Hemoglobin	250
Ascorbic Acid	2.0
Methyl dopa	1.0
Uric acid	23.0

The sponsor has the following in their limitations in their labeling:

Ascorbic acid concentrations above therapeutic levels (> 2.0 mg/dL) will interfere with the triglyceride level.

Do not use hemolyzed samples.

Do not use icteric samples.

f. Assay cut-off:

Not applicable

2. Comparison studies:

a. *Method comparison with predicate device:*

Cholesterol assay:

A method comparison study was performed using the HORIBA ABX Cholesterol CP reagent on a PENTRA 400 chemistry analyzer and the ELITech cholesterol SL reagent on the Selectra Junior analyzer according to CLSI EP9-A2. A total of 99 serum samples covering the measuring range of the cholesterol assay were assayed. Of these, 10 were altered samples (2 diluted and 8 spiked). The samples had values ranging from 20 mg/dL to 585 mg/dL. The comparison resulted in a slope of 1.006, an intercept of -1.734, correlation coefficient of r=0.999. The standard error of the estimate is equal to 4 mg/dL.

Triglycerides assay:

A method comparison study was performed using the HORIBA ABX triglycerides CP reagent on a PENTRA 400 chemistry analyzer and the ELITech triglycerides SL reagent on the Selectra Junior analyzer according to CLSI EP9-A2. A total of 99 serum samples covering the measuring range of the triglyceride assay were assayed. Of these, 6 were altered samples (2 diluted and 4 spiked). The samples had values ranging from 31 mg/dL to 963 mg/dL. The comparison resulted in a slope of 1.040, an intercept of 0.339, correlation coefficient of r=0.999. The standard error of the estimate is equal to 7 mg/dL.

b. *Matrix comparison:*

Cholesterol assay:

45 paired serum and plasma (lithium heparin) samples, ranging from 24 to 580 mg/dL, were tested on the Selectra Junior analyzer. 3 samples were altered. The comparison resulted in a slope of 1.020, an intercept of -4.0, correlation coefficient of r =1.000. The standard error of the estimate is equal to 5 mg/dL.

Triglycerides assay:

47 paired serum and plasma (lithium heparin) samples, ranging from 50 to 951 mg/dL, were tested on the Selectra Junior analyzer. 4 samples were altered. The comparison resulted in a slope of 0.986, an intercept of 1.0, correlation coefficient of r =0.999. The standard error of the estimate is equal to 11 mg/dL.

Based on the data, the sponsor claims that lithium heparin is an acceptable anti-coagulant for the cholesterol and triglyceride assays.

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 expected values are based on the NCEP ATP III *recommendations:

Cholesterol assay:
Desirable cholesterol: <200 mg/dL
Borderline high cholesterol: 200-239 mg/dL
High cholesterol: ≥240 mg/dL

Triglyceride assay:
Normal: <150 mg/dL
Borderline high: 150-199 mg/dL
High: 200-499 mg/dL
Very high: ≥500 mg/dL

*"Third Report of the NCEP Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III)-Final report". NIH publication (2002), No. 02-5215

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.