

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

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

K050955

**B. Purpose for Submission:**

New device

**C. Measurand:**

**Human Chorionic Gonadotropin (hCG)**

**D. Type of Test:**

Qualitative solid-phase, chromatographic immunoassay

**E. Applicant:**

PRINCETON BIOMEDITECH CORP.

**F. Proprietary and Established Names:**

LIFESIGN DXPRESS, MODEL LSR2000

**G. Regulatory Information:**

1. Regulation section:

21CFR Sec.-862.1155-Human chorionic gonadotropin (HCG) test system.

21CFR Sec.- 862.2300-Colorimeter, photometer, or spectrophotometer for clinical use.

2. Classification:

2, 1 respectively

3. Product code:

JHI - RADIOIMMUNOASSAY, HUMAN CHORIONIC GONADOTROPIN

JJQ - COLORIMETER, PHOTOMETER, SPECTROPHOTOMETER FOR  
CLINICAL USE

4. Panel:

Chemistry (75)

**H. Intended Use:**

1. Intended use(s):

See indications for use

2. Indication(s) for use:

- Reflectance photometer for the measurement of concentration of analyte in various assays manufactured by PBM. The concentration is measured by density of light reflectance.
- Reflectance photometer for a reading of test signal instead of visual reading in various qualitative assays manufactured by PBM.
- StatusFirst™ hCG Serum/Urine test is in vitro diagnostic use for a qualitative detection of Human Chorionic Gonadotropin(hCG) in serum or urine for the detection of pregnancy.

3. Special conditions for use statement(s):

prescription use

4. Special instrument requirements:

LIFESIGN DXPRESS

**I. Device Description:**

In the test procedure, sample is added to the sample well with the aid of a transfer pipette and sample is allowed to soak in. If hCG is present in the specimen, it will react with the conjugate dye, which binds to the antibody on the membrane to generate a colored line. The DXpress reader interprets the test result automatically by comparing the intensity of the test line to the preset cutoff value.

**J. Substantial Equivalence Information:**

1. Predicate device name(s):  
ACON LABORATORIES, Icon 25 hCG test.
2. Predicate 510(k) number(s):  
K993065
3. Comparison with predicate:

**StatusFirst™ hCG Serum/Urine Test vs. Icon 25 hCG test**

**Similarities:**

1. Both assays measure hCG in urine or serum.
2. Both assays are *in-vitro* immunological assays using immunochromatographic method.
3. Both assays give the result with the colored signal.
5. Both assays are qualitative test.
6. Both assays detect hCG at 25 mIU/mL in serum or urine.

**Differences:**

1. **StatusFirst™ hCG Serum/Urine Test** read the result by DXpress reader, whereas Icon25 hCG read the result visually.
2. **StatusFirst™ hCG Serum/Urine Test** reads the result at 5 min for both serum and urine samples, whereas Icon25 hCG read the result at 3 min for urine sample and 5 min for serum sample.

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

None referenced

**L. Test Principle:**

The StatusFirst™ hCG Serum/Urine Test is a rapid serum or urine test for detecting hCG qualitatively. The test employs a solid-phase, chromatographic immunoassay technology to selectively detect elevated levels of hCG in serum or urine with a high degree of sensitivity.

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

1. Analytical performance:
  - a. *Precision/Reproducibility:*

The precision study of **StatusFirst™ hCG Serum/Urine Test** was performed by carrying out the test for three days with three different readers. Two lots of devices were tested. Serum or urine samples for the study were prepared by

spiking hCG into pooled negative serum or urine. The prepared hCG concentrations were 0, 5, 25, 40 mIU/mL. The data are summarized below. There were no significant differences between readers, between days or between lots.

**Table 2. Precision Study Data:** Three days' and two lots' of data were combined for each reader.

**Serum**

|                    | hCG<br>(mIU/mL) | Percent<br>Positive<br>(N) | Percent<br>Borderline<br>(N) | Percent<br>Negative<br>(N) |
|--------------------|-----------------|----------------------------|------------------------------|----------------------------|
| Reader 1<br>(0490) | 0               | 0                          | 0                            | 100 (60)                   |
|                    | 5               | 0                          | 0                            | 100 (60)                   |
|                    | 25              | 100 (60)                   | 0                            | 0                          |
|                    | 40              | 100 (60)                   | 0                            | 0                          |
| Reader 2<br>(0598) | 0               | 0                          | 0                            | 100 (60)                   |
|                    | 5               | 0                          | 0                            | 100 (60)                   |
|                    | 25              | 100 (60)                   | 0                            | 0                          |
|                    | 40              | 100 (60)                   | 0                            | 0                          |
| Reader 3<br>(0662) | 0               | 0                          | 0                            | 100 (60)                   |
|                    | 5               | 0                          | 0                            | 100 (60)                   |
|                    | 25              | 100 (60)                   | 0                            | 0                          |
|                    | 40              | 100 (60)                   | 0                            | 0                          |
| Total              | 0               | 0                          | 0                            | 100 (180)                  |
|                    | 5               | 0                          | 0                            | 100 (180)                  |
|                    | 25              | 100 (180)                  | 0                            | 0                          |
|                    | 40              | 100 (180)                  | 0                            | 0                          |

### Urine

|                    | hCG<br>(mIU/mL) | Percent<br>Positive<br>(N) | Percent<br>Borderline<br>(N) | Percent<br>Negative<br>(N) |
|--------------------|-----------------|----------------------------|------------------------------|----------------------------|
| Reader 1<br>(0490) | 0               | 0                          | 0                            | 100 (60)                   |
|                    | 5               | 0                          | 1.7 (1)                      | 98.3 (59)                  |
|                    | 25              | 98.3 (59)                  | 1.7 (1)                      | 0                          |
|                    | 40              | 100 (60)                   | 0                            | 0                          |
| Reader 2<br>(0598) | 0               | 0                          | 0                            | 100 (60)                   |
|                    | 5               | 0                          | 2.3 (2)                      | 96.7 (58)                  |
|                    | 25              | 100 (60)                   | 0                            | 0                          |
|                    | 40              | 100 (60)                   | 0                            | 0                          |
| Reader 3<br>(0662) | 0               | 0                          | 0                            | 100 (60)                   |
|                    | 5               | 0                          | 0                            | 100 (60)                   |
|                    | 25              | 100 (60)                   | 0                            | 0                          |
|                    | 40              | 100 (60)                   | 0                            | 0                          |
| Total              | 0               | 0                          | 0                            | 100 (180)                  |
|                    | 5               | 0                          | 1.7 (3)                      | 98.3 (177)                 |
|                    | 25              | 99.4 (179)                 | 0.6 (1)                      | 0                          |
|                    | 40              | 100 (180)                  | 0                            | 0                          |

*b. Linearity/assay reportable range:*

Qualitative cut-off - positive is above 25

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

hCG calibration (cut-off) is performed using several levels of hCG between 0 to 40 mIU/mL.hCG made from a commercial source calibrated against the 4th WHO International Standard.

**Internal Control:** Each StatusFirst™ Serum/Urine Test device has a built-in control. The Control line is an internal positive procedural control. A distinct reddish-purple Control line should appear at the C position, indicating an adequate sample volume is used, the sample and reagent are wicking on the

membrane, and the reagents at the Control line and the conjugate-color indicator are reactive. In addition, the clearing background in the Result window, by providing a distinct readable result, may be considered an internal negative procedural control.

*d. Detection limit:*

To evaluate the sensitivity of **StatusFirst™ hCG Serum/Urine Test** the following experiment was performed.

The hCG (calibrated to the WHO 4<sup>th</sup> international standard) was spiked to the pooled negative serum or urine and made several levels of concentration. At each concentration the test was repeated 10 times with one lot of devices. Two lots of devices were used for the experiment. Therefore total 20 replicates were tested at each concentration.

The reader is tuned to read hCG levels below the cut-off, to detect hCG levels above 5 mIU/mL and less than 25 mIU/mL however since the reader does not identify 100% of hCG levels in this range the results are reported out as Borderline and are considered indeterminate. The results are summarized below (Table 1).

The results supported the sensitivity of 25 mIU/mL in both urine and serum.

**Table 1. Sensitivity Study**

**Serum**

| hCG<br>(mIU/mL) | Percent Positive<br>(N) | Percent Borderline<br>(N) | Percent Negative<br>(N) |
|-----------------|-------------------------|---------------------------|-------------------------|
| 0               | 0                       | 0                         | 100 (20)                |
| 3               | 0                       | 0                         | 100 (20)                |
| 5               | 0                       | 0                         | 100 (20)                |
| 10              | 0                       | 60 (12)                   | 40 (8)                  |
| 15              | 35 (7)                  | 55 (11)                   | 10 (2)                  |
| 20              | 85 (17)                 | 15 (3)                    | 0                       |
| 25              | 100 (20)                | 0                         | 0                       |
| 40              | 100 (20)                | 0                         | 0                       |

**Urine**

| hCG<br>(mIU/mL) | Percent Positive<br>(N) | Percent Borderline<br>(N) | Percent Negative<br>(N) |
|-----------------|-------------------------|---------------------------|-------------------------|
| 0               | 0                       | 0                         | 100 (20)                |
| 3               | 0                       | 0                         | 100 (20)                |
| 5               | 0                       | 0                         | 100 (20)                |

| hCG<br>(mIU/mL) | Percent Positive<br>(N) | Percent Borderline<br>(N) | Percent Negative<br>(N) |
|-----------------|-------------------------|---------------------------|-------------------------|
| 10              | 0                       | 55 (11)                   | 45 (9)                  |
| 15              | 30 (6)                  | 60 (12)                   | 10 (2)                  |
| 20              | 80 (16)                 | 20 (4)                    | 0                       |
| 25              | 100 (20)                | 0                         | 0                       |
| 40              | 100 (20)                | 0                         | 0                       |

e. *Analytical specificity:*

The cross-reactivity of Luteinizing hormone (LH), Follicle Stimulating Hormone (FSH), and Thyroid Stimulating Hormone (TSH), which are commonly known homologous hormones were tested.

No cross-reactivity was observed when tested at the levels specified below.

| Homologous Hormones | Urine            | Serum            |
|---------------------|------------------|------------------|
| hFSH                | 1000 mIU/mL      | 1000 mIU/mL      |
| hLH                 | 300 mIU/mL       | 300 mIU/mL       |
| hTSH                | 1000 $\mu$ IU/mL | 1000 $\mu$ IU/mL |

Potentially interfering substances were prepared at the following concentrations in both serum and urine containing either 0 or 25 mIU/mL hCG. These samples were tested with the **StatusFirst™ hCG Serum/Urine Test**. No interference was found at these concentrations.

|                      | in Urine | in Serum |
|----------------------|----------|----------|
| Acetaminophen        | 20 mg/dL | 20 mg/dL |
| Acetylsalicylic Acid | 20 mg/dL | 20 mg/dL |
| Ampicillin           | 20 mg/dL | 20 mg/dL |
| Ascorbic Acid        | 20 mg/dL | 20 mg/dL |
| Atropine             | 20 mg/dL | 20 mg/dL |
| Caffeine             | 20 mg/dL | 20 mg/dL |
| Gentisic Acid        | 20 mg/dL | 20 mg/dL |
| Phenothiazine        | 20 mg/dL | 20 mg/dL |
| Phenylpropanolamine  | 20 mg/dL | 20 mg/dL |
| Salicylic Acid       | 20 mg/dL | 20 mg/dL |
| Tetracycline         | 20 mg/dL | 20 mg/dL |
| Bilirubin            | 1mg/dL   | 15 mg/dL |

|            |            |            |
|------------|------------|------------|
| Glucose    | 2000 mg/dL | 2000 mg/dL |
| Hemoglobin | 1 mg/dL    | 125 mg/dL  |
| Ketones    | 100 mg/dL  | –          |

f. Assay cut-off:

**See Detection limit above**

2. Comparison studies:

a. *Method comparison with predicate device:*

A total of 116 clinical samples (51 serum samples and 65 urine samples) were collected and studied. Since the samples with hCG in near sensitivity level was hard to find some samples were made by diluting clinical samples with high hCG concentration with negative samples. These specimens were tested with **StatusFirst™ hCG Serum/Urine Test** and predicate device, Icon® 25 hCG by Beckman Coulter, according to the package inserts. The summary of the results is shown below tables (Table 3).

**Table 3. StatusFirst™ vs. Predicate Device (Icon® 25 hCG)**

**Serum**

|                  |          | StatusFirst™ hCG Serum/Urine |            |          | Total |
|------------------|----------|------------------------------|------------|----------|-------|
|                  |          | Positive                     | Borderline | Negative |       |
| Predicate Device | Positive | 25                           | 5          | 1        | 31    |
|                  | Negative | 0                            | 0          | 20       | 20    |
| Total            |          | 25                           | 5          | 21       | 51    |

**Urine**

|                  |          | StatusFirst™ Serum/Urine |            |          | Total |
|------------------|----------|--------------------------|------------|----------|-------|
|                  |          | Positive                 | Borderline | Negative |       |
| Predicate Device | Positive | 37                       | 1          | 0        | 38    |
|                  | Negative | 0                        | 1          | 26       | 27    |
| Total            |          | 37                       | 2          | 26       | 65    |

In serum sample testing, 6 samples showed discrepant results between the StatusFirst test and the predicate device. All 6 of the discrepant samples contained hCG but the amount of hCG present in these samples was less than 25mIU/mL. The predicate device gave positive results for these 6 discrepant samples. The StatusFirst(TM) Serum/Urine test gave borderline results for 5 of the 6 discrepant samples and a negative result for 1 of the 6 discrepant samples.

In urine sample testing, two samples gave discrepant results between the two devices. These two samples contained hCG, but the amount of hCG present in these samples was less than 25mIU/mL. The StatusFirst gave borderline (indeterminate) results for these two samples, while the predicate device gave 1 positive and 1 negative result for these two samples.

All discrepant samples had less than 25 mIU/mL hCG. StatusFirst Serum/Urine test gave correct results (borderline or negative) for all these samples.

- b. *Matrix comparison:*  
See method comparison
- 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):

#### **Physicians' Office Laboratory Evaluation**

The study was performed at three different physician's offices using a total of 120 blind control samples.

#### **Testing Sites**

1. Paramount Medical Group  
8 Mountain Blvd.  
Warren, NJ 07059
2. B. Bang, MD  
666 Plainsborough Road Building 100, Suites A & B  
Plainsboro, NJ 08536
3. Oberlin Road Pediatrics  
Oberlin Road  
Raleigh, NC



## Preparation of Samples

The test samples were prepared by spiking hCG into the pooled negative serum or urine. Each panel consisted of five negative (–) samples, five at 5 mIU/mL, five at 25 mIU/mL, and five at 100 mIU/mL hCG. The samples were aliquoted for each test and numbered for the blind test.

## Testing

The test protocol, data recording sheets, test devices, test samples, and a reader were given to the operator of each site. The operator tested each sample by following the test procedure.

## Results

The results obtained at each site agreed 100% with expected results in both serum and urine samples.

The summary of the results are shown below.

### Site Study results

#### Serum

| Sample Concentration | Results (Actual/Expected) |              |              |
|----------------------|---------------------------|--------------|--------------|
|                      | Site 1                    | Site2        | Site3        |
| Negative             | 5 (–) /5 (–)              | 5 (–) /5 (–) | 5 (–) /5 (–) |
| 5 mIU/mL             | 5 (–) /5 (–)              | 5 (–) /5 (–) | 5 (–) /5 (–) |
| 25 mIU/mL            | 5 (+) /5 (+)              | 5 (+) /5 (+) | 5 (+) /5 (+) |
| 100 mIU/mL           | 5 (+) /5 (+)              | 5 (+) /5 (+) | 5 (+) /5 (+) |

#### Urine

| Sample Concentration | Results (Actual/Expected) |              |              |
|----------------------|---------------------------|--------------|--------------|
|                      | Site 1                    | Site2        | Site3        |
| Negative             | 5 (–) /5 (–)              | 5 (–) /5 (–) | 5 (–) /5 (–) |
| 5 mIU/mL             | 5 (–) /5 (–)              | 5 (–) /5 (–) | 5 (–) /5 (–) |
| 25 mIU/mL            | 5 (+) /5 (+)              | 5 (+) /5 (+) | 5 (+) /5 (+) |
| 100 mIU/mL           | 5 (+) /5 (+)              | 5 (+) /5 (+) | 5 (+) /5 (+) |

4. Clinical cut-off:  
Not Applicable

5. Expected values/Reference range:  
Positive is 25 mIU/mL or greater see detection limit.

HCG levels in normal early pregnant women vary and hCG levels often exceed 100 mIU/mL by the first day of the missed menstrual period (Braunstein, G.D., Rasor, J., Adler, D., Danzer, H., and Wade, M.E. Serum Human Chorionic Gonadotropin Levels Throughout Normal Pregnancy. *Am. J. Obstet. Gynecol.* 126:678, 1976)

**N. Instrument Name:**

LifeSign DXpress™ reader

**O. System Descriptions:**

1. Modes of Operation:

The DXpress™ Reader is a multi-functional portable tabletop camera-based instrument used to read results of in vitro immunodiagnostic assays manufactured according to standards developed by LifeSign, LLC. The DXpress™ Reader uses an LED light source to illuminate an inserted test device. The reader captures and analyzes the reflected image. For quantitative tests, the reader converts the intensity of the test result line into a concentration of analyte using a calibration profile contained in a preprogrammed Data Chip provided with each lot of test devices. For qualitative tests, the reader reports a qualitative positive or negative result.

The barcode scanner enables rapid entry of information, including lot number, expiration date, and operator and patient identification.

2. Software:

FDA has reviewed applicant's Hazard Analysis and software development processes for this line of product types:

Yes   X   or No           

3. Specimen Identification:

Keypad alpha numeric or bar code

4. Specimen Sampling and Handling:

Single sample

5. Calibration:

Calibration QC checks and calibrates the reader optical system using the reference values in a 1-line Calibrator (included) to read test devices accurately. The Calibration QC is required at preset daily intervals determined by the laboratory supervisor. After the power-on and completion of the Self Check, the reader will instruct when to perform a Calibration QC if more than 24 hours have elapsed since the last calibration.

Calibration QC requires a 1-line Calibrator which is included with each DXpress. The barcode contains the quality control parameters for the Calibrator.

After completion of the Calibration QC, the reader will print a hard copy of the result and store it in memory.

6. Quality Control:

External QC follows the same procedure as Run Patient. The only difference is that Run Patient requires a Patient ID, whereas External QC requires a Sample ID.

**P. Other Supportive Instrument Performance Characteristics Data Not Covered In The “Performance Characteristics” Section above:**

Software documentation conforms to documentation in FDA premarket guidance and hazards identified and controlled for are similar to devices of the same type demonstrating the device was developed using good software lifecycle practices.

**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.