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| **TSH** |
| **Purpose** | The TSH method is an *in vitro* diagnostic test for the quantitative measurement of Thyroid Stimulating Hormone in human serum and plasma on the Dimension Vista® System. |
| **Policy Statements** | This procedure applies to all Siemens Dimension Vista 500 operators. |
| **Principle** | The TSH method is a homogeneous, sandwich chemiluminescent immunoassay based on LOCI® technology. The LOCI® reagents include two synthetic bead reagents and a biotinylated anti-TSH monoclonal antibody fragment. The first bead reagent (Sensibeads) is coated with streptavidin and contains a photosensitizer dye. The second bead reagent (Chemibeads) is coated with a second anti-TSH monoclonal antibody and contains chemiluminescent dye. Sample is incubated with biotinylated antibody and Chemibeads to form bead-TSH-biotinylated antibody sandwiches. Sensibeads are added and bind to the biotin to form bead-pair immunocomplexes. Illumination of the complex at 680 nm generates singlet oxygen from Sensibeads which diffuses into the Chemibeads, triggering a chemiluminescent reaction. The resulting signal is measured at 612 nm and is a direct function of the TSH concentration in the sample.NOTE: This assay is sensitive to higher than normal levels of supplemented Biotin. Results will be falsely decreased in a proportional manner based on concentration of Biotin in circulation. |
| **Clinical Significance** | Thyroid stimulating hormone is a glycoprotein secreted by the anterior lobe of the pituitary gland. TSH stimulates the normal thyroid gland to synthesize and secrete thyroxine (T4) and triiodothyronine (T3). Although less sensitive measurements of TSH (or free T4) can be used to diagnose severe, clinically apparent hypo- or hyperthyroidism, only a highly sensitive TSH assay has sufficient clinical sensitivity to detect the minor degrees of thyroxine excess or deficiency associated with early, subclinical phases of hypo- or hyperthyroidism.In primary hypothyroidism, where there is impaired production of thyroid hormones, the TSH level is typically highly elevated. In secondary or tertiary hypothyroidism, on the other hand, where thyroid hormone production is low as a consequence of pituitary or hypothalamic lesions, the TSH level is usually low. In hyperthyroidism, the TSH level is typically suppressed to subnormal levels. Less often, this condition may result from hyperstimulation of the thyroid, due to hypothalamic or pituitary lesions, in which case the TSH level is usually increased.Measurement of circulating TSH has been used as a primary test for differential diagnosis of hypothyroidism and as an aid in monitoring the adequacy of thyroid hormone replacement therapy. It should be remembered that hyperthyroidism and hypothyroidism are *graded* conditions. This implies that not all patients in these disease categories can be expected to have TSH levels far outside the euthyroid range. On the other hand, TSH levels exit the euthyroid reference range in the very early phases of developing thyroid disease, while the patient's disease is still *subclinical* and thyroid hormone levels remain within their euthyroid reference ranges. |
| **Instrument** | PRIMARY METHOD: Siemens Dimension Vista 500SECONDARY (BACKUP) METHOD: Siemens Dimension Vista 500 on opposite campus |
| **Sunquest Test Code** | **TSH** TSH µIU/mL |
| **Sample** | Lithium heparin plasma, Serum. Refer to the Specimen Collection Manual for collection of specimens.**Minimum Volume:**200μL preferred, 100μL minimum, 12 μL actual test volume |
| **Sample (cont)** | **Stability:**7 days at 2-8°C, 1 month at -20°C. Serum specimens are stable for up to 24 hours at room temperature on the clot.Freeze samples only once and mix thoroughly after thawing.**Specimen Rejection:*** Samples and controls stabilized with sodium azide cannot be used
* Unlabeled

**Preparation:**1. Complete clot formation should take place before centrifugation to prevent the appearance of fibrin in serum samples,. Serum or plasma should be physically separated from cells with a maximum limit of 2 hours from the time of collection. Specimens should be free of particulate matter.
2. Whole blood specimens should be centrifuged according to Specimen Processing procedures prior to analysis. See Processing Procedure Manual.
3. Transfer serum or plasma to a properly labeled Siemens SSC nested on a bar-coded pilot tube. Minimum labeling includes sample accession ID, and/ or patient name, medical record number, collection date and time.
4. Very lipemic or frozen samples that become turbid after thawing must be clarified by centrifugation before testing.
5. Patients should not receive supplemented Biotin through multivitamins or Biotin supplements within 24 hours prior to testing.
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| **Reagents** |

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| ***Product Description*** | ***Product Code*** | ***Stability*** |
| TSH Flex® reagent cartridge (Vista) | K6412 | **Store at:** 2 - 8 °C.**Unopened:** Refer to carton for expiration date of individual unopened reagent cartridges. **On-board:** Sealed wells on the instrument are stable for 30 days.**Open well stability:** 7 days for wells 1 - 12. |
| LOCI 1 CAL (Vista) | KC660 | **Store at:** 2 - 8 °C.**Unopened:** Refer to carton for expiration date.**Preparation:** Thaw and equilibrate at 22 – 28 C for 30 minutes. Mix by inverting 10 times.**On-board:** Once the vial stopper is punctured, assigned values are stable for 7 days when stored on board the Dimension Vista® System**Opened:** Once the cap is removed, the assigned values are stable for 30 days when recapped immediately and stored at 2 - 8 °C. Do not use this vial on board. |
| MULTI 2 Sample Diluent: Liquid ready to use | KD694 | **Store at:** 2 - 8 °C.**Unopened:** Refer to carton for expiration date.**On-board:** Once the vial stopper is punctured, assigned values are stable for 30 days when stored on board the Dimension Vista® System.**Opened:** Once the cap is removed, the product is stable for 30 days when recapped immediately and stored at 2 - 8 °C |

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| **Special Safety Precautions** | Irritant. Contains a mixture of 5-chloro-2-methyl-2H-isothiazol-3-one and 2-methyl-2Hisothiazol- 3-one (3:1).* May cause sensitization by skin contact.
* Avoid contact with skin.
* Wear suitable gloves.
* Safety data sheets (MSDS/SDS) available on www.siemens.com/diagnostics
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| **Calibration** |

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| Assay Range: | **0.005–100** µIU/ mL |
| Calibration Material: | LOCI 1 CAL, Cat. No. KC660  |
| Calibration Scheme | 6 levels, n=3 |
| Typical Calibration Levels | Level 1 (CAL A): 0.000 μIU/mL Level 2 (CAL B): 1.00 μIU/mL Level 3 (CAL C): 4.00 μIU/mL Level 4 (CAL D): 20.0 μIU/mL Level 5 (CAL E): 50.0 μIU/mL Level 6 (CAL F): 105 μIU/mL  |
| Calibration Frequency: | * Every 30 days
* For each new lot of Flex® reagent cartridges
* After major maintenance or service, if indicated by quality control results
* As indicated in laboratory quality control procedures
* When required by government regulations
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Consult the Vista Calibration Procedure or your Vista iGuide for calibration instructions. |
| **Analytical Measuring Range (AMR)** | Cal Verification and AMR verification meet regulatory requirements with each calibration using 6 calibrators that span the full measuring range. |
| **Quality Control** | Biorad Immunoassay Plus Control in Vista Vials, 2 levels. **Preparation**: Allow the frozen control to stand at room temperature (18 to 25°C) until it is completely thawed. Gently swirl the contents of the vial and immediately load the vial onto the instrument.**Frequency:** Two levels once each day of patient testing.**Stability:** This product will be stable until the expiration date when stored unopened at -20°C to -50°C.Thawed and stored at 2 to 8°C or on board the Siemens Dimension Vista, all analytes will be stable for 4 days. Once thawed, do not refreeze the control; discard the remaining material.**Sunquest Control Names:** Level 1 = C-IMV1, Level 3 = C-IMV3.**Acceptable Ranges:** Ranges are current in Sunquest and the instrument. Refer to the [Quality Control in Chemistry](http://khan.childrensmn.org/Manuals/Lab/SOP/Chem/Quality/201755.pdf) Procedure for QC exception codes. |
| **Interferences** | Biotin supplementation causes falsely decreased results. The approximate level of bias in a sample with typical levels of TSH (4.32 uIU/mL) is charted below:

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| Biotin Test Concentration Level (ng/mL) | % Bias |
| 250 | -18.2 |
| 500 | -56.2 |
| 1200 | -99.1 |

No interference was found for:* Other commonly used drugs.
* HIL:
	+ Hemoglobin (free) up to 1000 g/dL
	+ Bilirubin (conjugated or unconjugated) up to 60 mg/dL
	+ Lipemia (Intralipid®) up to 3000 mg/dL

Non-Interfering Substances:Refer to the product insert for a list of substances that were shown to have no measurable effect on the TSH result at typical concentrations.**Hook Effect**One-step sandwich immunometric assays are susceptible to a high dose “hook effect,” where an excess of antigen prevents simultaneous binding of the capture and detection antibodies to a single analyte molecule. Such samples must be diluted and reassayed prior to reporting the results. The TSH method shows no hook effect up to 30000 μIU/mL |
| **Reference Range** |

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| Age | Expected range |
| 1-7 days | 3.2-21.0 µIU/ mL |
| 8 days-Adult | 0.5-4.8 µIU/mL |

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| **Critical Values** | None specified. |
| **Limitations** | Patient samples may contain heterophilic antibodies that could react in immunoassays to give falsely elevated or depressed results. This assay has been designed to minimize interference from heterophilic antibodies. Nevertheless, complete elimination of this interference from all patient specimens cannot be guaranteed. A test result that is inconsistent with the clinical picture and patient history should be interpreted with caution. As with any immune-recognition measurement of a peptide, extremely rare genetic variants may exhibit varying degrees of detection.The instrument reporting system contains flags and comments to provide the user with information regarding instrument processing errors, instrument status information and potential errors in TSH results. Refer to your Dimension Vista® Operator’s Guide for the meaning of report flags and comments. Any report containing flags and/or comments should be addressed prior to reporting.Linear range of detection: 0.005–100 µIU/ mL |
| Dilutions |

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| **TSH** |
| Surplus Rack | Samples with results >100 µIU/ mL are repeated on a higher dilution (1:5). |
| Limited Rack | Samples with results >100 µIU/ mL should be repeated as an Add-On Test with a Special Dilution of 1:5 |

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| **Result Reporting** | Results between **0.005–100 µIU/ mL** without error messages are releasedResults below 0.005: report as < 0.01 µIU/mL instead of the numerical value.Results >100 µIU/mL without messages are reported following a maximum dilution of 1:5.Results that exceed the assay range following a dilution of 1:5 are reported as > 500 µIU/mL |
| **Specimen Storage** | Promptly stopper tested specimen and store upright in numbered specimen rack by accession number. Every 8 hours remove specimens to refrigerator/freezer storage. Samples are retained 7 days in specimen storage freezer. |
| **References** | 1. Siemens Dimension Vista TSH Flex Insert, PN 781412.001 G – US, 2015-04-03
2. Burtis CA, Ashwood ER, Bruns, DE, editors. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 4th Ed. St Louis, MO: Elsevier Saunders, 2006.
3. Jacobs & DeMott Laboratory Test Handbook, Lexi-Comp, Inc, Hudson, OH, 5th Edition, 2001
4. Siemens Dimension Vista LOCI 1 CAL Product Insert, KC660, 3-13-2014
5. Siemens Dimension Vista Multi 2 SDIL Product Insert, May 23, 2014
6. Biorad Immunoassay Plus Control Product Insert
7. Siemens Diagnostic Customer Bulletin, 11313747, Rev. A, December 2017
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| **Historical Record** | **Version** | **Written/Revised by:** | **Effective Date:** | **Summary of Revisions** |
|  | L. Lichty/C. Bryant | 5/2005 | Replaces TSH on ACS180:SE, D. Riedel, 7/2001 |
|  | L. Lichty | 10/2006 | TSH, 3rd Generation on Immulite 2000 |
|  | L. Lichty | June 1, 2011 | New format, updated package insert |
|  | L. Lichty | April 8, 2013 | Eliminate level 2 control, clarify max dilution reporting |
|  | L. Lichty | July 22, 2014 | Replaces TSH on Immulite 2000 |
|  | Erin Bartos | June 20, 2017 | Biennial Review, added comments to limitations, removed no gel for serum. |
|  | Kelsi Brown | October 31, 2017 | Updated interfering substances per instructions for use from Siemens. |
|  | Erin Bartos | January 8, 2018 | Biotin Interference updated |
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