SIEMENS Healthineers

Urea Nitrogen (UN_c)

Current Revision and Date[a]	Rev. 03, 2020-08	
Product Name	Atellica CH Urea Nitrogen (UN_c)	REF 11097593 (6240 tests)
Abbreviated Product Name	Atellica CH UN_c	
Test Name/ID	UN_c	
Systems	Atellica CH Analyzer	
Materials Required but Not Provided	Atellica CH CHEM CAL	REF 11099411
Specimen Types	Serum, plasma (lithium heparin), and urine	
Sample Volume	7 µL	
Measuring Interval	Serum and plasma: 5–150 mg/dL (1.8–53.6 mmol/L) Urine: 35–1000 mg/dL (12.5–357.0 mmol/L)	

[a] A vertical bar in the page margin indicates technical content that differs from the previous version.

CE

Intended Use

The Atellica® CH Urea Nitrogen (UN_c) assay is for *in vitro* diagnostic use in the quantitative determination of urea nitrogen (an end product of nitrogen metabolism) in human serum, plasma (lithium heparin), and urine using the Atellica® CH Analyzer. Such measurements are used in the diagnosis and treatment of kidney disease, urinary tract obstruction, and acute or chronic renal failure.

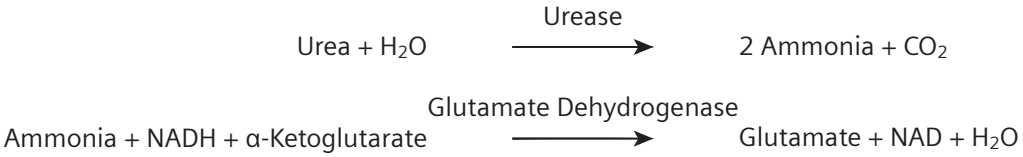
Summary and Explanation

The Atellica CH Urea Nitrogen (UN_c) assay is based on the Roch-Ramel enzymatic reaction using urease and glutamate dehydrogenase.[1]

Principles of the Procedure

Urea is hydrolyzed in the presence of water and urease to produce ammonia and carbon dioxide. The ammonia reacts with 2-oxoglutarate in the presence of glutamate dehydrogenase and reduced nicotinamide adenine dinucleotide (NADH). The oxidation of NADH to oxidized nicotinamide adenine dinucleotide (NAD) is measured as an inverse rate reaction at 340/410 nm.

Reaction Equation



Reagents

Material Description	Storage	Stability[a]
Atellica CH UN_c	Unopened at 2–8°C	Until expiration date on product
Pack 1 (P1)	Onboard per well	90 days
Well 1 (W1) Reagent 1 (R1) 23.5 mL NADH (≥ 0.69 mmol/L); sodium azide (0.09%)		
Well 2 (W2) Reagent 1 (R1) 23.5 mL NADH (≥ 0.69 mmol/L); sodium azide (0.09%)		
Pack 2 (P2)		
Well 1 (W1) Reagent 2 (R2) 23.5 mL Urease (≥ 7.2 U/mL); GLDH (≥ 0.9 U/mL); α-ketoglutarate (≥ 8.3 mmol/L); sodium azide (0.09%)		
Well 2 (W2) Reagent 2 (R2) 23.5 mL Urease (≥ 7.2 U/mL); GLDH (≥ 0.9 U/mL); α-ketoglutarate (≥ 8.3 mmol/L); sodium azide (0.09%)		

[a] Refer to *Storage and Stability*

Warnings and Precautions

For *in vitro* diagnostic use.

For Professional Use.

CAUTION

Federal (USA) law restricts this device to sale by or on the order of a licensed healthcare professional.

Safety data sheets (SDS) available on siemens.com/healthineers.

Contains sodium azide as a preservative. Sodium azide can react with copper or lead plumbing to form explosive metal azides. On disposal, flush reagents with a large volume of water to prevent buildup of azides. Disposal into drain systems must be in compliance with prevailing regulatory requirements.

Dispose of hazardous or biologically contaminated materials according to the practices of your institution. Discard all materials in a safe and acceptable manner and in compliance with prevailing regulatory requirements.

Note For information about reagent preparation, refer to *Preparing the Reagents* in the *Procedure* section.

Storage and Stability

Unopened reagents are stable until the expiration date on the product when stored at 2–8°C.

Do not use products beyond the expiration date printed on the product labeling.

Onboard Stability

Reagents are stable onboard the system for 90 days. Discard reagents at the end of the onboard stability interval. Do not use products beyond the expiration date printed on the product labeling.

Specimen Collection and Handling

Serum, plasma (lithium heparin), and urine are the recommended sample types for this assay.

Collecting the Specimen

- Observe universal precautions when collecting specimens. Handle all specimens as if they are capable of transmitting disease.[2]
- Follow recommended procedures for collection of diagnostic blood specimens by venipuncture.[3]
- Follow the instructions provided with your specimen collection device for use and processing.[4]
- Allow blood specimens to clot completely before centrifugation.[5]
- Keep tubes capped at all times.[5]
- Normal procedures for collecting and storing urine may be used for samples to be analyzed for this assay.[6-9]

Storing the Specimen

Separated blood urea nitrogen is stable in separated serum or plasma and may be stored for up to 3–5 days at room temperature or for up to 7 days at 4°C or stored frozen indefinitely at -20°C.[8,9]

Urine urea nitrogen may be stored for up to 4 days at 4–8°C when preserved with thymol to avoid bacterial action.[8,9]

The handling and storage information provided here is based on data or references maintained by the manufacturer. It is the responsibility of the individual laboratory to use all available references and/or its own studies when establishing alternate stability criteria to meet specific needs.

Transporting the Specimen

Package and label specimens for shipment in compliance with applicable federal and international regulations covering the transport of clinical specimens and etiological agents.

Preparing the Samples

This assay requires 7 µL of sample for a single determination. This volume does not include the unusable volume in the sample container or the additional volume required when performing duplicates or other tests on the same sample. For information about determining the minimum required volume, refer to the online help.

Note Do not use specimens with apparent contamination.

Before placing samples on the system, ensure that samples are free of:

- Bubbles or foam.
- Fibrin or other particulate matter.

Note Remove particulates by centrifugation according to CLSI guidance and the collection device manufacturer's recommendations.[5]

Note For a complete list of appropriate sample containers, refer to the online help.

Procedure

Materials Provided

The following materials are provided:

REF	Contents	Number of Tests
11097593	**Pack 1 (P1)** Well 1 (W1) 23.5 mL of Atellica CH UN_c Reagent 1 Well 2 (W2) 23.5 mL of Atellica CH UN_c Reagent 1 **Pack 2 (P2)** Well 1 (W1) 23.5 mL of Atellica CH UN_c Reagent 2 Well 2 (W2) 23.5 mL of Atellica CH UN_c Reagent 2	4 x 1560

Materials Required but Not Provided

The following materials are required to perform this assay, but are not provided:

REF	Description	
	Atellica CH Analyzer[a]	
11099411	Atellica CH CHEM CAL (calibrator)	2 x 3.0 mL calibrator CAL Calibrator lot-specific value sheet CAL LOT VAL
	Commercially available quality control materials	

[a] Additional system fluids are required to operate the system: Atellica CH Diluent, Atellica CH Wash, Atellica CH Conditioner, Atellica CH Cleaner, Atellica CH Reagent Probe Cleaner 1, Atellica CH Reagent Probe Cleaner 2, Atellica CH Reagent Probe Cleaner 4, Atellica CH Lamp Coolant, and Atellica CH Water Bath Additive. For system fluid instructions for use, refer to the Document Library.

Assay Procedure

The system automatically performs the following steps:

1. For serum/plasma, dispenses 50 µL of primary sample and 200 µL of Atellica CH Diluent into a dilution cuvette. For urine, dispenses 33.3 µL of primary sample and 200 µL of Atellica CH Diluent into a dilution cuvette.
2. Dispenses 26.7 µL of Reagent 1 and 53.3 µL of special reagent water into a reaction cuvette.
3. Dispenses 7 µL of pre-diluted sample into a reaction cuvette.
4. Measures the absorbance after sample addition.
5. Dispenses 16 µL of Reagent 2 into a reaction cuvette.
6. Mixes and incubates the mixture at 37°C.

7. Measures the absorbance after Reagent 2 addition.
8. Reports results.

Note For information about special reagent water requirements, refer to the online help.

Test Duration: 7 minutes

Preparing the Reagents

All reagents are liquid and ready to use.

Preparing the System

Ensure that the system has sufficient reagent packs loaded in the reagent compartment. For information about loading reagent packs, refer to the online help.

Performing Calibration

For calibration of the Atellica CH UN_c assay, use Atellica CH CHEM CAL. Use the calibrators in accordance with the calibrator instructions for use.

Calibration Frequency

Perform a calibration if one or more of the following conditions exist:

- When changing lot numbers of primary reagent packs.
- At the end of the lot calibration interval, for a specified lot of calibrated reagent on the system.
- At the end of the pack calibration interval, for calibrated reagent packs on the system.
- When indicated by quality control results.
- After major maintenance or service, if indicated by quality control results.

At the end of the onboard stability interval, replace the reagent pack on the system with a new reagent pack. Recalibration is not required, unless the lot calibration interval is exceeded.

Stability Interval	Days
Lot Calibration	75
Pack Calibration	6
Reagent Onboard Stability	90

For information about lot calibration and pack calibration intervals, refer to the online help.

Follow government regulations or accreditation requirements for calibration frequency. Individual laboratory quality control programs and procedures may require more frequent calibration.

Performing Quality Control

For quality control of the Atellica CH UN_c assay, use at least two levels (low and high) of the appropriate quality control material of known analyte concentration. Use the quality control material in accordance with the quality control instructions for use.

For the assigned values, refer to the lot-specific value sheet provided. A satisfactory level of performance is achieved when the analyte values obtained are within the expected control range for the system or within your range, as determined by an appropriate internal laboratory quality control scheme. Follow your laboratory's quality control procedures if the results obtained do not fall within the acceptable limits. For information about entering quality control definitions, refer to the online help.

Follow government regulations or accreditation requirements for quality control frequency. Individual laboratory quality control programs and procedures may require more frequent quality control testing.

Taking Corrective Action

If the quality control results do not fall within the assigned values, do not report results. Perform corrective actions in accordance with established laboratory protocol. For suggested protocol, refer to the online help.

Results

Calculation of Results

The system determines the result using the calculation scheme described in the online help. The system reports results in mg/dL (common units) or mmol/L (SI units), depending on the units defined when setting up the assay.

Conversion formula: mg/dL x 0.357 = mmol/L

For information about results outside the specified measuring interval, refer to *Measuring Interval*.

Interpretation of Results

Results of this assay should always be interpreted in conjunction with the patient's medical history, clinical presentation, and other findings.

Limitations

The Atellica CH UN_c assay is limited to the detection of urea nitrogen (an end product of nitrogen metabolism) in human serum, plasma (lithium heparin), and urine.

Hemoglobin at 250 mg/dL increases the UN result in serum/plasma at 9 mg/dL by 14%. Conjugated bilirubin at 30 mg/dL decreases the UN result in serum/plasma at 40 mg/dL by -14%.

Blood samples from some patients with monoclonal gammopathies may produce falsely elevated results.[10,11]

Expected Values

Reference Interval

A reference interval for healthy adults was established in accordance with CLSI Document EP28-A3c and verified on the Atellica CH Analyzer.[12]

Group	Specimen Type	Reference Interval Common Units (SI Units)
Adults	Serum/Plasma[13]	9–23 mg/dL (3.2–8.2 mmol/L)
Adults	Urine[6]	12–20 g/day (0.43–0.71 mol/day)

As with all *in vitro* diagnostic assays, each laboratory should determine its own reference interval for the diagnostic evaluation of patient results. Consider these values as guidance only.[12]

Performance Characteristics

Measuring Interval

The Atellica CH UN_c assay provides results from 5–150 mg/dL (1.8–53.6 mmol/L) for serum and plasma and 35–1000 mg/dL (12.5–357.0 mmol/L) for urine. The system flags all values that are outside the specified measuring interval.

Extended Measuring Interval

An automatic repeat condition for this assay extends the measuring interval to 300 mg/dL (107.1 mmol/L) for serum and plasma and 2000 mg/dL (714 mmol/L) for urine. You may configure the system to trigger an automatic repeat. Automatic repeat results will be flagged **Autorepeat**.

Detection Capability

Detection capability was determined in accordance with CLSI Document EP17-A2.[14] The assay is designed to have a limit of blank (LoB) ≤ limit of detection (LoD) and LoD ≤ 5 mg/dL (≤ 1.8 mmol/L) for serum and plasma, and a limit of blank (LoB) ≤ limit of detection (LoD) and LoD ≤ 35 mg/dL (≤ 12.5 mmol/L) for urine.

The LoD corresponds to the lowest concentration of urea nitrogen that can be detected with a probability of 95%. The LoD for the Atellica CH UN_c assay is 2 mg/dL (0.7 mmol/L) for serum and plasma and 7 mg/dL (2.5 mmol/L) for urine, and was determined using 120 determinations, with 60 blank and 60 low level replicates, and a LoB of 1 mg/dL (0.4 mmol/L) for serum and plasma and 4 mg/dL (1.4 mmol/L) for urine.

Assay results obtained at individual laboratories may vary from the data presented.

Precision

Precision was determined in accordance with CLSI Document EP05-A3.[15] Samples were assayed on an Atellica CH Analyzer in duplicate in 2 runs per day for 20 days (N ≥ 80 for each sample). The following results were obtained:

			Repeatability		Within-Lab Precision	
Sample Type	**N**	**Mean mg/dL (mmol/L)**	**SD[a] mg/dL (mmol/L)**	**CV[b] (%)**	**SD mg/dL (mmol/L)**	**CV (%)**
Serum	80	16 (5.7)	0.50 (0.18)	3.1	0.55 (0.20)	3.4
Serum QC	80	39 (13.9)	0.55 (0.20)	1.4	0.92 (0.33)	2.3
Serum QC	80	67 (23.9)	0.46 (0.16)	0.7	1.06 (0.38)	1.6
Plasma	80	118 (42.1)	0.91 (0.32)	0.8	2.96 (1.06)	2.5
Urine	80	158 (56.4)	2.27 (0.81)	1.4	5.99 (2.14)	3.8
Urine QC	80	400 (142.8)	4.69 (1.67)	1.2	12.22 (4.36)	3.1
Urine	80	538 (192.1)	8.17 (2.92)	1.5	15.87 (5.67)	2.9
Urine QC	80	815 (291.0)	7.66 (2.73)	0.9	20.30 (7.25)	2.5

[a] Standard deviation.

[b] Coefficient of variation.

Assay results obtained at individual laboratories may vary from the data presented.

Assay Comparison

The Atellica CH UN_c assay is designed to have a correlation coefficient of > 0.95, and a slope of 1.0 ± 0.05 for serum and a slope of 1.0 ± 0.06 for urine compared to ADVIA® Chemistry 1800 UN. Assay comparison was determined using the Deming linear regression model in accordance with CLSI Document EP09-A3.[16] The following results were obtained:

Specimen	Comparative Assay (x)	Regression Equation	Sample Interval	N[a]	r[b]
Serum	ADVIA Chemistry 1800 UN	y = 0.96x + 2 mg/dL (y = 0.96x + 0.7 mmol/L)	7–148 mg/dL (2.5–52.8 mmol/L)	100	1.000
Urine	ADVIA Chemistry 1800 UN	y = 0.95x + 1 mg/dL (y = 0.95x + 0.4 mmol/L)	37–985 mg/dL (13.2–351.6 mmol/L)	100	0.997

[a] Number of samples tested.

[b] Correlation coefficient.

The agreement of the assay may vary depending on the study design, comparative assay, and sample population. Assay results obtained at individual laboratories may vary from the data presented.

Specimen Equivalency

Specimen equivalency was determined using the Deming linear regression model (N = 1 replicate per sample) in accordance with CLSI Document EP09-A3.[16] The following results were obtained:

Specimen (y)	Reference Specimen (x)	Regression Equation	Sample Interval	N[a]	r[b]
Lithium heparin plasma	Serum	y = 0.94x - 1 mg/dL (y = 0.94x - 0.4 mmol/L)	7–140 mg/dL (2.5–50.0 mmol/L)	50	0.998

[a] Number of samples tested.

[b] Correlation coefficient.

Agreement of the specimen types may vary depending on the study design and sample population used. Assay results obtained at individual laboratories may vary from the data presented.

Interferences

Hemolysis, Icterus, and Lipemia (HIL)

The Atellica CH UN_c assay is designed to have ≤ 10% interference from hemoglobin, bilirubin, and lipemia. Interfering substances at the levels indicated in the table below were tested in accordance with CLSI Document EP07-A2 using the Atellica CH UN_c assay.[17]

Bias is the difference in the results between the control sample (does not contain the interferent) and the test sample (contains the interferent) expressed in percent. Bias > 10% is considered interference. Analyte results should not be corrected based on this bias.

Substance	Substance Test Concentration Common Units (SI Units)	Analyte Concentration	Percent Bias
Hemoglobin	200 mg/dL (0.125 mmol/L) 500 mg/dL (0.312 mmol/L)	8 mg/dL (2.9 mmol/L) 45 mg/dL (16.1 mmol/L)	7 3
Bilirubin, conjugated	30 mg/dL (513 µmol/L) 20 mg/dL (342 µmol/L)	9 mg/dL (3.2 mmol/L) 45 mg/dL (16.1 mmol/L)	-7 -3

Substance	Substance Test Concentration Common Units (SI Units)	Analyte Concentration	Percent Bias
Bilirubin, unconjugated	30 mg/dL (513 µmol/L) 30 mg/dL (513 µmol/L)	8 mg/dL (2.9 mmol/L) 42 mg/dL (15.0 mmol/L)	0 -1
Lipemia (Intralipid®)	650 mg/dL (7.35 mmol/L) 650 mg/dL (7.35 mmol/L)	8 mg/dL (2.9 mmol/L) 43 mg/dL (15.4 mmol/L)	0 0

Assay results obtained at individual laboratories may vary from the data presented.

Standardization

The Atellica CH UN_c assay is traceable to the CDC reference method, which uses SRM 912 and 909 reference materials from the National Institute of Standards and Technology (NIST).

Assigned values for calibrators are traceable to this standardization.[18]

Technical Assistance

For customer support, contact your local technical support provider or distributor.

siemens.com/healthineers

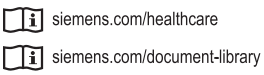
References

1. Roch-Ramel F. An enzymic and fluorophotometric method for estimating urea concentrations in nanoliter specimens. *Anal Biochem.* 1967;21(3):372–381.
2. Clinical and Laboratory Standards Institute. *Protection of Laboratory Workers from Occupationally Acquired Infections; Approved Guideline—Fourth Edition*. Wayne, PA: Clinical and Laboratory Standards Institute; 2014. CLSI Document M29-A4.
3. Clinical and Laboratory Standards Institute. *Procedures for the Collection of Diagnostic Blood Specimens by Venipuncture; Approved Standard—Sixth Edition*. Wayne, PA: Clinical and Laboratory Standards Institute; 2007. CLSI Document GP41-A6.
4. Clinical and Laboratory Standards Institute. *Tubes and Additives for Venous and Capillary Blood Specimen Collection; Approved Standard—Sixth Edition*. Wayne, PA: Clinical and Laboratory Standards Institute; 2010. CLSI Document GP39-A6.
5. Clinical and Laboratory Standards Institute. *Procedures for the Handling and Processing of Blood Specimens for Common Laboratory Tests; Approved Guideline—Fourth Edition*. Wayne, PA: Clinical and Laboratory Standards Institute; 2010. CLSI Document GP44-A4.
6. Wu AHB, ed. *Tietz Clinical Guide to Laboratory Tests.* 4th ed. St. Louis, MO: Saunders; 2006;22-25,1096.
7. Clinical and Laboratory Standards Institute. *Urinalysis and Collection, Transportation, and Preservation of Urine Specimens; Approved Guideline—Second Edition*. Wayne, PA: Clinical and Laboratory Standards Institute; 2001. CLSI Document GP16-A2.
8. Wilding P, Zilva JF, Wilde CE. Transport of specimens for clinical chemistry analysis. *Ann Clin Biochem.* 1977;14(6):301–306.
9. Tietz N. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: WB Saunders; 1995: 622–624.
10. Bakker AJ, Mücke M. Gammopathy interference in clinical chemistry assays: Mechanisms, detection and prevention. *Clin Chem Lab Med.* 2007;45(9):1240-1243.
11. Oudart JB, Ok V, Faucon C, et al. Interference of M-paraprotein in automated urea assays. *Clin Chem Lab Med.* 2013;51(7):E153-E155.

12. Clinical and Laboratory Standards Institute. *Defining, Establishing, and Verifying Reference Intervals in the Clinical Laboratory; Approved Guideline—Third Edition*. Wayne, PA: Clinical and Laboratory Standards Institute; 2010. CLSI Document EP28-A3c.
13. Thornton W, Levine R, Levine J. Boyce & Bynum Pathology Laboratories. *Evidence-based Medicine and Test Utilization*. Columbia, MO: Siemens Medical Solutions Diagnostics, 2007.
14. Clinical and Laboratory Standards Institute. *Evaluation of Detection Capability for Clinical Laboratory Measurement Procedures; Approved Guideline—Second Edition*. Wayne, PA: Clinical and Laboratory Standards Institute; 2012. CLSI Document EP17-A2.
15. Clinical and Laboratory Standards Institute. *Evaluation of Precision of Quantitative Measurement Procedures; Approved Guideline—Third Edition*. Wayne, PA: Clinical and Laboratory Standards Institute; 2014. CLSI Document EP05-A3.
16. Clinical and Laboratory Standards Institute. *Measurement Procedure Comparison and Bias Estimation Using Patient Samples; Approved Guideline—Third Edition*. Wayne, PA: Clinical and Laboratory Standards Institute; 2013. CLSI Document EP09-A3.
17. Clinical and Laboratory Standards Institute. *Interference Testing in Clinical Chemistry; Approved Guideline—Second Edition*. Wayne, PA: Clinical and Laboratory Standards Institute; 2005. CLSI Document EP07-A2.
18. Data on file at Siemens Healthcare Diagnostics.

Definition of Symbols

The following symbols may appear on the product labeling:

Symbol	Symbol Title and Description
	Consult instructions for use
	Version of instructions for use
	Internet URL address to access the electronic instructions for use
	Revision
	Caution Consult instructions for use or accompanying documents for cautionary information such as warnings and precautions that cannot, for a variety of reasons, be presented on the medical device.
	Biological risks Potential biological risks are associated with the medical device.
	Corrosive
	Dangerous to environment
	Irritant Oral, dermal, or inhalation hazard

Symbol	Symbol Title and Description
	Inhalation hazard Respiratory or internal health
	Flammable Flammable to extremely flammable
	Oxidizing
	Explosive
	Toxic
	Compressed gas
	Keep away from sunlight Prevent exposure to sunlight and heat.
	Up Store in an upright position.
	Do not freeze
	Temperature limit Upper and lower limits of temperature indicators are adjacent to the upper and lower horizontal lines.
	Handheld barcode scanner
	*In vitro* diagnostic medical device
	Contains sufficient for <n> tests Total number of IVD tests the system can perform with the IVD kit reagents appears adjacent to the symbol.
RxOnly	Prescription device (US only) Applies only to United States-registered IVD assays. CAUTION: Federal (USA) law restricts this device to sale by or on the order of a licensed healthcare professional.
	Mixing of substances Mix product before use.
	Reconstitute and mix lyophilized product before use.

Symbol	Symbol Title and Description
	Target
	Interval
	Legal Manufacturer
	Authorized Representative in the European Community
	Use-by date Use by the designated date.
	Batch code
	Catalog number
	Recycle
	Printed with soy ink
	CE Mark
	CE Mark with notified body ID number Notified body ID number can vary.
YYYY-MM-DD	Date format (year-month-day)
CHECKSUM	Variable hexadecimal number that ensures the Master Curve and Calibrator definition values entered are valid.
UNITS C	Common Units
UNITS SI	International System of Units
MATERIAL	Material
MATERIAL ID	Unique material identification number
CONTROL NAME	Name of control
CONTROL TYPE	Type of control

Legal Information

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