

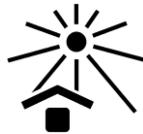
TG IgG ELISA

Instructions for Use

REF 2011FE00  12 x 8 determinations

IVD

CE



SBA
Part of **BBi** Solutions

Steffens biotechnische Analysen GmbH
Gewerbestr. 7
D - 79285 Ebringen
Tel.: +49 7664 600254
info-sba@bbisolutions.com

Contents

1. Overview.....	2
1.1 Introduction and background	2
1.2 Intended Purpose	2
2. Warnings and precautions.....	3
3. Principle of the test.....	4
4. Contents of the kit	4
5. Materials required but not supplied	5
6. Storage of the kit	6
7. Reagent and sample preparation / specimen requirements.....	6
8. Assay procedure.....	7
8.1. Manual operation.....	7
8.2. Dynex DS2 automated ELISA system	7
9. Evaluation and quality control.....	8
10. Interpretation of results / limitations of the procedure.....	9
11. Performance characteristics	10
11.1. Standardisation.....	10
11.2. Analytical specificity.....	10
11.3. Detection limit (analytical sensitivity)	10
11.4. Homogeneity of the solid phase	10
11.5. Linearity	12
11.6. Precision.....	12
11.7. Frequency distribution of TG IgG	13
11.8. Manual operation vs. Dynex DS2 automated ELISA system.....	15
12. Declaration	16
13. Symbols.....	16
14. References	18
15. Summary flow chart.....	19

The product described here complies with the requirements of the IVD Directive 98/79/EC and transitional provisions of Article 110 of 2017/746 IVD Regulation.

1. Overview

1.1 Introduction and background

Autoimmune-mediated, pathogenically related disorders of the thyroid gland are characterized by the occurrence of autoantibodies directed at thyroid antigens, such as thyroglobulin (TG), thyroid peroxidase (TPO) and TSH receptor.

TG is a 660 kDa dimeric globular glycoprotein that is involved in the synthesis and storage of thyroid hormones. It constitutes the major component of the central lumen of the thyroid gland and one of its predominant autoantigens (1).

High titers of autoantibodies to TG are frequently found in patients with goitrous thyroiditis (Hashimoto's disease) (2), atrophic thyroiditis (myxedema) and Graves' disease (immunogenic form of hyperthyroidism) (3). However, their concentration does not usually correlate with the degree of thyroid dysfunction (4). Thyroiditis is considered as mainly T-cell mediated disease with only a minor contribution of TG autoantibodies (4).

In most cases, TG antibodies are found together with TPO antibodies. TG antibodies are considered as better marker of thyroiditis induction while TPO antibodies more specifically indicate active thyroid inflammation (4). At a low percentage, TG antibodies also occur in the normal collective, their prevalence increasing with age (5). They may be predictive in asymptomatic individuals for hypothyroidism (6).

The present enzyme-linked immunosorbent assay (ELISA) is intended for the quantitative or qualitative determination of IgG antibodies in human serum or plasma (cf. section 7), directed against TG. The immobilised antigen is a highly purified preparation of human TG. The test is fast (incubation time 30 / 30 / 30 minutes) and flexible (divisible solid phase, ready-to-use reagents). Six calibrators allow quantitative measurements; a negative and a positive control check the assay performance.

1.2 Intended Purpose

TG IgG ELISA is an enzyme-linked immunosorbent assay (ELISA) intended for the quantitative or qualitative determination of IgG class antibodies directed against Thyroglobulin (TG) in human serum or plasma samples.

Its function is the aid to differential diagnosis of autoimmune diseases of the thyroid gland, like Hashimoto's thyroiditis, Graves' disease.

This product is intended for manual or automated professional in vitro diagnostic use only.

2. Warnings and precautions

The test kit is intended for in vitro diagnostic use only; not for internal or external use in humans or animals. It must be executed by trained professional staff.

The kit has been tested for transport stability and can be shipped unrefrigerated for up to 3 days. Store at 2 - 8°C on arrival. In case of doubt, contact your local distributor or the manufacturer.

Do not use reagents beyond their expiration dates. Adherence to the protocol is strongly recommended.

The sample buffer, calibrators and controls contain Na-azide as antimicrobial agent. The wash buffer contains bromonitrodioxane and the conjugate methylisothiazolone / bromonitrodioxane as preservative. The substrate contains 3, 3', 5, 5'-tetramethylbenzidine (TMB) and hydrogen peroxide (H₂O₂). The stop solution, 0,2 M sulfuric acid (H₂SO₄), is acidic and corrosive.

The above mentioned reagents may be toxic if ingested. Follow routine precautions for handling hazardous chemicals. Avoid all body contact, wear gloves and eye protection. If one of the reagents comes into contact with skin or mucous membrane, wash thoroughly with water. Never pipette by mouth. Dispose in a manner complying with local/national regulations.

Na-Azide may react with lead and copper plumbing to form explosive metal azides. On disposal, flush with a large amount of water to prevent azide build-up.

The calibrators and controls contain components of human origin. They were tested for human immunodeficiency virus (HIV)-Ag, hepatitis B surface (HBs)-Ag and antibodies against HIV 1/2 and hepatitis C virus (HCV) and showed negative results; either in an FDA-approved or a CE-compliant test, according to European Directive 98/79/EC.

However, no test can guarantee that material of human origin is not actually infectious. The preparations should therefore be treated as potentially infectious and disposed of accordingly, as should the samples (and residues thereof); according to CDC (Center of Disease Control, Atlanta, USA) or other local / national guidelines on laboratory safety and decontamination.

3. Principle of the test

The wells of the solid phase are coated with TG. On this surface, the following immunological reactions take place:

1st reaction: TG-specific antibodies present in the sample bind to the immobilised antigen, forming the antigen-antibody complex. Then, non-bound sample components are washed away from the solid phase.

2nd reaction: A second antibody, directed at human IgG antibodies and conjugated with horse-radish peroxidase (HRP), is added. This conjugate binds to the complex. Then, excess conjugate is washed away from the solid phase.

3rd reaction: The enzyme-labelled complex converts a colourless substrate into a blue product. The degree of colour development reflects the concentration of TG IgG in the sample.

4. Contents of the kit

a. TG Coated Microwell Plate

1 microwell plate, coated with TG and hermetically packed in a foil laminate pouch together with a desiccant bag. The plate consists of 12 strips, each of which can be broken into 8 individual wells.

MWP	12x8
------------	-------------

b. Sample buffer

Sample buffer, 100 mL, ready-to-use, orange coloured. Contains Tris-buffered saline (TBS), bovine serum albumin (BSA), Tween and Na-azide.

BUF	SPL
------------	------------

c. Wash buffer

Wash buffer, 100 mL, 10x-concentrate, blue coloured. Contains TBS, Tween and bromonitrodioxane.

BUF	WASH	10x
------------	-------------	------------

d. TG IgG Calibrator 1-6

6 calibrators, 2,0 mL each, 0 - 30 - 100 - 300 - 1000 and 3000 IU TG IgG / mL, ready-to-use, gradually blue coloured. Contain TBS, BSA, Tween and Na-azide.

CAL	1-6
------------	------------

e. TG IgG Negative and Positive Control

Negative and positive control, 2,0 mL each, ready-to-use, green and red coloured, respectively. Contain TBS, BSA, Tween and Na-azide.

CONTROL	-	CONTROL	+
----------------	----------	----------------	----------

f. TG IgG 14 mL Conjugate

Anti-human IgG HRP conjugate, 14 mL, ready-to-use, red coloured. Buffered solution containing stabilising protein, methylisothiazolone and bromonitrodioxane.

CONJ	IgG
-------------	------------

g. Substrate

Substrate solution, 14 mL, ready-to-use, colourless. Contains a buffered solution of TMB and H₂O₂. Contained in a vial impermeable to light.

SUBS	TMB
-------------	------------

h. Stop solution

Stop solution (0,2 M H₂SO₄), 14 mL, colourless, ready-to-use. Caution: sulfuric acid is corrosive.

SOLN	STOP
-------------	-------------

i. Instructions for Use

j. Lot-specific certificate of analysis

5. Materials required but not supplied

- a. Deionised or distilled water
- b. Graduated cylinder, 1000 mL
- c. Tubes for sample dilution (transfer tubes in the microwell plate format recommended)
- d. Pipettes for 10, 100 and 1000 µL (1- and 8-channel pipettes recommended)
- e. Microwell plate washer (optional)
- f. Microwell plate photometer fitted with a 450 nm filter
- g. ELISA evaluation program (recommended)

6. Storage of the kit

Store kit at 2 - 8°C, do not freeze. It is stable up to the expiry date stated on the label of the box. Do not use kit beyond its expiry date.

7. Reagent and sample preparation / specimen requirements

Do not exchange or pool corresponding components from different kits, due to possibly different shipping or storage conditions. If the kit is to be used for several tests, only the currently needed amount of reagents should be withdrawn. It is **crucially important** that no cross-contamination between the reagents occurs. Use only clean pipettes and do **not pour back** residues into the original flasks.

- a. The solid phase must reach room temperature before opening the pouch. Remove the supernumerary microwells from the frame and immediately put them back into the pouch, together with the desiccant bag. Reseal the pouch hermetically and keep it refrigerated for future use.
- b. Dilute the wash buffer 10x-concentrate (100 mL, blue) with 900 mL deionised water. Mix thoroughly. The diluted buffer is stable for several weeks if stored refrigerated (2 - 8°C).
- c. Preparation of the samples: handle patient specimens as potentially infectious agents. Besides serum, EDTA-, citrate- or heparin-treated plasma is suitable sample material as well.

Specimen requirements: highly lipemic, haemolysed or microbially contaminated samples may cause erroneous results and should be avoided.

Prepare samples using normal laboratory techniques. Turbid samples must first be clarified (centrifuged). The clarified or clear samples are mixed and then diluted 1/100, e.g. 10 µL serum or plasma + 990 µL sample buffer. Also mix the dilution.

For rapid dispensing during the assay procedure, preparation of the calibrators, controls and samples in microwell transfer tubes is recommended. This allows the operation of an 8-channel pipette during the assay procedure.

If samples are not assayed immediately, they should be stored at 2 - 8°C and assayed within 3 days. Repeated freezing and thawing of samples should be avoided. Thawed samples must be mixed prior to diluting.

8. Assay procedure

8.1. Manual operation

Before starting the assay, all components of the kit must have reached room temperature ($23 \pm 3^\circ\text{C}$).

To achieve best results, i.e. the maximum ratio between specific and background signal, **careful washing** is essential (steps a, c and e). It is **crucially important to remove the wash solution completely**. For that purpose, tap the plate firmly on several layers of absorbent tissue. Automated washers must be verified according to results obtained by manual washing.

- a. Immediately prior to use, wash the solid phase once: fill wells with 350 μL wash buffer each, let soak for about 10 seconds in the wells and remove.
- b. Dispense the calibrators (2,0 mL each, ready-to-use, gradually blue), controls (2,0 mL each, ready-to-use, green and red) and the diluted samples rapidly into the microwells; 100 μL per well. Duplicate measurements are recommended.

Incubate the plate for 30 minutes at room temperature ($23 \pm 3^\circ\text{C}$).

- c. Wash the wells 4 times as in step a.
- d. Rapidly (preferably using an 8-channel pipette) dispense the conjugate (14 mL, ready-to-use, red); 100 μL per well. Incubate the plate as in step b.
- e. Repeat wash step c.
- f. Rapidly (preferably using an 8-channel pipette) dispense the substrate solution (14 mL, ready-to-use, colourless, black vial); 100 μL per well. Incubate the plate as in step b. As the substrate is photosensitive, avoid intense light exposure (e.g. direct sunlight) during incubation.
- g. Rapidly (preferably using an 8-channel pipette) dispense the stop solution (14 mL, ready-to-use, colourless. Caution: corrosive!); 100 μL per well. Use the same sequence as for the substrate. The colour changes from blue to yellow. Agitate the plate, preferably on an orbital shaker, for about 10 seconds.
- h. Immediately read the absorbance in the microwell plate photometer at 450 nm.

Refrigerate the remainder of the reagents ($2 - 8^\circ\text{C}$) if they are to be used again.

8.2. Dynex DS2 automated ELISA system

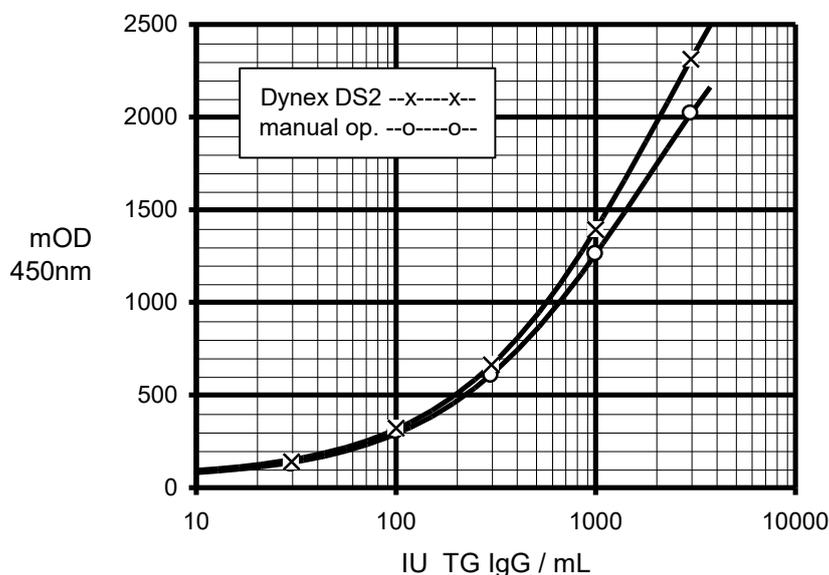
This product has been validated for use with the Dynex DS2 automated ELISA system. A description of the program flow for the assay execution and evaluation can be provided as a pdf file. The parameters of this program are merely a proposal and

may need to be adapted by the operator to the requirements of the actual assay. In general terms, we have attempted to stick as close as possible to the protocol of manual operation, as above. However, due to the necessarily elevated temperature within the DS2, the substrate incubation period had to be shortened.

Section 11.8. gives a performance comparison between manual assay operation and the DS2 ELISA system.

9. Evaluation and quality control

Quantitative evaluation: the data obtained are quantitatively evaluated with the standard curve, as shown below. However, the depicted curve can only serve as a model. It can not substitute the measurement of the calibrators, together with the controls and actual samples. The curve has been constructed with a conventional ELISA evaluation program, using a 4-parameter function. The Spline approximation is also appropriate.



2011FE00.FED/StdKurveV0111J

If no computer-supported evaluation is possible, the standard curve may be drawn by hand. It allows transformation of the absorbance value of a sample into its concentration, i.e. into IU TG IgG per mL sample.

Qualitative evaluation: the test may also be evaluated in a qualitative manner. This requires measurement of the positive control only. Nevertheless, measurement and examination of the negative control is recommended (see below: quality control).

In qualitative test evaluation, the absorbance of the samples is compared with the borderline absorbance (= cut-off). It is determined according to the following formula:

$$\text{absorbanceborderline} = \text{absorbancepositive control} \times \text{factor}$$

The factor depends on the kit lot and is quoted in the lot-specific certificate of analysis which is included with each test kit. Example:

$$\begin{aligned} \text{absorbance}_{\text{positive control}} &= 1250 \text{ mOD} \\ \text{factor} &= 0,35 \\ \text{absorbance}_{\text{borderline}} &= 1250 \text{ mOD} \times 0,35 = 438 \text{ mOD} \end{aligned}$$

In order to gain an impression of how positive a particular sample is for TG IgG, one may calculate the ratio, according to the formula:

$$\text{ratio} = \text{absorbance}_{\text{sample}} / \text{absorbance}_{\text{borderline}}$$

Example:

$$\begin{aligned} \text{absorbance}_{\text{borderline}} &= 438 \text{ mOD} \\ \text{absorbance}_{\text{sample}} &= 1480 \text{ mOD} \\ \text{ratio} &= 1480 \text{ mOD} / 438 \text{ mOD} = 3,4 \end{aligned}$$

Quality control: the positive and negative control check the assay performance. Their authorised values and acceptable ranges, respectively, are quoted in the lot-specific certificate of analysis. Values of the controls must fall within the indicated ranges; otherwise, the results of the assay are invalidated.

10. Interpretation of results / limitations of the procedure

Based on the measurement of a blood donor and a positive collective of sera (see below), we suggest for the assessment of patient sera:

	quantitative evaluation IU TG IgG / mL sample	qualitative evaluation ratio
normal (negative) range	< 87	< 0,91
cut-off	100	1,00
equivocal range	87 - 115	0,91 - 1,10
positive range	> 115	> 1,10

These specifications are given as an indication only; in order to check their accuracy, each analysis should include parallel samples of normal sera.

A negative test result indicates that the patient does not have an abnormal level of antibodies to TG. If nevertheless an autoimmune-mediated disorder of the thyroid gland is suspected, the titre of TPO autoantibodies should be determined.

A positive result should be considered as an indication for an autoimmune disease of the thyroid gland. However, sera from patients with other autoimmune disorders or from normal individuals may also contain TG autoantibodies, as outlined in the

beginning. Measurement of TPO autoantibodies could be useful to confirm the diagnosis.

Specimens exhibiting results within the borderline range quoted above should be considered as equivocal and reported as such. It is recommended that a second sample be collected two weeks later and run in parallel with the first sample to document a possible change of antibody titer.

As with any serological test, the results should be interpreted in the light of the patient's symptoms and other diagnostic criteria.

11. Performance characteristics

11.1. Standardisation

The test is standardised with a purified serum preparation containing IgG antibodies specifically directed at TG. This preparation has been calibrated against WHO standard 65/93 (1st internatl. ref. preparation). The degree of sample reactivity is measured in international units (IU/mL).

11.2. Analytical specificity

The test allows the specific determination of human IgG antibodies directed against TG.

Interference with anticoagulants (EDTA, Citrat, Heparin) in samples has been tested and no interference effects have been observed.

11.3. Detection limit (analytical sensitivity)

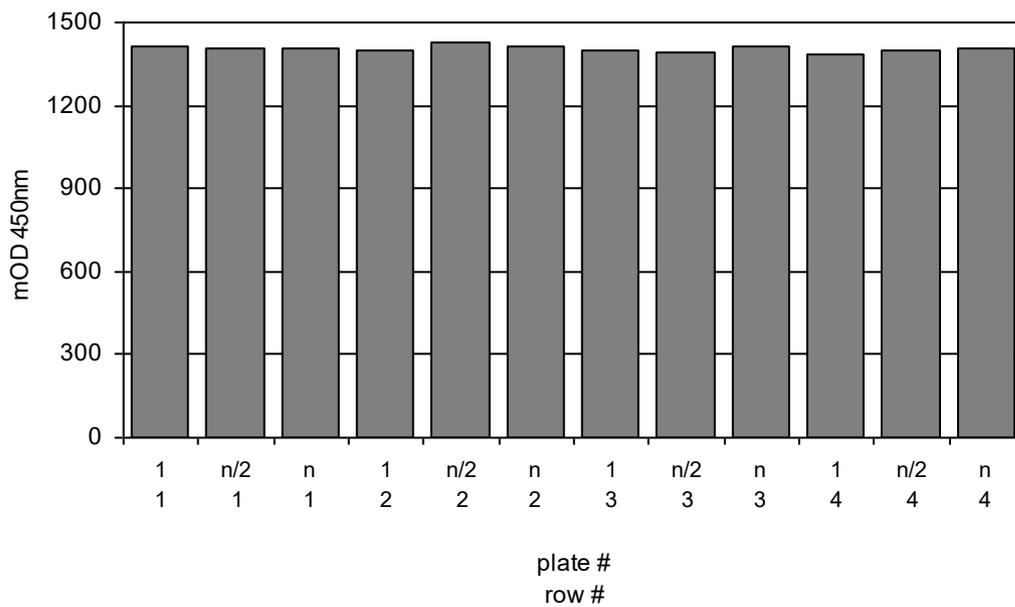
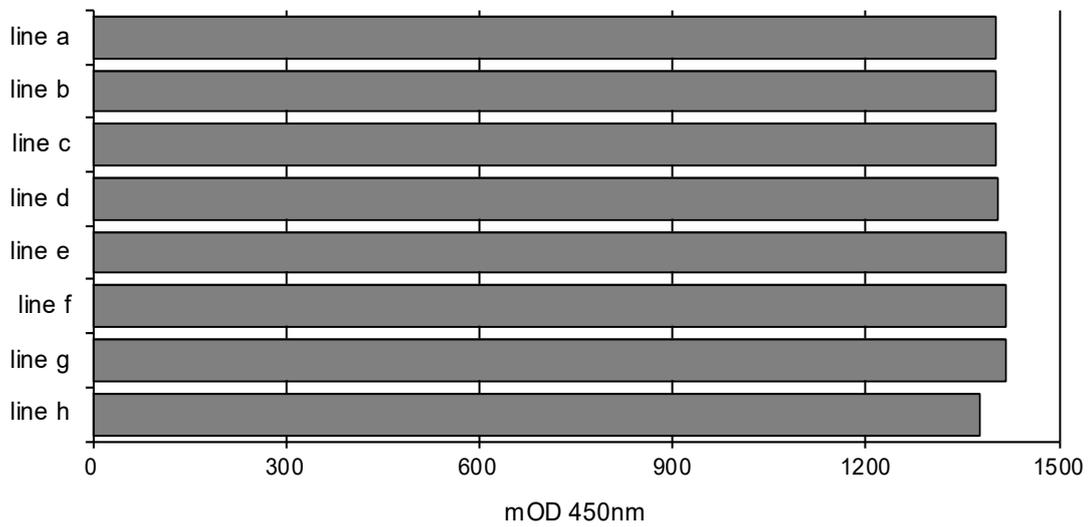
The detection limit is defined as that concentration of analyte that corresponds to the mean absorbance of sample buffer plus 3-fold standard deviation (s). It was determined as < 10 IU IgG per mL sample (n = 24).

Recommended measuring range: 10 - 1000 IU / mL

11.4. Homogeneity of the solid phase

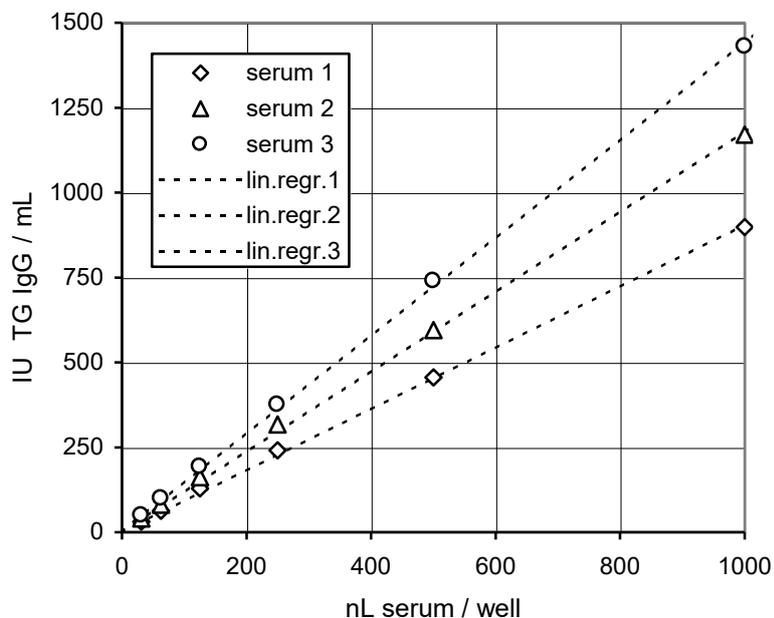
Measurement of the solid phase homogeneity is a regular QC part of each production lot. This is determined by 288-fold measurement of a positive but non-saturating sample on 3 selected plates. Acceptance criterion: mOD-coefficient of variation (cv) over the plates < 8%. The figure below shows a representative excerpt (solid phase lot no. 2505Q) of such an analysis.

plate row	1 1	n/2 1	n 1	1 2	n/2 2	n 2	1 3	n/2 3	n 3	1 4	n/2 4	n 4	mean	cv %
line a	1385	1401	1384	1414	1408	1408	1386	1381	1419	1379	1409	1429	1400	1,2
line b	1392	1407	1386	1402	1401	1418	1405	1372	1428	1422	1379	1408	1402	1,2
line c	1394	1405	1401	1389	1420	1423	1390	1386	1395	1367	1429	1416	1401	1,3
line d	1408	1399	1412	1399	1425	1389	1380	1394	1403	1389	1424	1427	1404	1,1
line e	1425	1412	1422	1417	1467	1423	1406	1398	1427	1387	1424	1402	1418	1,4
line f	1451	1404	1401	1412	1433	1422	1400	1413	1435	1397	1437	1419	1419	1,2
line g	1439	1419	1410	1407	1446	1430	1422	1407	1433	1404	1384	1397	1417	1,3
line h	1429	1390	1410	1375	1402	1388	1398	1376	1395	1310	1285	1379	1378	3,0
mean	1415	1405	1403	1402	1425	1413	1398	1391	1417	1382	1396	1410	1405	
cv %	1,7	0,6	0,9	1,0	1,6	1,1	0,9	1,1	1,2	2,4	3,6	1,2		1,7



11.5. Linearity

In order to assess the dose-response relationship of the test, positive sera were measured in serial 2-fold dilution. Acceptance criterion: linear regression of 4 successive dilutions must yield a correlation factor > 0,98. A typical result is depicted below.



11.6. Precision

For the assessment of the test precision, the variability of results under the following conditions was determined: a. within 1 assay and between 3 assays, b. between 3 operators and c. between 2 kit lots.

a. Intra- and inter-assay variability (n = 24 and 72, respectively)

sample	mean IU/mL	variability (cv, %)	
		intra-assay	inter-assay
1	102,6	3,8	4,7
2	351,9	2,6	2,6
3	612,2	6,6	7,0

b. Operator to operator variability (n = 12)

sample	mean IU/mL	variability (cv, %)
1	119,8	8,1
2	331,9	4,0
3	520,7	3,5

c. Variability between 2 kit lots (n = 6)

sample	mean IU/mL	variability (cv, %)
1	110,4	8,0
2	359,0	3,0
3	662,3	3,1

11.7. Frequency distribution of TG IgG

This was analysed in a sera collective of blood donors, equally distributed by sex and age, and a collective of sera found positive for TPO IgG autoantibodies according to a CE-compliant reference ELISA. The following distribution of the analyte was observed:

blood donor sera

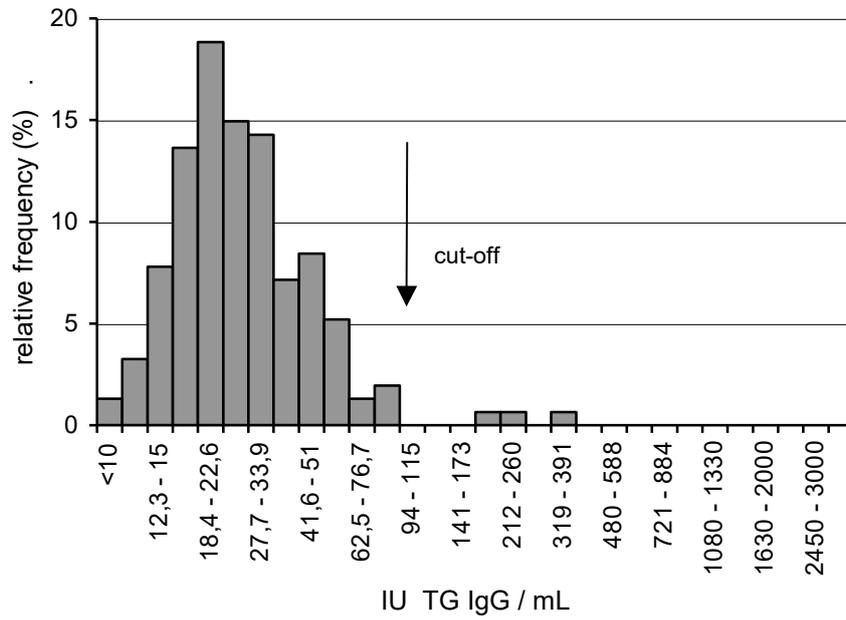
n: 154
 mean: 33,2 IU/mL
 mean + s: 70,2 IU/mL
 mean + 2s: 107,3 IU/mL
 median: 24,2 IU/mL
 95th percentile: 62,7 IU/mL

TPO IgG positive sera

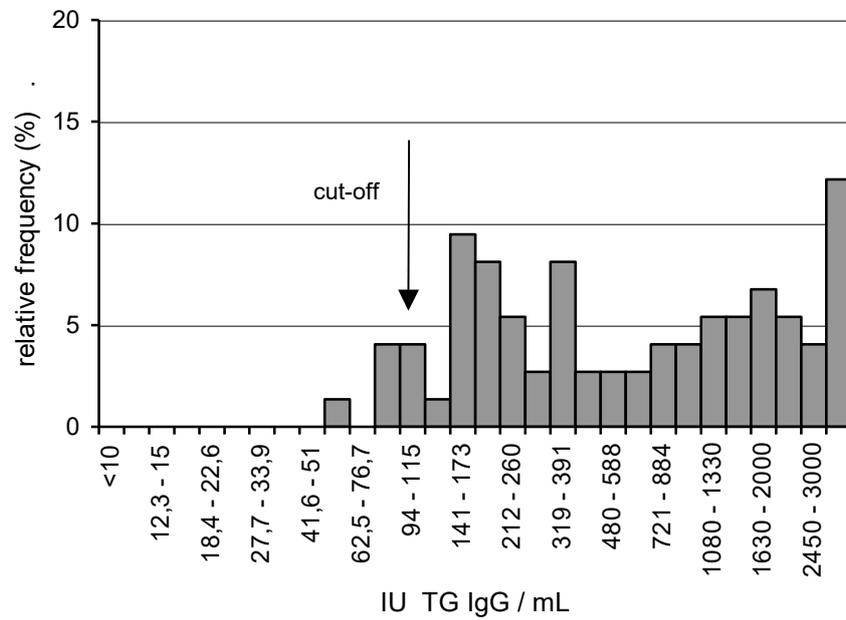
n: 74
 mean: 1303,9 IU/mL
 mean - s: <0 IU/mL
 mean - 2s: <0 IU/mL
 median: 593,3 IU/mL
 5th percentile: 100,7 IU/mL

ROC-analysis of these data was used to determine the cut-off as 100 IU/mL (7). The data presented here suggest a diagnostic specificity and sensitivity of the ELISA of about 98 % and 100 %, respectively. These values apply for the measured sera only; other collectives may yield different results.

blood donor sera



TPO IgG positive sera



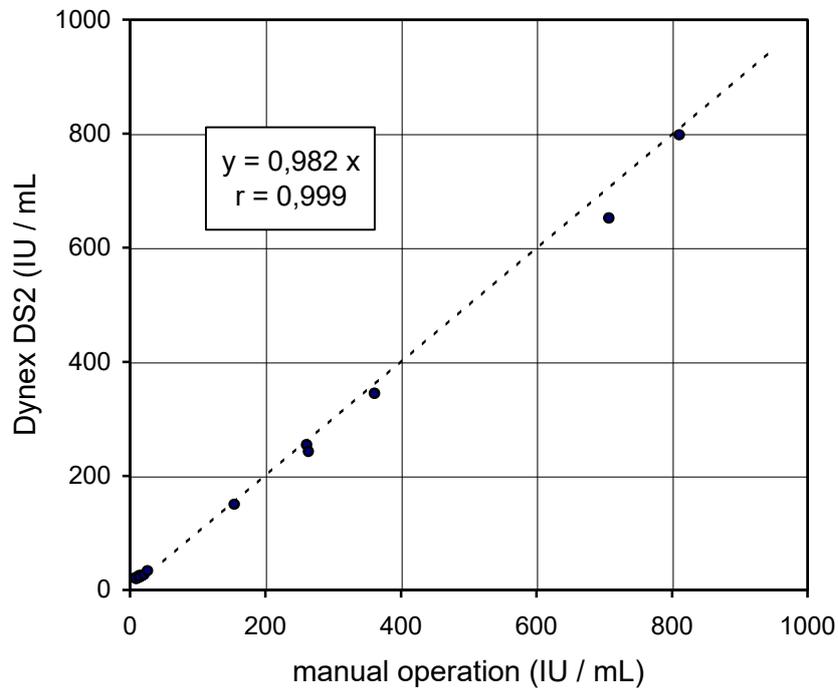
11.8. Manual operation vs. Dynex DS2 automated ELISA system

Variability: Using specimen of one and the same kit lot, the variability of assay results were compared between manual operation and the Dynex DS2 automated ELISA system:

	manual operation	Dynex DS2
intra-assay variability (n = 16)	mean cv = 3,2 %	mean cv = 4,4 %
inter-assay variability (n = 48)	mean cv = 4,3 %	mean cv = 4,5 %

Standard curve: depicted in section 9

Correlation:



2011FE00.FED/KorrDynexDS2-V0111J

12. Declaration

Steffens biotechnische Analysen GmbH (SBA) guarantees that the product delivered has been thoroughly tested to ensure that its properties specified herein are fulfilled. No further warranties are given.

The performance data presented here were obtained using the procedure indicated. Any modification in the procedure may affect the results in which case SBA disclaims all warranties whether expressed, implied or statutory. Moreover, SBA accepts no liability for any damage, whether direct, indirect or consequential, which results from inappropriate use or storage of the product.

13. Symbols



Catalogue number



Batch code



Unique Device Identification



Contains sufficient for <n> tests



In Vitro diagnostic medical device.



Conformité Européenne



Keep away from sunlight



Store at 2 - 8°C



Use-by Date



Consult "Instructions for Use"



Caution



Biological risk



Manufacturer



Distributor

14. References

1. Gentile, F., et al.: Thyroglobulin as an autoantigen: what can we learn about immunopathogenicity from the correlation of antigenic properties with protein structure? *Immunology* 112-1 (2004), 13 - 25
2. Roitt, I. M., et al.: Auto-antibodies in Hashimoto's disease (lymphadenoid goitre). *Lancet* 271-6947 (1956), 820 - 821
3. Kasagi, K., et al.: Clinical significance of measurements of antithyroid antibodies in the diagnosis of Hashimoto's thyroiditis: comparison with histological findings. *Thyroid* 6 (1996), 445 - 450
4. Burek, C. L., et al.: Thyroglobulin, thyroperoxidase, and thyrotropin-receptor autoantibodies. In: Shoenfeld, Y., et al. (eds.): *Autoantibodies* (2007), 403 - 414, Elsevier, Amsterdam
5. Barbesino, G., et al.: Anti-thyroid autoantibodies and aging: influence of overall health status. *Frontiers Endocrinol* 9 (1994), 89 - 92
6. Weetman, A. P.: Autoimmune thyroid disease. *Autoimmunity* 37-4 (2004), 337 - 340
7. Sommer, R., and Eitelberger, F.: Wertigkeit der Gliadin-Antikörper im Serum zur Diagnose der Zöliakie. *Wien Klin Wochenschr* 104/4 (1992), 86 - 92

15. Summary flow chart

- a. Dilute the samples 1/100 in sample buffer (100 mL, ready-to-use, orange) and mix.
- b. Dilute the wash buffer 10x-concentrate (100 mL, blue) with water and mix.
- c. Wash the wells once with 350 μ L wash buffer each. Dispense 100 μ L of the calibrators (2,0 mL each, ready-to-use, gradually blue) and controls (2,0 mL each, ready-to-use, green and red) and of the diluted samples into the wells of the solid phase. Duplicate measurements are recommended. Incubate for 30 minutes at room temperature ($23 \pm 3^{\circ}\text{C}$).
- d. Wash the wells 4 times with 350 μ L wash buffer each.
- e. Dispense 100 μ L of the conjugate (14 mL, ready-to-use, red) into the wells. Incubate as in step c.
- f. Repeat washing step d.
- g. Dispense 100 μ L of the substrate solution (14 mL, ready-to-use, black vial) per well. Incubate as in step c. Then, add 100 μ L stop solution (14 mL, ready-to-use, colourless) per well and agitate the plate briefly.
- h. Immediately measure the absorbance at 450 nm.
- i. Quantitative evaluation: determine the standard curve and, using this curve, transform the absorbance of the samples into their respective antibody concentration (IU/mL).
- j. Qualitative evaluation: determine the borderline absorbance by multiplying the absorbance of the positive control with the factor shown in the certificate of analysis. Then, calculate the ratio of the samples by dividing their absorbance by the borderline absorbance.