Truenat®

HBV

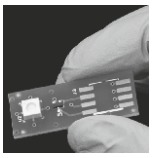
Chip-based Real Time PCR Test for Hepatitis B Virus

1. INTENDED USE

Truenat® HBV (REF601090005 / 601090020 / 601090025 / 601090050 / 601090100 / 601090200) is a chip-based Real Time Polymerase Chain Reaction (PCR) test for the quantitative estimation of the Hepatitis B Virus (HBV) in human blood /serum/ plasma specimen and aids in the diagnosis of infection with Hepatitis B Virus and in the estimation of viral load. **Truenat® HBV** runs on the **Truelab®** Real Time micro PCR Analyzers.

2. INTRODUCTION

Hepatitis B infection is caused by the Hepatitis B Virus (HBV) that affects around two billion people globally and causes around 6,00,000 deaths each year. The infection, which can be acute or chronic, occurs in the liver. Acute infections are mostly asymptomatic but sometimes may cause symptoms such as jaundice, extreme fatigue, vomiting and abdominal pain. A chronic infection can develop into cirrhosis of the liver and liver cancer. Transmission occurs from contact with infected blood or other body fluids through perinatal, transfusion, injection and sexual routes and through close contact with infected family members, especially in early childhood. Despite the availability of effective vaccination and antiviral drugs, Hepatitis B remains a major global health problem. The most common methods of diagnosing Hepatitis B are serology based assays and molecular tests. The HBV DNA is detectable about three weeks before the appearance of serological markers. HBV viral load quantitation by PCR is very useful for treatment initiation decisions and treatment monitoring. However PCR or Real Time PCR tests have so far been restricted to centralized reference laboratories as they require skilled manpower and elaborate infrastructure. Also the turnaround time for results could take a few days.



The **Truelab®** Real Time micro PCR System enables decentralization and near patient diagnosis and treatment monitoring of Hepatitis B infection by making real time PCR technology rapid, simple, robust and user friendly and offering "sample to result" capability even at resource limited settings. This is achieved through a combination of lightweight, portable, mains / battery operated **Truelab®** Real Time micro PCR Analyzer and **Trueprep® AUTO/AUTO v2** Sample Prep Device and room temperature stable **Truenat®** micro PCR chips and **Trueprep® AUTO/AUTO v2** Sample Prep kits so that even the peripheral laboratories with minimal infrastructure and minimally trained technician can easily perform these tests routinely in their facilities and report PCR results in less than an hour. Moreover, with these devices PCR testing can also be initiated in the field level, on site.

Truenat® HBV is a disposable, room temperature stable, chip-based Real Time PCR test with dried $MgCl_2$ in reaction well and freeze dried PCR reagents in microtube for performing Real Time PCR test for quantitative estimation of the Hepatitis B Virus and runs on the **Truelab®** Real Time micro PCR Analyzer. It requires only six (6) µL of purified DNA to be added to the reaction well for the analysis. The intelligent chip also carries test and batch related information including standard values for quantitation. The **Truenat® HBV** chip also stores information of used test to prevent any accidental re-use of the test.

NOTE: Truelab® / Truenat® / Trueprep® / Truepet® are all trademarks of Molbio Diagnostics Private Limited.

The Truelab® Real Time micro PCR Analyzer is protected by the following patents and patents granted: IN 2313/CHE/2007 (Patent No. 281573), WO2009/047804 and corresponding claims of any foreign counterpart(s) thereof.

The Truenat® micro PCR chip is protected by the following patents and patents pending: IN 2312/CHE/2007, WO 2009/047805 and corresponding claims of any foreign counterpart(s) thereof.

3. PRINCIPLE OF THE TEST

Truenat® HBV works on the principle of quantitative Real Time Polymerase Chain Reaction based on Taqman chemistry. The DNA from the patient sample is first extracted using **Trueprep® AUTO/AUTO v2** Universal Cartridge based Sample Prep Device and **Trueprep® AUTO/AUTO v2** Universal Cartridge based Sample Prep Kit. The **Truenat® HBV** chip is placed on the chip tray of the **Truelab®** Real Time micro PCR Analyzer. Six (6) µL of the purified DNA is then dispensed using the provided micropipette and tip into the microtube containing freeze dried PCR reagents and allowed to stand for 30-60 seconds to get a clear solution. ⚠ No mixing by tapping, shaking or by reverse pipetting should be done. Six (6) µL of this clear solution is then pipetted out using the same pipette and tip and dispensed into the reaction well of the **Truenat® HBV** chip and the test is started. A positive amplification causes the dual labeled fluorescent probe in the **Truenat® HBV** chip to release the fluorophores in an exponential manner and the emitted light is then captured by the built-in opto-electronic sensor and displayed as amplification curve on the analyzer screen, on a real time basis during the test run. The Cycle threshold (Ct) is defined as the number of amplification cycles required for the fluorescent signal to cross the threshold (i.e. exceed the background signal). Ct levels are inversely proportional to the amount of target nucleic acid in the sample. (i.e. the lower the Ct level the greater is the amount of target nucleic acid in the sample). In the case of negative samples, amplification does not occur and a horizontal amplification curve is displayed on the screen during the test run. At the end of the test run, a HBV "DETECTED" or "NOT DETECTED" result is displayed and in positive cases, Ct values and International Units (IU) per milliliter (IU/ml) is also displayed on the screen. Based on the Ct of the internal positive control (IPC), the validity of the test run is also displayed. The IPC is a full process control that undergoes all the processes the specimen undergoes - from extraction to amplification thereby validating the test run from sample to result. Absence of or shift of IPC Ct beyond a pre-set range in case of negative samples invalidates the test run. While IPC will co-amplify in most positive cases also, in some specimen having a high target load, the IPC may not amplify, however the test run is still considered valid. The results can be printed via Bluetooth using the **Truelab®** micro PCR printer or transferred to the lab computer/or any remote computer via Wifi network or 3G/GPRS network. Upto 20000 results in **Truelab® Uno Dx/Duo/Quattro** can be stored on the analyzer for future recall and reference.

4. TARGET SELECTION

The target sequence for this kit is part of the core/pre-core region of HBV genome. The region selected is specific to HBV and conserved across the HBV Genotypes.

5. CONTENTS OF THE Truenat® HBV KIT

A. Individually sealed pouches, each containing

1. **Truenat® HBV** micro PCR chip.
2. Microtube with freeze dried PCR reagents.
3. DNase & RNase free pipette tip.
4. Desiccant pouch.

B. Package Insert.

REF	601090005	601090020	601090025	601090050	601090100	601090200
Σ	5T	20T	25T	50T	100T	200T

6. CONTENTS OF THE Trueprep® AUTO Universal Sample Pre-treatment Pack

A. Lysis buffer.

B. Disposable transfer pipette (graduated).

C. Package Insert.

REF	60205AB05	60205AB20	60205AB25	60205AB50	60205AB100	60205AB200
Σ	5T	20T	25T	50T	100T	200T

7. STORAGE AND STABILITY

Truenat® HBV chip is stable for two (2) years from the date of manufacture if stored between 2-30°C. It is also stable for one (1) month at temperatures up to 45°C. Avoid exposure to light or elevated temperatures (above recommended levels). Do not freeze.

Trueprep® AUTO Universal Sample Pre-treatment Pack is stable for two (2) years from the date of manufacture if stored between 2-40°C. It is also stable for one (1) month at temperatures upto 45°C. Do not freeze.

8. MATERIALS REQUIRED BUT NOT PROVIDED WITH THE KIT

Truelab® Real Time micro PCR Workstation (REF623010001/633010001/643010001/653010001) consisting of,

1. **Trueprep® AUTO/AUTO v2** Sample Prep Device (REF603041001/603042001)
2. **Truelab® Uno Dx / Truelab® Duo / Truelab® Quattro** Real Time micro PCR Analyzer (603021001/603022001/603023001).
3. **Truelab®** micro PCR Printer (REF 603050001).
4. **Truepet®** SPA fixed volume precision micropipette - 6 µl (REF 604070006).
5. **Truelab®** Microtube Stand (REF 603070001).

Also required additionally are: **Trueprep® AUTO** Universal Sample Pre-treatment Pack (REF60205AB05 / REF60205AB20 / REF60205AB25 / REF60205AB50 / REF60205AB100 / REF60205AB200), **Trueprep® AUTO** Universal Cartridge Based Sample Prep Kit (REF60203AR05 / REF60203AR25 / REF60203AR50 / REF60203AR100) or **Trueprep® AUTO v2** Universal Cartridge Based Sample Prep Kit (REF60207AR05 / REF60207AR25 / REF60207AR50 / REF60207AR100), **Truenat®** Positive Control Kit - Panel II (REF 801020008), Powder free disposable gloves, waste disposal container with lid.

9. SPECIMEN PREPARATION FOR EXTRACTION WITH Trueprep® AUTO/AUTO v2

Truenat® HBV requires purified nucleic acids from whole blood/plasma collected in EDTA anticoagulant or serum specimen that are extracted using the **Trueprep® AUTO/AUTO v2** Universal Cartridge based Sample Prep Device and **Trueprep® AUTO/AUTO v2** Universal Cartridge based Sample Prep kit. Sample must be pre-treated using **Trueprep® AUTO** Universal Sample Pre-treatment pack. Transfer 250µl of whole blood or 500µl of plasma/serum specimen using the transfer pipette provided into the Lysis buffer tube provided and mix well. (Refer to the package insert of **Trueprep® AUTO** Universal Sample Pre-treatment pack for further details).

Sample Storage and Transportation:

Sample Pre-treatment decontaminates the specimen and makes it ready for storage/ transportation/ extraction. The specimen in this form is stable for up to 3 days at 40ºC and 1 week at 30ºC.

Nucleic acid extraction: Use entire content from the Lysis Buffer tube containing specimen for further procedure with the **Trueprep® AUTO/AUTO v2** Universal Cartridge Based Sample Prep Device and **Trueprep® AUTO/AUTO v2** Universal Cartridge Based Sample Prep Kit. (Refer to the User Manual of **Trueprep® AUTO/AUTO v2** Universal Cartridge Based Sample Prep device and the package insert of **Trueprep® AUTO/AUTO v2** Universal Cartridge Based Sample Prep kit for details). ⚠ Dispose off lysis buffer tube and transfer pipette after use, as per the section on "Disposal and Destruction" (Section 17).

10. SAFETY PRECAUTIONS

1. For *in vitro* diagnostic use only.
2. Bring all reagents and specimen to room temperature (20 - 30°C) before use.
3. Do not use kit beyond expiry date.
4. Carefully read the User Manuals, package inserts and Material Safety Data Sheets (MSDS) of all the components of the **Truelab® Real Time micro PCR System** before use.
5. All materials of human origin should be handled as though potentially infectious.
6. Do not pipette any material by mouth.
7. Do not eat, drink, smoke, apply cosmetics or handle contact lenses in the area where testing is done.
8. Use protective clothing and wear disposable gloves when handling samples and while performing sample extraction.

11. PROCEDURAL PRECAUTIONS

1. Check all packages before using the kit. Damage to the packaging does not prevent the contents of the kit from being used. However, if the outer packaging is damaged the user must confirm that individual components of the kit are intact before using them.
2. Do not perform the test in the presence of reactive vapours (e.g., from sodium hypochlorite, acids, alkalis or aldehydes) or dust.
3. While retrieving the **Truenat® HBV** micro PCR chip, microtube and the DNase & RNase free pipette tip from the pouch, ensure that neither bare hands nor gloves that have been used for previous tests run are used.

12. PROCEDURAL LIMITATIONS

1. Optimal performance of this test requires appropriate specimen collection, handling, storage and transport to the test site.
2. Though very rare, mutations within the highly conserved regions of the target genome where the **Truenat®** assay primers and/or probe bind may result in the under-quantitation of or a failure to detect the presence of the concerned pathogen.
3. The instruments and assay procedures are designed to minimize the risk of contamination by PCR amplification products. However, it is essential to follow good laboratory practices and ensure careful adherence the procedures specified in this package insert for avoiding nucleic acid contamination from previous amplifications, positive controls, or specimens.
4. A specimen for which the **Truenat®** assay reports "Not Detected" cannot be concluded to be negative for the concerned pathogen. As with any diagnostic test, results from the **Truenat®** assay should be interpreted in the context of other clinical and laboratory findings.

13. CLEANING AND DECONTAMINATION

1. Spills of potentially infectious material should be cleaned up immediately with absorbent paper tissue and the contaminated area should be decontaminated with disinfectants such as 0.5% freshly prepared sodium hypochlorite [10 times dilution of 5% sodium hypochlorite (household bleach) before continuing work].
2. Sodium hypochlorite should not be used on an acid-containing spill unless the spill-area is wiped dry first. Materials used to clean spills, including gloves, should be disposed off as potentially bio- hazardous waste e.g. in a biohazard waste container.

14. TEST PROCEDURE

(Please also refer the **Truelab®** Real Time micro PCR Analyzer user manual)

1. Switch on the **Truelab®** Analyzer.
2. Select User and enter password.
3. For **Truelab® Uno Dx**, select the test profile for "HBV" to be run from the Profiles Screen on the Analyzer screen. For **Truelab® Duo/Quattro**, select the Bay (Idle1/2) for **Duo** and (Idle1/2/3/4) for **Quattro** from the Status Screen to view the Profiles Screen. Select the test profile for "HBV" to be run from the Profiles Screen on the Analyzer screen.
4. Enter the patient details as prompted in the **Truelab®** Analyzer screen.
5. Press Start Reaction.
6. For **Truelab® Uno Dx,** Press the eject button to open the chip tray. For **Truelab® Duo/Quattro**, the chip tray opens automatically on tapping the "Start Reaction" button.
7. Open a pouch of **Truenat® HBV** and retrieve the micro PCR chip, microtube and DNase & RNase free pipette tip.
8. Place the **Truenat® HBV** chip on the chip tray without touching the white reaction well. The reaction well should be facing up and away from the Analyzer. Gently press the chip to ensure that it has seated in the chip tray properly.
9. Place the microtube containing freeze dried PCR reagents in the microtube stand provided along with the **Truelab®** Real Time micro PCR workstation **after ensuring that white pellet of dried PCR reagents remains at the bottom of the microtube.** Remove the microtube cap and dispose it off as per the section on "Disposal and Destruction" (Section 17). Using the filter barrier tip provided in the pouch, pipette out six (6) µL of the purified DNA from the Elute Collected Tube into the microtube. Allow it to stand for 30-60 seconds to get a clear solution. ⚠ Do not mix it by tapping, shaking or by reverse pipetting. Using the same filter barrier tip, pipette out six (6) µL of this clear solution and dispense into the centre of the white reaction well of the **Truenat® HBV** chip. Take care not to scratch the internal well surface and not to spill elute on the outside of the well. Dispose off the microtip as per the section on "Disposal and Destruction" (Section 17).
10. For **Truelab® Uno Dx,** slide the chip tray containing the **Truenat® HBV** chip-based Real Time PCR test loaded with the sample into the **Truelab®** Analyzer. Press Done on the "Please Load Sample" Alert message. For **Truelab® Duo/Quattro**, select "YES" at the Please load Sample prompt. Chip tray will close automatically and the reaction will start.
11. Read the result from the screen.
12. After the reaction is completed, for **Truelab® Uno Dx,** push the Eject button to eject the chip tray. For **Truelab® Duo/Quattro**, tap the "Open/Close Tray" button to eject the chip tray.
13. Take out the **Truenat® HBV** micro PCR chip at end of the test and dispose it off as per the section on "Disposal and Destruction" (Section 17).
14. Turn on **Truelab®** micro PCR printer and select print on the screen for printing out hard copy of the results. Test results are automatically stored and can be retrieved any time later. (Refer to **Truelab®** Analyzer manual).
15. Switch off the **Truelab®** Analyzer.

15. RESULTS & INTERPRETATIONS

Two amplification curves are displayed on the **Truelab®** Real Time micro PCR Analyzer screen when optical plot is selected to indicate the progress of the test. Both the target and the internal positive control (IPC) curves will take a steep, exponential path when the fluorescence crosses the threshold value in case of positive samples. The Ct will depend on the number of viral genomes in the sample. The target curve will remain horizontal throughout the test duration and the IPC curve will take an exponential path in case of negative samples. In case the IPC curve remains horizontal in a negative sample, the test is considered as Invalid. At the end of the test run, the results screen will display "DETECTED" for Positive result or "NOT DETECTED" for Negative result. The result screen would also display the Ct value and the IU/ml for positive specimen. The result screen also displays the validity of the test run as "VALID" or "INVALID". Invalid samples have to be repeated with fresh specimen from the sample preparation stage. While IPC will co-amplify in most positive cases also, in some specimen having a high target load, the IPC may not amplify, however the test run is still considered valid.

16. QUALITY CONTROL PROCEDURES

To ensure that the **Truelab®** Real Time micro PCR Analyzer is working accurately, run positive and negative controls from time to time. **Truenat®** Positive Control Kit - Panel II (REF 801020008) containing Positive Control and Negative Control must be ordered separately. It is advisable to run controls under the following circumstances: ● Whenever a new shipment of test kits is received. ● When opening a new test kit lot. ● If the temperature of the storage area falls outside of 2-30° C. ● By each new user prior to performing testing on clinical specimen.

17. DISPOSAL AND DESTRUCTION

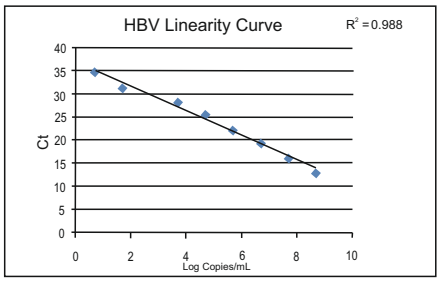
1. Submerge the used **Truenat® HBV** chip, microtube, microtube cap, transfer pipette, pipette tips, lysis buffer tube etc. in freshly prepared 0.5% sodium hypochlorite solution for 30 minutes before disposal as per the standard medical waste disposal guidelines.
2. Disinfect the solutions and/or solid waste containing biological samples before discarding them according to local regulations.
3. Samples and reagents of human and animal origin, as well as contaminated materials, disposables, neutralized acids and other waste materials must be discarded according to local regulations after decontamination by immersion in a freshly prepared 0.5% of sodium hypochlorite for 30 minutes (1 volume of 5% Sodium hypochlorite for 10 volumes of water).
4. Do not autoclave materials or solutions containing Sodium hypochlorite.
5. Chemicals should be handled in accordance with Good Laboratory Practice and disposed off according to the local regulations.

19. SPECIFIC PERFORMANCE CHARACTERISTICS

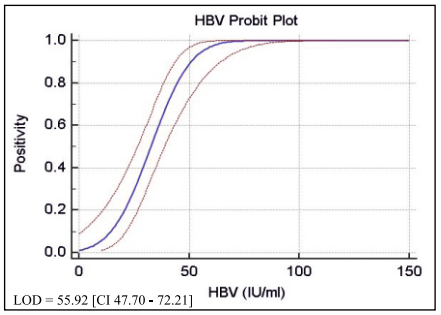
Analytical Exclusitivity (Primer specificity): The following microorganisms were evaluated *in silico* from the NCBI database using the NCBI nucleotide blast and primer blast tools to determine potential cross-reactivity in the **Truenat® HBV** assay. No interference in the performance of the **Truenat® HBV** assay was observed with the listed group of organisms.

Bacteria	*Trichomonas vaginalis*	Simian virus
Acinetobacter anitratus	*Enterococcus faecalis*	Human Immunodeficiency virus
Candida albicans	*Escherichia coli*	Cytomegalovirus
Chlamydia trachomatis	*Streptococcus mutans*	Herpes Simplex virus
Enterobacter cloacae	*Gardnerella vaginalis*	Hepatitis C virus
Salmonella enterica	**Virus**	
Staphylococcus aureus	Adenovirus	
Neisseria gonorrheae	Epstein-Barr virus	

Linearity & Assay range:
The linearity assay was performed according to CLSI Guidelines. Serial dilutions of the HBV DNA cloned in a plasmid was made from 5.09E+09 Copies/ml to 5.09E+02 Copies/ml were made and nucleic acids were extracted on **Trueprep® AUTO** Sample Prep Device in triplicates for each dilution followed by PCR on **Truelab® Uno Dx/Duo** Real Time micro PCR Analyzer. The assay is found to be linear over 8 orders of magnitude (from 5.09E+09 Copies/ml to 5.09E+02 Copies/ml) for HBV DNA.



Limit of detection (Analytical Sensitivity):
The LoD was determined by testing dilutions of HBV 4th International Standard from NIBSC in plasma. Probit analysis of the data was used to determine the concentration of the respective DNA with 95% probability of detection. LoD was determined to be 55.92 IU/ml for HBV in plasma.



Robustness:
To determine whether the **Truenat® HBV** chip-based Real Time PCR test showed any signs of carryover of PCR products between runs, alternating runs of positive samples and negatives samples were performed. 10 positive samples and 10 negative samples were used for the study. The **Truenat® HBV** test did not exhibit detectable carryover between positive and negative sample runs.

Reproducbility:
The purpose of this study is to compare the functional performance of the **Truenat® HBV** assay using three different titres of samples on **Truelab® Uno Dx** Real Time micro PCR Analyzer. High, Medium and low titre samples were extracted on **Trueprep® AUTO** Universal Cartridge Based Sample Prep Device and tested among three different users (Inter user), on three different devices (Inter device) and on 5 consecutive days (Inter day) to check the variability. Mean %CV values for all titres has been calculated as Inter User (1.79), Inter day (1.50) and Inter Device (1.32) which were in the accepted range of ≤15% CV for **Truenat® HBV** assay.

Interference:
The purpose of this study is to determine the effect of potentially interfering substances on the performance of **Truenat® HBV** assay. The experiments were performed with HBV positive samples spiked in negative human plasma. Interfering substances used in this study are: Albumin- 9 g/dL, Triglycerides-3.0 mg/dL, Human DNA-0.4 mg/dL and Hemoglobin- 500 mg/dL. The presence of these substances did not interfere with the performance of **Truenat® HBV** assay.

Precision of Truenat® HBV assay:
Precision was tested by performing **Truenat® HBV** assay of High, Medium and Low titre HBV DNA for five consecutive days. Every day PCR for each titre DNA was run in duplicates. The %CV values obtained for High titre (2.39), Medium titre (2.28) and low titre (1.49) were within the accepted range of ≤15% CV for **Truenat® HBV** assay.

Analytical reactivity or Inclusivity:
Analytical reactivity or Inclusivity of **Truenat® HBV** assay was performed on a clinical genotype panel consisting of 6 HBV Genotypes. The genotype panel was procured from Discovery life Sciences (DLS). The respective genotype DNA was extracted on **Trueprep® AUTO** Sample Prep Device in duplicates followed by PCR on **Truelab® Uno Dx** Real Time micro PCR Analyzer. **Truenat® HBV** assay effectively detected all the 6 HBV genotypes.

Validation of specimen types:
The validity of specimen types was demonstrated for the blood, plasma and serum. The panel comprised of 25 positive and 25 negative specimens for each claimed specimen type. Positive specimens were spiked with 3X LLOQ of NIBSC (code:10/266) 4th WHO International Standard for Hepatitis B virus DNA. Each sample was subjected for nucleic acid extraction on **Trueprep® AUTO** Sample Prep Device followed by PCR on **Truelab®** Real Time micro PCR Analyzer by using **Truenat® HBV** test of one lot of reagents. The %CV values obtained for blood (5.10), plasma (6.46) and serum (3.76) were within the accepted range of ≤15% CV.

Whole system failure:
Whole system failure rate was performed utilizing blood sample spiked at 3X LLOQ of NIBSC (code:10/266) 4th WHO International Standard for Hepatitis B virus DNA. The study was performed on a sample panel of 100 numbers spread over 5 consecutive days. Every day 20 samples were utilized for nucleic acid extraction on **Trueprep® AUTO** Sample Prep Device followed by PCR on **Truelab®** Real Time micro PCR Analyzer by using **Truenat® HBV** test of one lot of reagents and by single user. Since the study had to be performed on high viscosity sample, blood was chosen as the sample matrix. The runs were not showed false results with 2.54 IU/ml Average log. The observed standard deviation across the 100 runs was 0.314 and a %CV of 12.38.

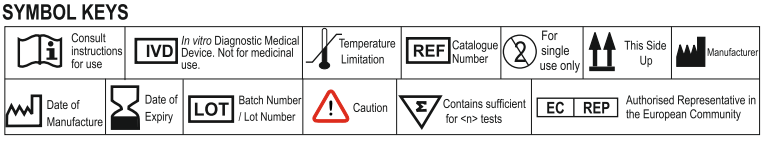
Trueness of measurement:
The Trueness of **Truenat® HBV** was demonstrated by comparison of the performance of the **Truenat® HBV** test with artus® HBV RG PCR comparator. The sample panel comprised of 100 positive specimens of plasma. The viral loads covered the entire linear range of the IVD covering all the HBV genotypes. Two lots of reagents were utilized for the study. All the 100 samples positive by comparator artus® HBV RG PCR were found to be positive by **Truenat® HBV** test also.

Clinical validations:
Totally 107 plasma samples comprising of 76 negative and 31 positive specimens were tested on three different manufacturing lots of **Truenat® HBV** assay at AIIMS (All India Institute of Medical Sciences, New Delhi) against the AIIMS in-house HBV PCR assay.
Specificity: 76 negative runs correlated between the methods, depicting **100%** specificity for the **Truenat® HBV** assay.
Sensitivity: Positive samples containing viral loads ranging from ~ 140 IU/ml to 8,50,00,000 IU/ml were tested. All 31 positive runs correlated between the methods giving a sensitivity of **100%** for the **Truenat® HBV** assay.
Concordance of viral loads:
Satisfactory concordance [over 95% within log variation] was seen between the viral load obtained using **Truenat® HBV** assay and AIIMS in-house HBV PCR assay.

20.REFERENCES

1 http://www.who.int/mediacentre/factsheets/fs204/en/.
2 http://www.cdc.gov/hepatitis/hbv/pdfs/hepbgeneralfactsheet.pdf.
3 Fryer JF, Heath AB, Wilkinson DE, Minor PD and the collaborative study group. Collaborative study to evaluate the proposed 3rd WHO International Standard for hepatitis B virus (HBV) for nucleic acid amplification technology (NAT)-based assays. WHO ECBS Report 2011;.2170 .
4 Abe, Aki, et al. Quantitation of hepatitis B virus genomic DNA by real-time detection PCR. Journal of Clinical Microbiology 37.9 (1999): 2899-2903.
5 Chen, Ren Wei, et al. Realtime PCR for detection and quantitation of hepatitis B virus DNA. Journal of medical virology 65.2 (2001): 250-256.
6 Brechtbuehl, K., et al. A rapid real-time quantitative polymerase chain reaction for Hepatitis B virus. Journal of virological methods 93.1 (2001): 105-113.

SYMBOL KEYS



molbio®

Molbio Diagnostics Private Limited

Registered Office & Manufacturing Unit - I:

Plot No. L-46, Phase II D, Verna Industrial Estate, Verna, Goa - 403 722, INDIA

Manufacturing Unit - II:

Plot No. L-42, Phase II B, Verna Industrial Estate, Verna, Goa - 403 722, INDIA

www.molbiodiagnostics.com Email: sales@molbiodiagnostics.com

TNHBV/1021/V-02