

## Instruction Manual

### KEY TO SYMBOLS USED

	Catalogue number		Contains sufficient for <n> tests
	Batch code		Use-by Date
	Research Use Only		Consult instructions for use
	Version		Keep away from sunlight
	Temperature limit		Negative control of amplification
	Manufacturer		Negative control of extraction
	Date of manufacture		Positive control of amplification
	Caution		Internal control
			Positive control of extraction

### 1. INTENDED USE

AmpliSens® *EBOV* Zaire-FRT PCR kit is an *in vitro* nucleic acid amplification test for qualitative detection of the Zaire Ebola virus (*EBOV* Zaire) RNA in the biological material (whole blood, saliva, urine, viscera biopsy material), taken from the persons suspected of Ebola fever without distinction of form and presence of manifestation, using real-time hybridization-fluorescence detection of amplified products.

**NOTE:** For research use only. Not for diagnostic procedures

### 2. PRINCIPLE OF PCR DETECTION

The method is based on the RNA extraction from the test material with the Internal Control (Internal Control STI-87-rec (IC)) and simultaneous RNA reverse transcription reaction and amplification of the cDNA fragments of the detected virus and Internal Control STI-87-rec cDNA with hybridization-fluorescence detection. The Internal Control must be used in the extraction procedure in order to control the extraction process of each individual sample and to identify possible reaction inhibition.

*EBOV* Zaire detection by the polymerase chain reaction (PCR) is based on the RNA reverse transcription using TM-Revertase enzyme and amplification of the pathogen genome specific region using specific *EBOV* Zaire primers. In the real-time PCR, the amplified product is detected with the use of fluorescent dyes. These dyes are linked to oligonucleotide probes, which bind specifically to the amplified product during thermocycling. The real-time monitoring of fluorescence intensities during the real-time PCR allows the detection of accumulating product without re-opening the reaction tubes after the PCR run.

AmpliSens® *EBOV* Zaire-FRT PCR kit uses "hot-start", which greatly reduces the frequency of nonspecifically primed reactions. "Hot-start" is guaranteed by the separation of nucleotides and Taq-polymerase by using chemically modified polymerase (TaqF). The chemically modified polymerase (TaqF) is activated by heating at 95 °C for 15 min. 2 reactions are carried out in one tube at the RT-PCR stage – amplification of *EBOV* Zaire cDNA and Internal Control STI-87-rec cDNA sequence. The results of *EBOV* Zaire cDNA and Internal Control STI-87-rec cDNA amplification are registered in two different channels of fluorescence detection:

Table 1

Channel for fluorophore	FAM	JOE
cDNA-target	Internal Control STI-87-rec cDNA	<i>EBOV</i> Zaire cDNA
Target gene	Artificially synthesized sequence	L-gene

### 3. CONTENT

AmpliSens® *EBOV* Zaire-FRT PCR kit is produced in 2 forms:

variant FRT-50 F, R-V69-50-F-CE;

variant FRT-50 F in bulk<sup>1</sup>, R-V69-50-F-CE-B.

Variant FRT-50 F includes:

Reagent	Description	Volume, ml	Quantity
PCR-mix-FL <i>EBOV</i> Zaire	clear liquid from colorless to light lilac colour	0.6	1 tube
PCR-buffer-C	colorless clear liquid	0.3	1 tube
Polymerase (TaqF)	colorless clear liquid	0.03	1 tube
TM-Revertase (MMLv)	colorless clear liquid	0.015	1 tube
RT-G-mix-2	colorless clear liquid	0.015	1 tube
Positive Control <i>EBOV</i> Zaire / STI (C+ <i>EBOV</i> Zaire / STI)	colorless clear liquid	0.2	1 tube
TE-buffer	colorless clear liquid	0.2	1 tube
Negative Control (C-)*	colorless clear liquid	1.2	1 tube
Internal Control STI-87-rec (IC)**	colorless clear liquid	0.5	1 tube
Positive Control <i>EBOV</i> Zaire	colorless clear liquid	0.1	1 tube

\* must be used in the extraction procedure as Negative Control of Extraction.

\*\* add 10 µl of Internal Control STI-87-rec (IC) during the RNA extraction procedure directly to the sample/lysis mixture (see RIBO-prep, MAGNO-sorb or QIAGEN QIAamp MinElute Virus protocols).

Variant FRT-50 F is intended for 55 reactions (including controls).

### 4. ADDITIONAL REQUIREMENTS

- Plastic container (50-60 ml) for storage and transportation of biological samples.
- Disposable polypropylene tightly closed tubes of 1.5 ml, 2.0 ml.
- Screw caps for the tubes.
- Vacuette® blood collection system.
- Transport medium for urine samples pretreatment.
- 0.9 % sodium chloride solution (sterile physiological solution) or phosphate buffer solution (137 mM sodium chloride, 2.7 mM potassium chloride, 10 mM sodium monophosphate, 2 mM potassium diphosphate; pH=7.5±0.2).
- Sterile tools (individual for each sample) for homogenization (porcelain mortar and mallet) or homogenizer for pretreatment of viscera material.
- Vacuum aspirator with flask for removing supernatant.
- RNA extraction kit.
- Disposable powder-free gloves and a laboratory coat.
- Pipettes (adjustable).
- Sterile RNase-free pipette tips with aerosol filters (up to 200 µl).
- Tube racks.
- Vortex mixer.
- Desktop centrifuge with a rotor for 2-ml reaction tubes.
- PCR box.
- Real-time instruments (for example, Rotor-Gene Q (QIAGEN, Germany)).
- Disposable polypropylene PCR tubes:
  - a) 1.5-ml screwed or tightly closed tubes for reaction mixture preparation;
  - b) 0.2-ml PCR tubes with flat caps or strips of four 0.1-ml Rotor-Gene PCR tubes if a rotor-type instrument is used.
- Refrigerator for 2–8 °C.
- Deep-freezer at the temperature from minus 24 to minus 16 °C.
- Reservoir for used tips.

<sup>1</sup> In bulk form contains unlabeled tubes. Tubes with identical reagent are packed in one bag with label.

## 5. GENERAL PRECAUTIONS

The user should always pay attention to the following:

- Use sterile pipette tips with aerosol filters and use a new tip for every procedure.
- Store all extracted positive material (specimens, controls and amplicons) away from all other reagents and add it to the reaction mix in a distantly separated facility.
- Thaw all components thoroughly at room temperature before starting an assay.
- When thawed, mix the components and centrifuge briefly.
- Use disposable protective gloves and laboratory cloths, and protect eyes while samples and reagents handling. Thoroughly wash hands afterwards.
- Do not eat, drink, smoke, apply cosmetics, or handle contact lenses in laboratory work areas.
- Do not use a kit after its expiration date.
- Dispose of all specimens and unused reagents in accordance with local regulations.
- Samples should be considered potentially infectious and handled in biological cabinet in compliance with appropriate biosafety practices.
- Clean and disinfect all samples or reagents spills using a disinfectant, such as 0.5 % sodium hypochlorite or another suitable disinfectant.
- Avoid inhalation of vapors, samples and reagents contact with the skin, eyes, and mucous membranes. Harmful if swallowed. If these solutions come into contact, rinse the injured area immediately with water and seek medical advice if necessary.
- Safety Data Sheets (SDS) are available on request.
- Use of this product should be limited to personnel trained in DNA amplification techniques.
- Workflow in the laboratory must be one-directional, beginning in the Extraction Area and moving to the Amplification and Detection Area. Do not return samples, equipment and reagents in the area where the previous step was performed.



Some components of this kit contain sodium azide as a preservative. Do not use metal tubing for reagent transfer.

## 6. SAMPLING AND HANDLING

**NOTE:** Obtaining samples of biological materials for PCR-analysis, transportation, and storage are described in the manufacturer's handbook [1]. It is recommended that this handbook is read before starting work.

**AmpliSens® EBOV Zaire-FRT PCR kit** is intended for analysis of the RNA extracted with RNA extraction kits from the biological material (whole blood, saliva, urine, viscera biopsy material).

### Sampling

6.1. **Whole blood.** Blood samples are taken after overnight fasting or 3 hour fasting from median cubital vein by disposable needle (0.8-1.1 mm diameter) in a special Vacuette® vacuum system (lilac caps with 6% EDTA). After sampling a tube with blood is to be rotated gently several times for mixing with the anticoagulant (otherwise blood will coagulate and the RNA extraction will be impossible). Place the tube in a rack after mixing. The whole blood samples can be stored at room temperature for 2 hours, at 2- 8 °C for 12 hours.

6.2. **Saliva.** Saliva samples are taken (after 3 mouthwashes with physiological solution) in the sterile dry tubes (2 ml) in an amount of at least 1 ml. Tightly cap the tube avoiding airspace and deformation of cap internal part. Mark the tube.

The saliva samples can be stored at room temperature for 6 hours, at 2-8 °C for 1 day or at the temperature from minus 24 to minus 16 °C for 1 week or at not more than minus 70 °C for a long time.

6.3. **Urine.** The urine samples are taken in an amount of 15-25 ml into the dry sterile container (50-60 ml) or dry clean vessel.

The urine samples before pretreatment can be stored at 2-8 °C for 1 day or at the temperature from minus 24 to minus 16 °C for 1 week or at not more than minus 70 °C for a long time. Only one freeze-thaw cycle is allowed.

6.4. **Viscera biopsy material.** Biopsy material is taken by a sterile tools in a sterile plastic containers with tightly closed caps or 2 ml tubes. The tube is to be closed tightly.

The biopsy material samples can be stored at room temperature for 6 hours, at 2-8 °C for 3 day or at the temperature from minus 24 to minus 16 °C for 1 week or at not more than minus 70 °C for a long time.

### Pretreatment

6.5. **Whole blood and saliva samples.** The pretreatment is not required.

6.6. **Urine samples** are to be pretreated. Shake a vessel with urine. Transfer 1 ml of urine using a tip with filter in a 1.5 ml sterile disposable tube. Centrifuge at 10,000 g (for example, 12,000 rpm for microcentrifuge MiniSpin, Eppendorf Manufacturing Corporation) for 5 min. In the case of a large quantity of salts resuspend only the upper layer of salts sediment in a 1 ml volume and then concentrate again. Discard the supernatant completely using vacuum aspirator with flask and a new tip without filter for each sample and avoiding transferring the sediment. Add to the sediment the **Transport Medium with Mucolytic Agent** or **Transport Medium for Swabs** to the 0.2 ml final volume. Mix thoroughly by vortexing.

The pretreated urine sample can be stored at 2-8 °C for 1 day or at the temperature from minus 24 to minus 16 °C for 1 week or at not more than minus 70 °C for a long time.

6.7. **Viscera biopsy material** is to be pretreated. For RNA extraction take 30-50 µl of the material and homogenize it by trituration using precooled sterile porcelain mortar and mallet or homogenizer. Prepare suspension using grinded tissue and precooled sterile physiological solution or phosphate buffer. For this, add 5 volumes of physiological solution to 1 volume of grinded tissue. Use 100 µl of suspension for RNA extraction.

The pretreated viscera biopsy material sample can be stored at the temperature from minus 24 to minus 16 °C for 1 week or at not more than minus 70 °C for a long time.

### Interfering substances and limitations of using test material samples

The excessive amount of impurities in biological material such as mucus, blood, pus, and others can lead to the amplification reaction inhibition. In order to control the RNA extraction efficiency and possible reaction inhibition the Internal Control (Internal Control STI-87-rec (IC)) is used in the PCR kit. The Internal Control is added in each biological sample at the extraction stage. The presence of internal control signal after the amplification testifies the effectiveness of nucleic acid extraction and the absence of PCR inhibitors.

The next samples are inapplicable for analysis:

- the urine samples collected more than 24 hours before the delivery to the laboratory,
- the whole blood samples, collected in the tubes with heparin as anticoagulant,
- the whole blood samples, containing blood clot or which has been exposed to freezing.

## 7. WORKING CONDITIONS

**AmpliSens® EBOV Zaire-FRT PCR kit** should be used at 18–25 °C.

## 8. PROTOCOL

### 8.1. RNA extraction

It is recommended to use the following nucleic acid extraction kits:

- **RIBO-prep;**
- **MAGNO-sorb;**
- **QIAGEN QIAamp MinElute Virus.**

**NOTE:** Extract the RNA according to the manufacturer's protocol.

The volumes of reagents and samples when the RNA is extracted by the RIBO-prep, RIBO-zol-A, MAGNO-sorb reagent kits:

The RNA extraction for each sample is carried out in the presence of **Internal Control STI-87-rec (IC)**.

Add **10 µl of Internal Control STI-87-rec (IC)** to each tube with samples.

The volume of the test sample is **100 µl**.

Add **100 µl of Negative Control (C-)** to the tube labeled C- (Negative Control of Extraction).

Add **90 µl of Negative Control (C-)** and **10 µl of Positive Control EBOV Zaire** to the tube labeled PCE (Positive Control of Extraction).

The volume of elution is **50 µl**.

**NOTE:**

The volumes of reagents and samples when the RNA is extracted by QIAGEN QIAamp MinElute Virus reagent kit:

The RNA extraction for each sample is carried out in the presence of **Internal Control STI-87-rec (IC)**.

Add **10 µl of Internal Control STI-87-rec (IC)** to each tube with samples.

The volume of the test sample is **200 µl**.

Add **190 µl of Negative Control (C-)** to the tube labeled C- (Negative Control of Extraction).

Add **190 µl of Negative Control (C-)** and **10 µl of Positive Control EBOV Zaire** to the tube labeled PCE (Positive Control of Extraction).

The volume of elution is **50 µl**.

### 8.2. Preparing reverse transcription and PCR

#### 8.2.1 Preparing tubes for RT-PCR

The total reaction volume is **25 µl**, the volume of RNA sample is **10 µl**.

1. Calculate the required quantity of each reagent for one reaction:

- 10 µl of PCR-mix-FL EBOV Zaire,**
- 5 µl of PCR-buffer-C,**
- 0.5 µl of Polymerase (TaqF),**
- 0.25 µl of TM-Revertase (MMIv),**
- 0.25 µl of RT-G-mix-2.**

Prepare the reaction mixture for required number of reactions (including test and control samples and one extra reaction).

**NOTE:** Prepare the reaction mixture just before use.

2. Thaw the tube with **PCR-mix-FL EBOV Zaire**. Thoroughly vortex all the reagents of the PCR kit and sediment the drops by vortex.

3. In a new tube prepare the reaction mixture. Mix the required quantities of **PCR-mix-FL EBOV Zaire, PCR-buffer-C, Polymerase (TaqF), TM-Revertase (MMIv) and RT-G-mix-2** in accordance to the table 2. Sediment the drops by vortex.

Table 2

Scheme of reaction mixture preparation

Reagent volume per one reaction, µl		Reagent volume for specified number of reactions				
		10,00	5,00	0,25	0,50	0,25
Number of test samples	Number of reactions <sup>2</sup>	PCR-mix-FL EBOV Zaire	PCR-buffer-C	RT-G-mix-2	Polymerase (TaqF)	TM-Revertase (MMIv)
1	6	60	30	1.5	3.0	1.5
3	8	80	40	2.0	4.0	2.0
5	10	100	50	2.5	5.0	2.5
7	12	120	60	3.0	6.0	3.0
9	14	140	70	3.5	7.0	3.5
11	16	160	80	4.0	8.0	4.0
13	18	180	90	4.5	9.0	4.5
15	20	200	100	5.0	10.0	5.0
17	22	220	110	5.5	11.0	5.5
19	24	240	120	6.0	12.0	6.0
21	26	260	130	6.5	13.0	6.5
23	28	280	140	7.0	14.0	7.0
25	30	300	150	7.5	15.0	7.5
27	32	320	160	8.0	16.0	8.0

4. Take the required number of the tubes or strips taking into account the number of test samples and control samples.

5. Transfer **15 µl** of the prepared reaction mixture to each tube. Discard the unused reaction mixture.

6. Add **10 µl of RNA samples** extracted from test or control samples of RNA extraction stage using tips with filter.

**NOTE:** Avoid transferring of sorbent together with the RNA samples extracted by reagent kit with magnetic separation method.

**NOTE:** Mix the tubes thoroughly by pipetting avoiding foaming.

7. Carry out the control reactions:

**NCA** - Add **10 µl of TE-buffer** to the tube labeled NCA (Negative Control of Amplification).

**C+EBOV Zaire / STI** - Add **10 µl of Positive Control EBOV Zaire / STI (C+EBOV Zaire / STI)** to the tube labeled **C+EBOV Zaire / STI** (Positive Control of Amplification).

**C-** - Add **10 µl of the sample extracted from the Negative Control (C-) reagent** to the tube labeled C- (Negative Control of Extraction).

**PCE** - Add **10 µl of the sample extracted from the Positive Control EBOV Zaire reagent** to the tube labeled PCE (Positive control of Extraction).

**NOTE:** Mix the tubes thoroughly by pipetting avoiding foaming.

**NOTE:** Carry out the RT-PCR just after the mix of reaction mixture and RNA-samples and controls. Time of the addition of samples to the reaction mixture and the reaction run on the instrument cannot be more than 10-15 min.

<sup>2</sup> Number of reactions = number of test samples + the controls of extraction stage and RT-PCR (C-, PCE, C+, NCA) + one extra reaction. (N+4+1, N - number of test samples).

## 8.2.2. Reverse transcription and amplification

1. Create a temperature profile on your instrument as follows:

Table 3

Step	Temperature, °C	Time	Fluorescent signal detection	Cycles
1	50	30 min	–	1
2	95	15 min	–	1
3	95	10 s	–	5
	55	20 s	–	
	72	15 s	–	
4	95	10 s	–	40
	55	20 s	FAM, JOE	
	72	15 s	–	

Fluorescent signal is detected in the channels for the FAM and JOE fluorophores

2. Adjust the fluorescence channel sensitivity according to *Important Product Information Bulletin* [1].

3. Insert tubes into the reaction module of the device.

4. Run the amplification program with fluorescence detection.

5. Analyze results after the amplification program is completed.

## 9. DATA ANALYSIS

Analysis of results is performed by software of the used real-time PCR instrument by measuring fluorescence signal accumulation in two channels.

Table 4

Channel for the fluorophore	FAM	JOE
Signal registration, indicating the amplification product accumulation	Internal Control STI-87-rec cDNA	<i>EBOV</i> Zaire cDNA

Results are interpreted by the crossing (or not-crossing) the fluorescence curve with the threshold line set at a specific level that corresponds to the presence (or absence) of a Ct value of a cDNA sample in the corresponding column of the result grid.

The results are interpreted in accordance with the Table 5.

Table 5

Ct value in the channel for the fluorophore		Result
FAM	JOE	
< boundary value	absent	<i>EBOV</i> Zaire RNA is not detected
determined or absent	< boundary value	<i>EBOV</i> Zaire RNA is detected
absent or > boundary value	absent or > boundary value	Invalid result Repeat the extraction and amplification

**NOTE:** Boundary Ct values are specified in the *Important Product Information Bulletin* [1] enclosed in the PCR kit.

The result of the analysis is considered reliable only if the results obtained for Positive and Negative Controls of amplification as well as for the Positive and Negative Control of extraction are correct (see Table 6).

Table 6

Control	Stage for control	Ct value in the channel for fluorophore	
		FAM	JOE
PCE	RNA extraction	< boundary value	< boundary value
C–	RNA extraction	< boundary value	Absent
C+	RT-PCR	< boundary value	< boundary value
NCA	RT-PCR	Absent	Absent

## 10. TROUBLESHOOTING

Results of analysis are not taken into account in the following cases:

- If the Ct value determined for the Positive Control of Amplification (C+) in the channel for the JOE fluorophore is greater than the boundary Ct value or absent, the amplification and detection should be repeated for all samples in which the *EBOV* Zaire RNA was not detected.
- If the Ct value determined for the Positive Control of Extraction (PCE) in the channel for the JOE fluorophore is greater than the boundary Ct value or absent, the PCR analysis (beginning with the RNA extraction stage) should be repeated for all samples.
- If the Ct value is determined for the Negative Control of Extraction (C–) in the channel for the JOE fluorophore, the contamination of laboratory with amplification fragments or contamination of reagents, test samples is probable at any stage of PCR analysis. Measures for detecting and elimination of contamination source must be taken. The PCR analysis (beginning with the RNA extraction stage) should be repeated for all samples in which *EBOV* Zaire RNA was detected.
- If the Ct value is determined for the Negative Control of Amplification (NCA) in the channels for the FAM and/or JOE fluorophores, the contamination of laboratory with amplification fragments or contamination of reagents, test samples is probable at any stage of PCR analysis. Measures for detecting and elimination of contamination source must be taken. The amplification and detection should be repeated for all samples in which *EBOV* Zaire RNA was detected.
- If the Ct value is determined for the test sample, whereas the area of typical exponential growth of fluorescence is absent (the graphic looks like approximate straight line). It is necessary to check that threshold line or parameters of threshold line measurement are correct. If the result has been obtained with the correct threshold line level, the amplification and detection should be repeated for this sample.

## 11. TRANSPORTATION

**AmpliSens® EBOV Zaire-FRT** PCR kit should be transported at 2–8 °C for no longer than 5 days.

## 12. STABILITY AND STORAGE

All components of the **AmpliSens® EBOV Zaire-FRT** PCR kit are to be stored at 2–8 °C when not in use (except for PCR-mix-FL *EBOV* Zaire, PCR-buffer-C, RT-G-mix-2, polymerase (TaqF), TM-Revertase (MMIV)). All components of the **AmpliSens® EBOV Zaire-FRT** PCR kit are stable until the expiry date stated on the label. The shelf life of reagents before and after the first use is the same, unless otherwise stated.

**NOTE:** PCR-mix-FL *EBOV* Zaire, PCR-buffer-C, RT-G-mix-2, polymerase (TaqF) and TM-Revertase (MMIV) are to be stored at the temperature from minus 24 to minus 16 °C

**NOTE:** PCR-mix-FL *EBOV* Zaire is to be kept away from light

## 13. SPECIFICATIONS

### 13.1. Analytical sensitivity

Biological material	Nucleic acid extraction kit	PCR kit	Sensitivity, GE/m <sup>3</sup>
Whole blood, saliva, urine, viscera biopsy material	RIBO-prep	variant FRT-50 F	2x10 <sup>3</sup>
	MAGNO-sorb	variant FRT-50 F	2x10 <sup>3</sup>
	QIAGEN QIAamp MinElute Virus	variant FRT-50 F	2x10 <sup>3</sup>

**NOTE:** The claimed sensitivity is achieved only when biomaterial pretreatment is carried out in accordance with chapter *Sampling and Handling*.

### 13.2. Analytical specificity

The analytical specificity of **AmpliSens® EBOV Zaire-FRT** PCR kit is ensured by selection of specific primers and probes as well as stringent reaction conditions. The primers and probes were checked for possible homologies to all sequences published in gene banks by sequence comparison analysis.

The specificity was proved on the follows viruses and strains of microorganisms: *Tahyna virus*, *Batai virus*, *Inkoo virus*, *CCHFV*, *Dhori virus*, *Yellow fever virus*, *WNV*, *Sindbis virus*, *Chikungunya virus*, *Rubella virus*, *Kemerovo virus*, *Rotavirus*, *Enteric Cytopathic Human Orphan virus*, *HIV*, *Rabies virus*, *CMV*, *Human parvovirus B19*, *Francisella tularensis*, *Yersinia enterocolitica*, *Yersinia pestis*, and human DNA.

Nonspecific responses were absent in tests of DNA samples of this organisms and human DNA samples.

### 13.3. Reproducibility and repeatability

The biological material with the addition of Ebola fever virus standard (manufactured by Robert-Koch-Institut, Berlin, Germany) with concentration 10<sup>5</sup> GE/ml was used as positive samples.

Biological material	Number of repeats	Coefficient of variation CV, %
Dispersion of values in a single test		
Whole blood	6	1.68
Saliva	6	0.64
Urine	6	1.11
Viscera biopsy material	6	0.74
Dispersion of values between tests, carried out in different days		
Whole blood	12	3.57
Saliva	12	1.13
Urine	12	1.09
Viscera biopsy material	12	0.89

## 14. REFERENCES

- Rapid detection and quantification of Ebola Zaire virus by one-step real-time quantitative reverse transcription-polymerase chain reaction. Young-Tae Ro, Anysha Ticer, Ricardo Carrion Jr, Jean L. Patterson *Microbiol Immunol*. 2017 Apr; 61(3-4):130-137.

## 15. QUALITY CONTROL

In compliance with Federal Budget Institute of Science "Central Research Institute for Epidemiology" ISO 13485-Certified Quality Management System, each lot of the **AmpliSens® EBOV Zaire-FRT** PCR kit has been tested against predetermined specifications to ensure consistent product quality.



<sup>3</sup>Genome equivalents (GE) of the pathogen agent per 1 ml of a sample.