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Intended for research use only

eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME

PCR Detection Kit

USER MANUAL



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1. INTENDED USE

The **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** is intended for research applications. The **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** is an *in vitro* Nucleic Acid Test (NAT) – pathogen-detection-based product. The **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** is designed to detect Coronavirus SARS -CoV-2, Influenza A virus and Influenza B virus in human biological samples with an aid of Polymerase Chain Reaction (PCR) method. Samples are human biological materials: nasopharyngeal swabs, oropharyngeal swabs, bronchoalveolar lavage, endotracheal aspirate, nasopharyngeal aspirate, sputum.

Indications for the use: Research Use Only. NOT to be used for the diagnosis of a disease.

The application of the kit does not depend on population and demographic aspects. There are no contradictions for use the **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit**.

The **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** can be used in research practice.

Potential users: personnel qualified in molecular testing methods and working with biological material.

It is necessary to apply the kit only as directed in this user manual.

2. METHOD

The implemented method of reverse transcription followed by polymerase chain reaction is based on RNA reverse transcription process and subsequent amplification of cDNA.

The RNA reverse transcription stage and PCR amplification of cDNA stage are performed in one test tube, that increases the sensitivity of the method, reduces the likelihood of contamination and reduces the time of the study.

To increase the sensitivity and specificity of the amplification reaction, the use of a hot-start is provided. Hot-start is provided by reaction mixture preparation consisting of two layers separated by a layer of paraffin. The polymerase chain reaction starts only when paraffin is melted. It excludes non-specific annealing of primers to targets DNA in the initial heating of the tube.

The **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** is based on fluorescent modification of the PCR method. The PCR-mix contains four target-specific probes bearing reporter fluorescent dyes (Fam, Hex, Rox and Cy5) and quencher molecules. Once hybridized to a target sequence, the probes become activated. As a result of activation fluorescence increases proportionally to target sequence amplification. The intensity of fluorescence is measured at every cycle of reaction with a Real-time PCR thermal cycler data collection unit and analyzed with the software provided.

The **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** includes the Internal control RNA-IC "A", which is intended to assess the quality of the RNA extraction and polymerase chain reaction. DNA probe used for the detection of the Influenza A virus product amplification includes fluorescent dye Fam. DNA probe used for the detection of the SARS-CoV-2 (E, N - genes) product amplification includes fluorescent dye Rox. DNA probe used for the detection of the Influenza B virus product amplification includes fluorescent dye Cy5. DNA probe used for the detection of the internal control amplification product includes the fluorescent dye Hex. The application of four fluorescent dyes makes it possible to register the results of different amplification reactions taking place simultaneously in one tube. Table 1 shows the detection channels of amplification products.

Table 1. Detection channels of amplification products

Fam/Green	Hex/Yellow	Rox/Orange	Cy5/Red	Cy5.5/Crimson
Influenza A virus	RNA-IC	SARS-CoV-2 coronavirus, E, N - genes	Influenza B virus	-

The **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** is also approved for use with Rotor-Gene Q (Qiagen) real-time thermal cycler.

3. CONTENT

The **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** contains PCR-mix, RT-PCR-buffer, Enzyme Taq/RT, internal control RNA-IC "A" and positive control sample. The detailed description of content is represented in Table 2.

Table 2. The **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** content for ES3311A

Reagent	Description	Total volume	Amount
Paraffin sealed PCR-mix	Colorless transparent liquid under waxy white fraction	1440 µL (15 µL per tube)	96 tubes or 12 8-tube strips
RT-PCR-buffer	Colorless transparent liquid	1620 µL (810 µL per tube)	2 tubes
Enzyme Taq/RT	Colorless transparent viscous liquid	55 µL	1 tube
Internal control RNA-IC "A"	Colorless transparent liquid	1.0 mL	1 tube
Positive control	Colorless transparent liquid	130 µL	1 tube
Strip's caps ¹	12 8-caps strips		

All components are ready to use and do not require additional preparation for operation.

The kit is intended for single use and designed for 96 tests (94 defined samples, one positive control and one negative control) for **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit**. It is recommended to perform no more than 12 performances.

¹ - for detection kit packaged in strips **REF** ES3311A

4. REAGENTS AND EQUIPMENT REQUIRED BUT NOT PROVIDED

4.1. Specimen collection

- Specimen collection swabs: use only dacron, rayon, or calcium alginate tipped collection swabs with plastic or non-aluminum wire shafts;
- Place swabs into sterile tubes containing transport media;
- For bronchoalveolar lavage, endotracheal aspirate, nasopharyngeal aspirate, sputum: sterile containers with a volume of up to 60 mL.

4.2. RNA extraction and PCR

Preamplification-specimen and control preparation area

- Biological safety cabinet class II-III;
- Vortex mixer;
- Refrigerator;
- Nucleic acid extraction kit - follow the manual for the respective extraction kit. Any commercial RNA isolation kit can be used as long as it is validated for the sample types listed. Ecoli Dx, s.r.o. recommends the use of the ePure Viral NA Extraction kit (400ul), (48) E2003
- High speed centrifuge (RCF 12000 - 16000 x g) for 1.5 mL tubes;
- solid-state thermostat with timer or similar and RNase and DNase free tubes with snap caps, for example Eppendorf Safe-Lock Tubes, or solid-state thermostat maintained a temperature of 65 °C and RNase and DNase free 1.5 mL microcentrifuge tubes with caps;
- Tube rack for 1.5 mL tubes;
- Physiological saline solution 0.9% NaCl (Sterile) for the preparation of negative control sample (if needed)
- Container for used pipette tips;
- Electric laboratory aspirator with trap flask for the removal of supernatant;
- Single channel pipettes (dispensers covering 0.2-1000 µL volume range);
- RNase and DNase free filtered pipette tips (volume 20 µL, 200 µL, 1000 µL);
- RNase and DNase free pipette tips for aspirator with trap flask;
- Powder-free surgical gloves;
- Disinfectant solution.

Preamplification-reagent preparation area

- UV PCR cabinet;
- Vortex mixer;
- Refrigerator;
- Tube rack for 1.5 mL tubes;
- 1.5 mL microcentrifuge tubes with caps;
- PCR tube rack for 0.2 mL tubes;
- PCR tube rack for strips of eight 0.2 mL tubes;
- Vortex rotor for strips;

- Single channel pipettes (dispensers covering 2.0-1000 µL volume range);
- RNase and DNase free filtered pipette tips (volume 20 µL, 200 µL, 1000 µL);
- DTstream M1 dosage instrument (only for automated dosing);
- Powder-free surgical gloves;
- Disinfectant solution;
- Container for used pipette tips.

Post-Amplification – Amplification detection area

- Real-time PCR thermal cycler

5. TRANSPORT AND STORAGE CONDITIONS

Expiry date – 12 months from the date of production.

All components of **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit**, except the Enzyme Taq/RT, must be stored at temperatures from 2 °C to 8 °C during the storage period. The PCR-mix for amplification must be stored out of light at temperatures from 2 °C to 8 °C during the storage period. The excessive temperature and light can be detrimental to product performance. The Enzyme Taq/RT must be stored at temperatures from minus 18 °C to minus 22 °C during the storage period.

The kit can be transported in thermal containers with icepacks by all types of roofed transport at temperatures corresponding to the storage conditions of the kit components over the transportation. Transportation is allowed in thermal containers with icepacks by all types of covered transport at temperatures from 2 °C to 25 °C inside the container, but for no longer than 5 days.

Shelf-life of the kit following the first opening of the primary container:

- components of the kit, except the Enzyme Taq/RT, should be stored at temperatures from 2 °C to 8 °C during the storage period; PCR-mix for amplification should be stored at temperatures from 2 °C to 8 °C and out of light during the storage period;
- Enzyme Taq/RT should be stored at temperatures from minus 18°C to minus 22 °C during the storage period.

The kit stored in under undue regime should not be used.

An expired the **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** should not be used.

We strongly recommend to follow the given instructions in order to obtain accurate and reliable results.

The conformity of the **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** to the prescribed technical requirements is subject to compliance of storage, transportation and handling conditions recommended by manufacturer.

Contact our official representative in EU by quality issues of the **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit**.

6. WARNINGS AND PRECAUTIONS



The SARS-CoV-2 is classified as particularly pathogenic. Laboratories performing research on the detection of SARS-CoV-2 RNA are required to ensure the safety of work in accordance with the requirements of national legislation in the field of sanitary and epidemiological welfare.

Only specially trained personnel with medical or biological (veterinary) education who have been trained at licensed courses of primary specialization in working with pathogenic microorganisms and who have received additional special training at advanced training courses on molecular and biological methods are allowed to work with the kit of reagents.

Handle and dispose all biological samples, reagents and materials used to carry out the assay as if they were able to transmit infective agents. The samples must be exclusively employed for certain type of analysis. Samples must be handled under a laminar flow hood. Tubes containing different samples must never be opened at the same time. Pipettes used to handle samples must be exclusively employed for this specific purpose. The pipettes must be of the positive dispensation type or be used with aerosol filter tips. The tips employed must be sterile, free from the DNases and RNases, free from DNA and RNA. The reagents must be handled under a laminar flow hood. The reagents required for amplification must be prepared in such a way that they can be used in a single session. Pipettes used to handle reagents must be exclusively employed for this specific purpose. The pipettes must be of the positive dispensation type or be used with aerosol filter tips. The tips employed must be sterile, free from the DNases and RNases, free from DNA and RNA. Avoid direct contact with the biological samples reagents and materials used to carry out the assay. Use powder-free surgical gloves. Use protective clothing (work clothes and personal protective equipment) working with microorganisms classified as particularly pathogenic. The protective clothing and personal protective equipment must comply with the work to be performed and health and safety requirements. Avoid producing spills or aerosol. Any material being exposed to biological samples must be treated for at least 30 minutes with disinfecting solution or autoclaved for 1 hour at 121 °C before disposal.

Molecular biology procedures, such as nucleic acids extraction, reverse transcription, amplification and detection require qualified staff to avoid the risk of erroneous results, especially due to the degradation of nucleic acids contained in the samples or sample contamination by amplification products.

All oligonucleotide components are produced by artificial synthesis technology according to internal quality control protocol and do not contain blood or products of blood processing.

Positive control is produced by artificial synthesis technology. Positive control does not include parts of infectious agents.

All the liquid solutions are designed for single use and cannot be used more than once in amplification reactions. Plastic tubes do not contain phthalates. Do not breathe gas/fumes/vapor/spray produced by the components of the kit. Do not eat/drink components of the kit. Avoid contact with eyes. Only use the reagents provided in the kit and those recommended by manufacturer. Do not mix reagents from different batches. Do not use reagents from third party manufacturers' kits. All laboratory equipment, including pipettes, test tube racks, laboratory glassware, lab coats, bouffant caps, etc., as well as reagents should be strictly stationary. It is not allowed to move them from one room to another. Equip separate areas for the extraction/preparation of amplification reactions and for the amplification/detection of amplification products. Never introduce an amplification product in the area designed for extraction/preparation of amplification reactions. Wear lab coats, gloves and tools, which are exclusively employed for the extraction/preparation of the amplification reaction and for the amplification/detection of the amplification products. Never transfer lab coats, gloves and tools from the area designed for amplification/detection of the amplification products to the area designed for extraction/preparation of amplification reactions. Amplification products must be handled in such a way as to reduce dispersion into the environment as much as possible, in order to avoid the possibility of contamination. Pipettes used to handle amplification products must be exclusively employed for this specific purpose. Remove PCR waste only in a closed form. Remove waste materials (tubes, tips) only in a special closed container containing a disinfectant solution. Work surfaces, as well as rooms where NA extraction and PCR are performed, must be irradiated with bactericidal irradiators for 30 minutes before and after the work.

Do not open the tubes after amplification. Waste materials are disposed of in accordance with local and national standards. All surfaces in the laboratory (work tables, test tube racks, equipment, etc.) must be treated daily with disinfecting solution.

Emergency actions

Inhalation: Inhalation of the Master Mix contained within this kit is unlikely, however care should be taken.

Eye Contact: If any component of this kit enters the eyes, wash eyes gently under potable running water for 15 minutes or longer, making sure that the eyelids are held open. If pain or irritation occurs, obtain medical attention.

Skin Contact: If any component of this kit contacts the skin and causes discomfort, remove any contaminated clothing. Wash affected area with plenty of soap and water. If pain or irritation occurs, obtain medical attention.

Ingestion: If any component of this kit is ingested, wash mouth out with water. If irritation or discomfort occurs, obtain medical attention.

Do not use the kit:

- When the transportation and storage conditions are breached;
- When the reagents' appearance does not respond to the kit passport;
- When the kit components packaging is breached;
- After the expiry date provided.

Significant health effects are **NOT** anticipated from routine use of this kit when adhering to the instructions listed in the current manual.

7. SAMPLES

The **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** is designed to detect RNA extracted from the nasopharynx and oropharynx swabs, bronchoalveolar lavage, endotracheal aspirate, nasopharyngeal aspirate, sputum, depending on professional prescription.

Interfering substances

The presence of PCR inhibitors in a sample may cause controversial (uncertain) results. The sign of PCR inhibition is the simultaneous absence of internal control and specific product of amplification.

PCR inhibitors are the presence of hemoglobin in the RNA sample as a result of incomplete removal during the extraction of RNA from a biomaterial sample containing an impurity of blood, as well as the presence of isopropyl alcohol and methyl acetate in the RNA sample as a result of incomplete removal of washing solutions during sample preparation.

The maximum concentration of interfering substances, which do not affect the amplification of the laboratory control sample and internal control: hemoglobin – 0.35 mg/mL RNA sample, isopropyl alcohol – 100 µL/mL RNA sample, methyl acetate – 100 µL/mL RNA sample.

Impurities contained in the biomaterial sample, such as mucus, blood, elements of tissue breakdown and inflammation, local medicines, including those that are contained in nasal sprays, etc. should be removed during the NA extraction using sample preparation kits. To reduce the count of PCR inhibitors, it is necessary to follow the principles of taking biological material. Suspecting a large count of PCR inhibitors in the sample, it is recommended to choose NA extraction methods that allow to remove PCR inhibitors from the sample as much as possible. It is not recommended to use express methods of NA extraction.

The features of biomaterial sampling:

Work with biomaterials should be performed in accordance with Laboratory testing for coronavirus disease (COVID-19) in suspected human cases, Interim guidance, 19 March 2020 and national legislation.

Each sample of biomaterial should be placed in a separate transport container providing requirements in accordance with the table of guidance.

Sampling procedure is carried out using special sterile disposable instruments – dacron, rayon, or calcium alginate tipped collection swabs with plastic or non-aluminum wire shafts, depending on the source of biological material in accordance with established procedures.

Transportation and storage of the samples in accordance with guidance

Type of the sample	Collecting material requirements	Transportation	Storage conditions before transportation	Comments
Nasopharynx and oropharynx swabs	Plastic test tubes and tampons for swabs **	4 °C	≤5 days: 4 °C >5 days *: -70 °C	Nasopharyngeal and oropharyngeal tampons should be placed in the same tube to increase the viral load
Bronchoalveolar lavage	Sterile container	4 °C	≤48 hours: 4 °C >48 hours *: -70 °C	A small sample dilution is possible
Endotracheal aspirate, nasopharyngeal aspirate or nasal lavage	Sterile container	4 °C	≤48 hours: 4 °C >48 hours *: -70 °C	
Sputum	Sterile container	4 °C	≤48 hours: 4 °C >48 hours *: -70 °C	Make sure that the material is from the lower respiratory tract

* if it is not possible to store samples at minus 70 °C, store samples at minus 20 °C.

** To transport samples, use a transport medium for storing and transporting respiratory swabs or saline solution (if transportation to the laboratory is no more than 24 hours after taking the sample) or a dry swab probe (if transportation to the laboratory is no more than 4 hours after taking the sample).

It is recommended to use transport media containing preservatives.



Avoid repeated freezing and thawing of samples.

Samples must be transported in accordance with the requirements of the sanitary legislation in relation to pathogenic microorganisms.

8. PROCEDURE



The range of Influenza and SARS-CoV-2 viral load can vary widely. In this regard, when performing research in a laboratory, the risk of cross-contamination between samples at all stages of work is a serious danger, especially during aliquoting and RNA extracting. Cross-contamination with high-copy biomaterial can lead to sporadic false-positive results.

To prevent cross-contamination of the biological material in the laboratory, the following rules are recommended:

- it is necessary to conduct a visual assessment of the incoming biomaterial and cull test tubes with broken integrity;
- if possible, it is recommended to analyze samples of patients from a hospital with symptoms of acute infection separately from the rest of the samples (the biological material for screening exposed individuals and patients with mild disease). It is desirable to work with the supposed high-copy samples in a separate box or after working with the supposed low-copy samples. This recommendation mentioning patient samples does NOT imply any usage for diagnostics purposes as this kit is intended for Research Use Only;
- It is necessary to use negative control samples, starting from the stage of extracting RNA in each protocol;
- use tips with aerosol filters at all stages of the assay;
- strictly follow the assay procedure, open the Eppendorf test tubes with tweezers or a special opener (do not touch inside the tube cap by the gloved hand); when applying reagents, do not touch inside the test tube by the tip (if this happened, immediately replace the tip).

8.1. RNA extraction

For RNA extraction from the nasopharynx and oropharynx swabs, bronchoalveolar lavage, endotracheal, nasopharyngeal aspirate, sputum, RNA extraction kits are used (see Table 3).

Table 3. The reagent kits validated for RNA extraction and further study with the **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit**

Reagent kit	Biomaterial
ePure Viral Nucleic Acid Extraction Kit , produced by “eColi”	nasopharynx and oropharynx swabs, bronchoalveolar lavage, endotracheal, nasopharyngeal aspirate, sputum, nasopharynx and oropharynx swabs)

RNA extraction is carried out according to the extraction kit instructions.



The volume of the resulting RNA preparation should not exceed 50 µL.



The resulting RNA preparation must be used immediately for RT-PCR. If it is needed, the resulting RNA preparation can be stored at temperatures from minus 18 °C to minus 22 °C for no longer than a week with a single defrost before reverse transcription.

8.2. The features of biomaterial preparation



Do not perform centrifugation as a pretreatment of nasopharyngeal and oropharyngeal swabs (smears) taken into transport medium.



For RNA extraction, 100 µL of the sample is used.

8.3. The use of control samples at the stage of nucleic acid extraction

Internal control sample

To exclude false negative results of the study and to control the quality of the study, it is necessary to use an internal control sample to the biological samples at the stage of nucleic acid extraction.

The internal control RNA-IC “A” from the **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** should be used as an internal control sample.

The RNA-IC “A” should be used in the amount of 10 µL per sample.



The internal control (RNA-IC) and internal control (DNA-IC) from the **ePure Viral Nucleic Acid Extraction Kit** are not used.

Negative control sample

To exclude false positive results of the study and to control the quality of the study, it is necessary to use a negative control sample from the nucleic acid extraction stage.



Independently of DNA/RNA extraction kit used, a negative control sample should go through all stages of DNA/RNA extraction simultaneously with the RNA extraction from biological samples.

Physiological saline solution can be used as a negative control sample in volumes as indicated in the instructions for use of extraction kits or negative control sample that is included in the corresponding extraction kit.

8.4. PCR with Reverse Transcription (RT-PCR)



The reagents and tubes should be kept away from direct sun light.



When using kit ES3311A, strictly observe the completeness of the strips and caps to them. Do not use the caps to the strips of the other kits!

8.4.1 Mark the required number of the tubes or strips with paraffin sealed PCR-mix according to the number of samples to be analyzed, 1 tube for negative control (C-) and 1 tube for positive control (C+).

Example: to test 6 samples, mark 6 tubes (one for each sample), one for “C-” and one for “C+”). The resulting number of tubes is 8.

8.4.2 Vortex the RT-PCR-buffer and Enzyme Taq/RT thoroughly for 3-5 seconds, then spin for 1-3 seconds.



Enzyme Taq/RT should be got out from the freezer immediately prior to use.

8.4.3 Prepare the mixture of RT-PCR-buffer and Enzyme Taq/RT. Add to the one tube:

- 15 x (N+1) μ L of RT-PCR-buffer;
- 0.5 x (N+1) μ L of Enzyme Taq/RT,

N is a quantity of the samples to be tested taking to account "C-", "C+".

Example: to test 6 samples, mark 8 tubes. Prepare the mixture of RT-PCR-buffer and Enzyme Taq/RT for 9 (8+1) tubes. Mix 135 μ L of RT-PCR-buffer and 4.5 μ L of Enzyme Taq/RT.



Taking the Enzyme Taq/RT, it is necessary to dip the tip no more than 1.0 mm and observe the rules for dosing viscous liquids. Thoroughly flush the remaining Enzyme Taq/RT from the tip by pipetting at least 5 times.

8.4.4 Vortex the tube with the mixture of RT-PCR-buffer and Enzyme Taq/RT thoroughly for 3-5 seconds, then spin for 1-3 seconds.



Mixture of RT-PCR-buffer and Enzyme Taq/RT must be prepared immediately prior to use and should be used within one hour after preparation. If it is needed, the prepared mixture can be stored at the temperatures from 2 °C to 8 °C but for no longer than one hour.

8.4.5 Add 15 μ L of the RT-PCR-buffer and Enzyme Taq/RT mixture into each tube. Avoid paraffin layer break. Close the tubes/strips.

8.4.6 Vortex the tubes with samples, "C-" and "C+" for 3-5 seconds and spin down drops for 1-3 seconds.



Open the tube, add RNA sample (or control sample), then close the tube before proceeding to the next RNA sample to prevent contamination. In case of using tubes in strips, close the strip before proceeding to the next RNA sample to prevent contamination. Use filter tips.

8.4.7 Add 10 μ L of the RNA sample into corresponding tubes. Do not add RNA into the "C-", "C+" tubes. Avoid paraffin layer break. Close the tubes/strips tightly.

8.4.8 Add 10 μ L of negative control sample (C-), which passed whole RNA extraction procedures into corresponding tube. Add 10 μ L of positive control sample (C+) into corresponding tube. Avoid paraffin layer break. Close the tubes/strips tightly.

8.4.9 Spin down the tubes/strips for 3-5 seconds to collect drops (when using the Rotor-Gene Q thermal cycler, centrifugation is not required).

8.4.10 Set the tubes/strips into the Real-time Thermal Cycler.

8.4.11 Launch the RealTime_PCR application in "Device operation" mode. Upload "SARS_Influ_en.ini" file supplied with the kit before first run. Please refer to eQuantia thermal cycler's user manual for details on working with .ini files. In subsequent runs add corresponding test to the protocol, specify the number and ID's of the samples, specify the position of the tubes/strips in the thermal unit (p. 8.4.10) and run PCR. See Table 4.

For use with Rotor-Gene Q real-time thermal cyclers consult user manual for devices. See Table 5.



Amplification products can be stored at temperatures from 2 °C to 8 °C for one month or at temperatures from minus 20 °C for 12 months.

Table 4. The PCR program for eQuantia Thermal Cyclers

Step	Temperature, °C	Min.	Sec.	Number of cycles	Optical measurement	Type of the step
1	35	20	0	1		Cycle
2	95	5	0	1		Cycle
3	94	0	10	5		Cycle
	64	0	10		v	
4	94	0	5	45		Cycle
	64	0	10		v	
5	80	0	1	1		Cycle
6	10	Holding		Holding

v - optical measurement

Table 5. The PCR program for Rotor-Gene Q thermal cycler

Cycling	Temperature	Hold time, sec	Cycle repeats
Cycling	32 deg	1200	1 time
Cycling 2	95 deg	300	1 time
Cycling 3	94 deg	10	50 times
	60 deg*	15	

* optical measurement, set the fluorescence measurement (Acquiring) on the channels Green (Fam), Yellow (Hex), Orange (Rox) and Red (Cy5) at 60 °C.

8.5. PCR with Reverse Transcription (RT-PCR)



The reagents and tubes should be kept away from direct sun light.



When using kit ES3311A, strictly observe the completeness of the strips and caps to them. Do not use the caps to the strips of the other kits!

8.5.1 Mark the required number of the strips with paraffin sealed PCR-mix according to the number of samples to be analyzed, 1 tube for negative control (C-) and 1 tube for positive control (C+).

Example: to test 6 samples, mark 6 tubes (one for each sample), one for "C-" and one for "C+". The resulting number of tubes is 8.

8.5.2 Vortex the RT-PCR-buffer and Enzyme Taq/RT thoroughly for 3-5 seconds, then spin for 1-3 seconds.



Enzyme Taq/RT should be got out from the freezer immediately prior to use.

8.5.3 Prepare the mixture of RT-PCR-buffer and Enzyme Taq/RT. Follow the eQuantia instructions or mix in a separate tube:

- 15.0 x (N+1) µL of RT-PCR-buffer;
- 0.5 x (N+1) µL of Enzyme Taq/RT,

N is a quantity of the samples to be tested taking to account "C-", "C+".



Taking the Enzyme Taq/RT, it is necessary to dip the tip no more than 1.0 mm and observe the rules for dosing viscous liquids. Thoroughly flush the remaining Enzyme Taq/RT from the tip by pipetting at least 5 times.

8.5.4 Vortex the tube with the mixture of RT-PCR-buffer and Enzyme Taq/RT thoroughly for 3-5 seconds, then spin for 1-3 seconds.



Mixture of RT-PCR-buffer and Enzyme Taq/RT must be prepared immediately prior to use and should be used within one hour after preparation. If it is needed, the prepared mixture can be stored at the temperatures from 2 °C to 8 °C but for no longer than one hour.

8.5.5 Vortex the tubes with samples, “C-“ and “C+“ for 3-5 seconds and spin down drops for 1-3 seconds.

8.5.6 Set tubes with mixture of RT-PCR-buffer and Enzyme Taq/RT, analyzed samples, positive and negative controls and strip tubes with PCR-mix to the eQuantia and dispense the components according to the instruction manual.

8.5.7 Close the caps of the strips.

8.5.8 Spin the strips for 3-5 seconds.

8.5.9 Set strips to the Real-Time PCR Thermal Cycle. Launch the RealTime_PCR application in “Device operation” mode. Upload “SARS_Influ_en.ini” file supplied with the kit before first run. Please refer to eQuantia thermal cycler’s user manual for details on working with .ini files. In subsequent runs add corresponding test to the protocol, specify the number and ID’s of the samples, specify the position of the strips in the thermal unit and run PCR. See Table 4.

9. CONTROLS

The **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** contains positive control sample. Positive control is a cloned part of the virus genome. It is produced with genetic engineering techniques and characterized by automatic sequencing. The kit includes the Internal control RNA-IC “A”. RNA-IC “A” is intended to assess the quality of the RNA extraction and polymerase chain reaction. To reveal possible contamination a negative control is required.



A negative control sample should go through all stages of RNA extraction. Physiological saline solution can be used as a negative control sample in volumes indicated in supplied instructions.

For **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** the test result is considered valid when:

- the exponential growth of the fluorescence level for the specific product is present, in this case the internal control is not taken into account;
- the exponential growth of the fluorescence level for the specific product is absence and for internal control is present.

For **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** the test result is considered invalid when the exponential growth of the fluorescence level for the specific product and for internal control is not observed.

If positive control (C+) does **not** express growing fluorescence of the specific product or positive result, it is required to repeat the whole test. It may be caused by inhibitors, operation error or violation of storage and handling.

If negative control (C-) expresses growing fluorescence of the specific product or positive result, all tests of the current batch are considered false. Decontamination is required.

10. DATA ANALYSIS

In case of using eQuantia Thermal Cyclers, the analysis is performed automatically. In all other cases, the analysis is based on the presence or absence of specific signal.

The Real-time PCR Thermal Cyclers detects and interprets results automatically. Analysis will be performed by Real-Time PCR application. The interpretation should be performed in accordance with Table 6.

Table 6. The interpretation of assay results for control samples

Detection channel				Interpretation
Fam/Green	Hex/Yellow	Rox/Orange	Cy5/Red	
Positive control sample				
Cp/Ct is specified	Cp/Ct is not specified	Cp/Ct is specified	Cp/Ct is specified	Positive result The results are valid
Negative control sample				
Cp/Ct is not specified	Cp/Ct is specified	Cp/Ct is not specified	Cp/Ct is not specified	Negative result The results are valid

In the samples of human biological material with target viruses RNA, the Real-time PCR thermal cycler should register an increase in fluorescence on the corresponding detection channels (Fam/Green, Rox/Orange or Cy5/Red), see Tables 7, 8.

In the samples of human biological material free of target viruses RNA, the Real-time PCR thermal cycler should register an increase in fluorescence on the Hex/Yellow (Internal control sample) detection channel, the increase in fluorescence on the Fam/Green, Rox/Orange, and Cy5/Red channels should be absent.

The results are considered as unreliable (Invalid) if there is no exponential increase in fluorescence on the Fam/Green, Rox/Orange, and Cy5/Red channels (specific product) and on the Hex/Yellow channel (Internal control sample).

Table 7. The interpretation of assay results for PCR

Detection channel				Interpretation
Fam/Green	Hex/Yellow	Rox/Orange	Cy5/Red	
Analyzed samples				
Cp/Ct is specified	Is not considered	Cp/Ct is not specified	Cp/Ct is not specified	Influenza A virus RNA is detected
Cp/Ct is not specified	Is not considered	Cp/Ct is specified	Cp/Ct is not specified	SARS-CoV-2 RNA is detected
Cp/Ct is not specified	Is not considered	Cp/Ct is not specified	Cp/Ct is specified	Influenza B virus RNA is detected
Cp/Ct is not specified	Cp/Ct is specified	Cp/Ct is not specified	Cp/Ct is not specified	Target viruses RNA is not detected
Cp/Ct is not specified	Unreliable result. Repeat PCR amplification or NA extraction or re-collect of a biol. sample, performed sequentially			

Table 8. Other possible results

Detection channel				Interpretation
Fam/Green	Hex/Yellow	Rox/Orange	Cy5/Red	
Analyzed samples				
Cp/Ct is specified	Is not considered	Cp/Ct is specified	Cp/Ct is not specified	Influenza A virus RNA is detected, SARS-CoV-2 RNA is detected
Cp/Ct is not specified	Is not considered	Cp/Ct is specified	Cp/Ct is specified	Influenza B virus RNA is detected, SARS-CoV-2 RNA is detected
Cp/Ct is specified	Is not considered	Cp/Ct is not specified	Cp/Ct is specified	Influenza A virus RNA is detected, Influenza B virus RNA is detected,
Cp/Ct is specified	Is not considered	Cp/Ct is specified	Cp/Ct is specified	Influenza A virus RNA is detected, Influenza B virus RNA is detected, SARS-CoV-2 RNA is detected

Unreliable results may be caused by the presence of inhibitors in the nucleic acid preparation obtained from the biological material, errors in the pre-analytical stage, incorrect implementation of the analysis Protocol, non-compliance with the temperature mode of amplification, etc. In this case, either re-staging of reverse transcription and polymerase chain reaction, or re-extracting of the nucleic acid preparation, or re-collect of biological material (performed sequentially) is required.

When the expressed growing fluorescence (Cp/Ct is not specified) through the Fam/Green, Rox/Orange, or Cy5/Red channels is not expressed for positive control (C+), the results of whole series are considered false. It is required to repeat the whole test.

When the expressed growing fluorescence (Cp/Ct is specified) through the Fam/Green, Rox/Orange, or Cy5/Red channels is expressed for negative control (C-), the results of whole series are considered false. It is required to eliminate contamination.



A single negative test result, especially if it is a sample from the upper respiratory tract, does not exclude infection.



Negative results should not be used as the sole basis for making a decision about the treatment of patients. NO results should be used as the basis for making a decision about the treatment of patients – this kit is NOT intended for diagnostic purposes, it is intended for Research Use Only.

If in the samples of human biological material the Real-time PCR thermal cycler registers an increase in fluorescence for the specific product earlier than 25 cycle for Cp (Cp less than 25 or Ct less than 22), this indicates a high initial RNA concentration of the corresponding pathogen. In this case, it is possible to obtain a false negative result during mixed infection for a pathogen whose RNA is present in a low concentration. To exclude false negative results, it is recommended to repeat RT-PCR for the extracted RNA preparation using the kit for individual detection of the corresponding virus. The issue of mixed infection has not been sufficiently studied, based on a small amount of published literature data, co-infection with Influenza (A or B) and SARS-CoV-2 may occur in 0.5-5% of cases, increasing with age of patients – this kit is NOT intended for diagnostic purposes, it is intended for Research Use Only.

11. SPECIFICATIONS

a. The analytical specificity of the **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit** was assessed by bioinformatics analysis using available on-line databases with up-to-date comprehensive genetic information. The specific oligonucleotides used in the test were checked against GenBank database sequences. None of the sequences showed sufficient similarity for unspecific detection.

Since it is impossible to exclude the occurrence of new mutations in the genome of the SARS-CoV-2 coronavirus, two genome sites were selected as targets to improve the reliability of testing: the N and E genes sites.

In the samples of human biological material with target viruses RNA, the detecting amplifier should register an increase in fluorescence on the corresponding detection channels.

In the samples of human biological material free of target viruses RNA, the detecting amplifier should register an increase in fluorescence on the Hex/Yellow detection channel, the increase in fluorescence on the Fam/Green, Rox/Orange, and Cy5/Red channels should be absent.

There are not cross-nonspecific reactions of each of the oligonucleotide systems included in the kit in relation to viruses determined by other systems.

There are not non-specific positive results of amplification of RNA sample in the presence of Human coronaviruses HKU-1, NL-63, OC-43, 229E, Human parainfluenza viruses type 1-4, Human respiratory syncytial virus, Human metapneumovirus, Human rhinovirus, DNA of Human adenovirus, Human bocavirus, *Mycoplasma pneumoniae*, *Streptococcus pneumoniae*, *Chlamydomphila pneumoniae*, *Haemophilus influenzae*, *Klebsiella pneumoniae*, *Moraxella catarrhalis*, *Bordetella pertussis*, *Bordetella parapertussis*, as well as human DNA in concentrations up to 1.0×10^8 copies/mL of the sample. There are specific results of amplification of RNA sample in the presence of four strains of SARS-CoV-2 (studied under the international system QCMD (Quality Control for Molecular Diagnostics, This does NOT imply any usage for diagnostics purposes as this kit is intended for Research Use Only.), Great Britain), 11 strains of influenza B, 15 strains of different types of Influenza A.

b. Analytical sensitivity is 10 copies of RNA per amplification tube. Sensitivity is determined by the analysis of serial dilutions of the laboratory control sample (LCS).

Sensitivity depends on the sampling and the final volume of the extracted NA (elution volume).

c. Testing characteristics

The testing sensitivity and specificity were established for each virus of the ARVI pathogen which RNA is detected using the **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit**.

Number of samples (n) – 263.

Testing characteristics	Viruses caused ARVI which RNA is detected by tested kit		
	SARS-CoV-2 coronavirus	Influenza A virus	Influenza B virus
Testing sensitivity (95% CI)	100% (96.55–100%)	100% (96.15–100%)	100% (95.94–100%)
Testing specificity (95% CI)	100% (97.69–100%)	100% (97.84–100%)	100% (97.90–100%)



The claimed specifications are guaranteed when RNA extraction is performed with **ePure Viral nucleic acid extraction kit E2003**

12. TROUBLESHOOTING

Table 8. Troubleshooting

	Result	Possible cause	Solution
C+	-	Operation error PCR inhibition Violation of storage and handling requirements	Repeat whole test Dispose current batch
C-	+	Contamination	Dispose current batch Perform decontamination procedures
IC	Invalid	PCR inhibition	Repeat whole test Resample

If you face to any undescribed issues contact our customer service department regarding quality issues with the kit:

Phone: +420 325 209 912, <https://ecolidx.com/>

13. QUALITY CONTROL

eColi Dx, s.r.o. declares, that the above mentioned products meet the highest possible quality standards.

Contact our customer service with quality issues of **eSens NA SARS-CoV-2/Influenza A/B Multiplex REAL-TIME PCR Detection Kit**:

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14. KEY TO SYMBOLS

	Research Use Only		Date of manufacture
	Temperature limitation		Consult instructions for use
	Sufficient for		Catalogue number
	Use by		Manufacturer
	Batch code		Keep away from sunlight
	Caution		Version
	Negative control		Positive control
	Non-sterile		Do not reuse

