

# CMV Real-TM Quant

## Handbook

Real Time PCR test for quantitative detection of  
Cytomegalovirus (CMV)

**REF** TV7-100/2FRT



## 1. INTENDED USE

**CMV Real-TM Quant** PCR kit is an *in vitro* nucleic acid amplification test for qualitative detection and quantification of human cytomegalovirus (CMV) DNA in the clinical materials (peripheral blood plasma, amniotic fluid, cerebrospinal fluid (liquor), saliva, oropharyngeal swabs, urine samples, bronchoalveolar lavage, whole human blood, white blood cells, and viscera biopsy material) by using real-time hybridization-fluorescence detection.



The results of PCR analysis are taken into account in complex diagnostics of disease.

## 2. PRINCIPLE OF PCR DETECTION

CMV determination by the polymerase chain reaction (PCR) with hybridization fluorescent detection includes three stages: DNA extraction from clinical samples, PCR-amplification of pathogen genome specific region, and real-time hybridization fluorescent detection. DNA is extracted from peripheral blood plasma, amniotic fluid, cerebrospinal fluid (liquor), saliva, oropharyngeal swabs, urine samples, bronchoalveolar lavage, whole human blood, white blood cells, and viscera biopsy material in presence of Internal Control (IC), which allows monitoring of analysis of each sample. Endogenous internal control (IC Glob -  $\beta$ -globin gene DNA) allows monitoring of PCR analysis stages (DNA extraction and PCR amplification), material sampling and storage adequacy. Then, CMV DNA is amplified using specific primers and polymerase (TaqF).

$\beta$ -globin gene DNA is a part of human genome DNA and it should be present in an adequate amount in DNA sample, obtained from the cells. There must be no less than 20 000 genomes per sample (DNA from 10 000 cells). Internal Control (IC), added during the sample preparation from plasma, liquor, amniotic liquid, sputum, bronchial lavages and other cell free or low in DNA content materials, serves as an amplification control for each individually processed specimen and to identify possible reaction inhibition, while endogenous IC ( $\beta$ -globine gene), present in all samples obtained from cells (whole blood, leucocytes, biopsy and autopsy material, saliva, swabs) allows not only to control analysis steps, but also to estimate sample handling and storage.

In real-time PCR, the amplified product is detected using fluorescent dyes. These dyes are linked to oligonucleotide probes which bind specifically to the amplified product during thermocycling. The real-time monitoring of the fluorescence intensities during the real-time PCR allows the detection of accumulating product without re-opening the reaction tubes after the PCR run. **CMV Real-TM Quant** PCR kit uses "hot-start", which greatly reduces the frequency of nonspecifically primed reactions. "Hot-start" is guaranteed by separation of nucleotides and Taq-polymerase by using a chemically modified polymerase (TaqF). Chemically modified polymerase (TaqF) is activated by heating at 95 °C for 15 min.

### 3. CONTENT

Part N° 1 – “DNA-Sorb-B”:

<b>Reagent</b>	<b>Description</b>	<b>Volume (ml)</b>	<b>Quantity</b>
<b>Lysis Solution</b>	colorless clear liquid	15,0	2 tubes
<b>Washing Solution 1</b>	colorless clear liquid	15,0	2 tubes
<b>Washing Solution 2</b>	colorless clear liquid	50,0	2 tubes
<b>Sorbent</b>	colorless clear liquid	1,25	2 tubes
<b>DNA-eluent</b>	colorless clear liquid	5,0	2 tubes

Contains reagents for 100 extractions

Part N° 2 – “CMV Real-TM Quant ”:

<b>Reagent</b>	<b>Description</b>	<b>Volume (ml)</b>	<b>Quantity</b>
<b>PCR-mix-1-FRT CMV</b>	colorless clear liquid	0.6	2 tubes
<b>PCR-mix-2-FRT</b>	colorless clear liquid	0.3	2 tubes
<b>Polymerase (TaqF)</b>	colorless clear liquid	0.03	2 tubes
<b>RNA-buffer</b>	colorless clear liquid	0.6	1 tube
<b>DNA calibrator QS1</b>	colorless clear liquid	0.2	1 tube
<b>DNA calibrator QS2</b>	colorless clear liquid	0.2	1 tube
<b>RNA-buffer</b>	colorless clear liquid	1.2	1 tube
<b>Negative Control (C-)*</b>	colorless clear liquid	1.2	2 tubes
<b>Positive Control DNA CMV/ human DNA **</b>	colorless clear liquid	0.1	2 tubes
<b>Internal Control (IC)***</b>	colorless clear liquid	0.6	2 tubes

\* *must be used in the extraction procedure as Negative Control of Extraction: add 100 µl of C- (Negative Control) to labeled NCE;*

\*\* *must be used in the extraction procedure as Positive Control of Extraction (PCE): add 90 µl of C- (Negative Control) and 10 µl of DNA CMV/human DNA Rec Pos control to the tubes labeled PCE;*

\*\*\* *add 10 µl of Internal Control STI-87 during the DNA extraction procedure directly to the sample/lysis mixture.*

#### 4. ADDITIONAL REQUIREMENTS

- Disposable powder-free gloves and laboratory coat.
- Automatic adjustable pipettes (from 5 to 20 µl and from 20 to 200 µl).
- Disposable tips with aerosol barriers (100 or 200 µl) in tube racks.
- Tube racks.
- Vortex mixer/desktop centrifuge.
- PCR box.
- Real Time PCR instrument.
- Disposable polypropylene microtubes for PCR or PCR-plate
- Refrigerator for 2–8 °C.
- Deep-freezer for  $\leq -16$  °C.
- Waste bin for used tips.

## 5. GENERAL PRECAUTIONS

The user should always pay attention to the following:

- Use sterile pipette tips with aerosol barriers and use new tip for every procedure.
- Store and handle amplicons away from all other reagents.
- Thaw all components thoroughly at room temperature before starting detection.
- When thawed, mix the components and centrifuge briefly.
- Use disposable gloves, laboratory coats, protect eyes while samples and reagents handling. Thoroughly wash hands afterward.
- 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 samples and unused reagents in compliance with local authorities requirements.
- Samples should be considered potentially infectious and handled in a biological cabinet in accordance with appropriate biosafety practices.
- Clean and disinfect all sample or reagent spills using a disinfectant such as 0.5% sodium hypochlorite, or other suitable disinfectant.
- Avoid contact with the skin, eyes, and mucous membranes. If skin, eyes, and mucous membranes contact, immediately flush with water, seek medical attention.
- Material Safety Data Sheets (MSDS) are available on request.
- Use of this product should be limited to personnel trained in the techniques of DNA amplification.
- The laboratory process must be one directional, it should begin in the Extraction Area and then move to the Amplification and Detection Areas. Do not return samples, equipment and reagents to the area in which the previous step was performed.



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



Sampling of biological materials for PCR-analysis, transportation, and storage are described in details in the handbook of the manufacturer. It is recommended that this handbook is read before beginning of the work.

## 6. SAMPLING AND HANDLING

**CMV Real-TM Quant** can analyze DNA extracted from:

- *Plasma*:
  - EDTA tubes may be used with the **CMV Real-TM Quant**. Follow sample tube manufacturer's instructions.
  - Whole blood collected in EDTA should be separated into plasma and cellular components by centrifugation at 800-1600 x g for 20 min within six hours. The isolated plasma has to be transferred into a sterile polypropylene tube. Plasma may be stored at 2-8°C for an additional 3 days. Alternatively, plasma may be stored at -18°C for up to one month or 1 year when stored at -70°C.
  - Do not freeze whole blood.
  - Specimens anti-coagulated with heparin are unsuitable for this test.
  - Thaw frozen specimens at room temperature before using.
  - Whole blood must be transported at 2-25°C and processed within 6 hours of collection. Plasma may be transported at 2-8°C or frozen.
- *Liquor (CSF)* collected in the sterile "Eppendorf" tube:
  - Liquor may be stored at 2-8°C for 1 days. Alternatively, may be stored at -18°C for up to one month or 1 year when stored at -70°C
- *Amniotic liquid* collected in the sterile "Eppendorf" tube:
  - centrifuge 1,0 ml of sample at 8000-9000 x g for 10 min. Discard the supernatant and leave about 200 µl of solution. Vortex the the tube and use 100 µl for DNA extraction.
- *White blood cells*. Collect 2.5-10 ml blood samples according to standard procedures in tubes containing anticoagulant (recommended anticoagulant is EDTA). Centrifuge samples at ~1500-2000 X g for 10-15 min. This will separate the blood into an upper plasma layer, a lower red blood cell (RBC) layer, and a thin interface containing the WBCs, also called the buffy coat. Remove the plasma with a transfer pipet, being careful not to disturb the WBCs. Samples with exceptionally high WBC counts will have a thicker buffy coat. Use transfer pipet to carefully aspirate the exposed WBC layer in a volume of about 0.5 ml or less. Aspirate slowly, using a circular motion, to pull all the visible buffy coat material into the transfer pipet. Some contamination of the WBCs with the underlying RBCs is expected.



Add 300 µl of Solution for Lysis to the tube with the obtained leukocyte sample (for **DNA/RNA-Prep** protocol).

Specimens can be stored at +2-8°C for no longer than 12 hours, or freeze at -20°C to -80°C.

Transportation of clinical specimens must comply with country, federal, state and local regulations for the transport of etiologic agents.

## 7. WORKING CONDITIONS

CMV Real-TM Quant PCR kit should be used at 18–25 °C.

## 8. PROTOCOL

### 8.1. DNA Extraction

1. Lysis Solution and Washing Solution (in case of their storage at +2-8°C) should be warmed up to 56°C until disappearance of ice crystals.
2. Prepare required quantity of 1.5 ml polypropylene tubes.
3. Add to each tube 10 µl of Internal Control and 300 µl of Lysis Solution.
4. Vortex specimens for 5 sec.
5. Add 100 µl of Samples to the appropriate tube.
6. Prepare Controls as follows:
  - add 100 µl of C– (Negative Control) to labeled Cneg.
  - add 90 µl of C– (Negative Control) and 10 µl of Positive Control DNA CMV/ human DNA to the tube labeled PCE.
7. Vortex the tubes and centrifuge for 7-10 sec.
8. Vortex vigorously Sorbent and add 25 µl to each tube.
9. Vortex for 5-7 sec and incubate all tubes for 10 min at room temperature.
10. Centrifuge all tubes for 1 min at 10000g and using a micropipette with a plugged aerosol barrier tip, carefully remove and discard supernatant from each tube without disturbing the pellet. Change tips between tubes.
11. Add 300 µl of Washing Solution 1 to each tube. Vortex vigorously and centrifuge for 1 min at 10000g and using a micropipette with a plugged aerosol barrier tip, carefully remove and discard supernatant from each tube without disturbing the pellet. Change tips between tubes.
12. Add 500 µl of Washing Solution 2 to each tube. Vortex vigorously and centrifuge for 1 min at 10000g and using a micropipette with a plugged aerosol barrier tip, carefully remove and discard supernatant from each tube without disturbing the pellet. Change tips between tubes.
13. Repeat step 12.
14. Incubate all tubes with open cap for 5 min at 65°C.
16. Resuspend the pellet in 50 µl of DNA-eluent. Incubate for 10 min at 65°C and vortex periodically.
17. Centrifuge the tubes for 2 min at maximum speed (12000-16000 g). The supernatant contains DNA ready for amplification. The amplification can be performed on the same day of extraction.



## 8.2. Preparing PCR

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

### 8.2.1 Preparing tubes for PCR

1. Prepare the mixture of **PCR-mix-2-FRT** and **polymerase (TaqF)**. For this purpose transfer the content of the tube with **polymerase (TaqF) (30 µl)** into the tube with **PCR-mix-2-FRT (300 µl)** and mix by vortexing without foam forming.



The prepared mixture is intended for 60 samples analysis. Mixture is to be stored at the temperature between 2 °C and 8 °C for 3 months. Use when needed.



If the mixture can't be used up for 3 months it's necessary to prepare mixture for smaller number of reactions. For example, mix **150 µl of PCR-mix-2-FRT** and **15 µl of polymerase (TaqF)**. The obtained mixture is intended for 30 reactions.

2. Prepare the reaction mixture. Note that for analysis of even one clinical DNA sample in the qualitative format, it is necessary to run two controls of PCR amplification stage: positive control (DNA calibrator QS2) and negative control of amplification (RNA-buffer). For analysis of even one clinical DNA sample in the quantitative format, it is necessary to run five controls of PCR amplification stage: two calibrators (QS1 and QS2) in two replicates and the negative control of amplification (RNA-buffer). In addition, you should take reagents for one extra reaction.
3. Mix **PCR-mix-1-FL CMV** and the mixture of **PCR-mix-2-FRT** and **polymerase (TaqF)** prepared before in a new tube in the following proportion:
  - **10 µl of PCR-mix-1-FRT CMV,**
  - **5 µl of PCR-mix-2-FRT and polymerase (TaqF).**

Calculate the required number of reactions with allowance for the clinical and control samples. See Appendix 1.



If 60 samples are analyzed simultaneously, you can use a simplified version of mixture preparation: transfer the content of one tube with PCR-mix-2-Flu and the content of one tube with polymerase (TaqF) to the tube with PCR-mix-1-FL CMV screen/monitor.

4. Take the required quantity of tubes for amplification of clinical and control DNA samples. Transfer **15 µl** of the prepared mixture to each tube.
5. Add **10 µl** of **DNA** obtained from clinical or control samples to the tubes with the reaction mixture.

#### For qualitative analysis:

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

**C+** - Add **10 µl** of DNA calibrator QS2 to the tube labeled C+ (Positive Control of Amplification).

For quantitative analysis:

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

**Standards**  
**QS1 & QS2** - Add **10 µl** of QS1 to **two tubes** and **10 µl** of QS2 to **two other tubes**.

## 8.2. 2. Amplification

1. Program the thermocycler according to **Manufacturer's manual, Guidelines** and Tables 1 and 2.
2. Create a temperature profile on your instrument as follows:

### Program for rotor-type instruments<sup>1</sup>

<b>Step</b>	<b>Temperature, °C</b>	<b>Time</b>	<b>Fluorescence detection</b>	<b>Cycle repeats</b>
Hold	95	15 min	–	1
Cycling 1	95	5 s	–	5
	60	20 s	–	
	72	15 s	–	
Cycling 2	95	5 s	–	40
	60	20 s	FAM/Green, JOE/Yellow, ROX/Orange	
	72	15 s	–	

### Program for plate-or modular type instruments<sup>2</sup>

<b>Step</b>	<b>Temperature, °C</b>	<b>Time</b>	<b>Fluorescence detection</b>	<b>Cycle repeats</b>
1	95	15 min	–	1
2	95	5 s	–	5
	60	20 s	–	
	72	15 s	–	
3	95	5 s	–	40
	60	30 s	FAM, HEX/JOE/Cy3, ROX/Texas Red	
	72	15 s	–	

Fluorescence is detected on the 2nd step (**60 °C**) in FAM/Green, HEX/JOE/Cy3 Yellow and ROX/Orange/Texas Red fluorometer channels.

<sup>1</sup> For example, Rotor-Gene 6000/Q (Qiagen), or equivalent.

<sup>2</sup> For example, SaCycler-96 (Sacace), iQ5™ (BioRad); Mx3005P™ (Stratagene), ABI® 7300/7500/StepOne (Applied), SmartCycler® (Cepheid), LineGeneK® (Bioer) or equivalent.

## 9. DATA ANALYSIS

$\beta$ -Globin gene DNA (IC Glob) is detected in the FAM/Green channel, *CMV* DNA (Positive Control DNA *CMV* and human DNA) is detected in the JOE/HEX/Yellow channel, Internal Control STI-87 (IC) DNA is detected in the ROX/Orange channel.

If total DNA from cell suspension (whole human blood, white blood cells, viscera biopsy material) is isolated, the results are detected in two channels -  $\beta$ -globin gene DNA (IC Glob) in the FAM/Green channel, *CMV* DNA in the JOE/HEX/Yellow/Cy3 channel.

If total DNA from peripheral blood plasma, amniotic fluid, cerebrospinal fluid (liquor), saliva, oropharyngeal swabs, urine samples, and bronchoalveolar lavage are isolated with internal control sample, the results are detected in two channels: *CMV* DNA is detected in the JOE/Yellow/HEX/Cy3 channel, Internal Control (IC) DNA is detected in the ROX/Orange/Texas Red channel.

### Interpretation of results

The results are interpreted by the software of the PCR instrument used by the crossing (or not crossing) of the fluorescence curve with the threshold line.

**If total DNA from cell suspension (whole human blood, white blood cells, viscera biopsy material) is extracted, the results are interpreted as follows:**

1. The sample is considered to be **positive** for *CMV* DNA if a Ct value in the JOE/Yellow/HEX/Cy3 channel, which does not exceed the Ct value of the positive result (Ct < 38), is defined in the results grid. The fluorescence curve should cross the threshold line in the exponential growth region.
2. For qualitative analysis, the sample is considered to be **negative** for *CMV* DNA if its Ct value is not defined in the results grid (the fluorescence curve does not cross the threshold line) in the JOE/HEX/Yellow/Cy3 channel and the Ct value in the results grid in the FAM/Green channel does not exceed 38. For quantitative analysis, the sample is considered to be negative for *CMV* DNA if its Ct value is not defined in the results grid (the fluorescence curve does not cross the threshold line) in the JOE/HEX/Yellow channel and the quantity of IC Glob DNA is greater than 2000 copies per reaction.
3. For qualitative analysis, the analysis result is considered to be **invalid** if the Ct value is not defined in the results grid (the fluorescence curve does not cross the threshold line) in the JOE/HEX/Yellow channel and the Ct value in the results grid in the FAM/Green channel exceeds the Ct 38. For quantitative analysis, the result of analysis is considered to be invalid if the Ct value is not defined in the results grid (the fluorescence curve does not cross the threshold line) in the JOE/HEX/Yellow/cy3 channel and the quantity of IC Glob DNA is less than 2000 copies per reaction. In such cases, PCR analysis of the sample should be repeated.
4. For clinical samples whose Ct values in the JOE/Yellow/HEX/Cy3 channel exceed the boundary Ct value (> 38), the result is considered to be **equivocal**. Such DNA samples should be additionally analyzed in duplicate. If a reproducible positive Ct value is obtained, the result should be considered as **positive**. If Ct values are not reproduced in two replicates, the result is

considered as **equivocal**.

For qualitative analysis, if the Ct value in the FAM/Green channel exceeds 38, the negative result is considered to be **invalid**.

For quantitative analysis, if the quantity of IC Glob DNA is less than 2000 copies/reaction then the quantitative positive or negative result is considered to be **invalid**.

Results of analysis are accepted as relevant if the results obtained for positive and negative controls of amplification and the negative control of extraction are correct. For quantitative analysis, the results for C+ should fall into the concentration range indicated in the **Data Sheet CMV Real-TM Quant**.

**Results for controls if total DNA was isolated from cell suspension (whole human blood, white blood cells, and viscera biopsy material)**

Control	Stage for control	Ct in channel				Interpretation
		FAM/Green		JOE/HEX/Yellow		
		Qualitative format	Quantitative format	Qualitative format	Quantitative format	
<b>NCE</b>	DNA extraction, amplification	Neg	Neg	Neg	Neg	OK
<b>PCE</b>	DNA extraction, amplification	Pos (< boundary value)	Pos (< boundary value)	Pos (< boundary value)	Ct value is in the range indicated in Data Sheet	OK
<b>NCA</b>	Amplification	Neg	Neg	Neg	Neg	OK
<b>C+</b>	Amplification	Pos (< boundary value)	–	Pos (< boundary value)	–	OK
<b>QS1, QS2</b>	Amplification	–	Ct value and calculated concentration are determined	–	Ct value and calculated concentration are determined	OK

For quantitative analysis, the concentration in log of *CMV* DNA copies per standard cell quantity ( $10^5$ ) in control and clinical samples (whole human blood, white blood cells, viscera biopsy material) is calculated by following formula:

$$\log \left\{ \frac{\text{CMV DNA copies in PCR sample}}{\text{Glob DNA copies in PCR sample}} \times 2 \cdot 10^5 \right\} = \log \{ \text{CMV DNA copies} / 10^5 \text{ cells} \}.$$

To express relative *CMV* DNA concentration in copies per the standard cell quantity (e.g., for  $10^5$ ), use the following recalculation ratio:

$$10^5 \text{ cells} = 2 \cdot 10^5 \text{ human genomic equivalents}$$

**If total DNA from peripheral blood plasma, amniotic fluid, cerebrospinal fluid (liquor), saliva, oropharyngeal swabs, urine samples, and bronchoalveolar lavage is isolated together with the internal control sample, the results are interpreted as follows:**

1. The sample is considered to be **positive** for *CMV* DNA if a Ct value in the JOE/Yellow/HEX/Cy3 channel, which does not exceed the Ct value of the positive result (< 38), is defined in the results grid. The fluorescence curve should cross the threshold line in the exponential growth region.
2. The sample is considered to be **negative** for *CMV* DNA if its Ct value is not defined in the results grid (the fluorescence curve does not cross the threshold line) in the JOE/HEX/Yellow/Cy3 channel and the Ct value in the results grid in the ROX/Orange /Texas Red channel is < 38.
3. The analysis result is considered to be **invalid** if the Ct value is not defined in the results grid (the fluorescence curve does not cross the threshold line) in the JOE/HEX/Yellow/Cy3 channel and the Ct value in the results grid in the ROX/Orange/ Texas Red channel is > 38. PCR analysis of such clinical samples should be repeated.
4. For clinical samples whose Ct values in the JOE/Yellow/HEX/Cy3 channel exceed the boundary Ct value (38) the result is considered to be **equivocal**. Such DNA samples should be additionally analyzed in duplicate. If a reproducible positive Ct value is obtained, the result should be considered as **positive**. If Ct values are not reproduced in two replicates, the result is considered as **equivocal**.

Results of analysis are accepted as relevant if the results obtained for positive and negative controls of amplification and the negative control of extraction are correct. For quantitative analysis, the results for C+ should fall into the concentration range indicated in the **Data Sheet CMV Real-TM Quant**.

**Table. Results for controls if total DNA was isolated from peripheral blood, amniotic fluid, cerebrospinal fluid (liquor), saliva, oropharyngeal swabs, urine samples, and bronchoalveolar lavage together with the internal control**

Control	Stage for control	Ct in channel				Interpretation
		JOE/HEX/Yellow/Cy3		ROX/Orange/Texas Red		
		Qualitative format	Quantitative format	Qualitative format	Quantitative format	
<b>NCE</b>	DNA extraction, amplification	Neg	Neg	Pos (< boundary value)	Pos (< boundary value)	OK
<b>PCE</b>	DNA extraction, amplification	Pos (< boundary value)	Ct value is in the range indicated in Data Card	Pos (< boundary value)	Pos (< boundary value)	OK
<b>NCA</b>	Amplification	Neg	Neg	Neg	Neg	OK
<b>C+</b>	Amplification	Pos (< boundary value)	–	Pos (< boundary value)	–	OK
<b>QS1, QS2</b>	Amplification	–	Ct value and calculated, concentration determined	–	Ct value and calculated, concentration determined	OK

For quantitative analysis, the concentration of *CMV* DNA (**KP *CMV* DNA**) per ml of sample for peripheral blood plasma, amniotic fluid, cerebrospinal fluid (liquor), saliva, oropharyngeal swabs, urine samples, and bronchoalveolar lavage is calculated by the following formula:

$$\text{KP } CMV \text{ DNA} = K_{CMV \text{ DNA}} / K_{IC} \times IC \text{ coefficient (copies/ml)}$$

**$K_{CMV \text{ DNA}}$**  is the number of *CMV* DNA copies in DNA sample;

**$K_{IC}$**  is the number of IC DNA copies in DNA sample;

**IC coefficient** corresponds to the number of IC DNA copies in DNA sample. It is specified in the Data Sheet **CMV Real-TM Quant** provided with each lot of the reagent kit. This coefficient is specific for each lot.

CMV Real-TM Quant PCR kit is a test which contains the Internal Control IC (human beta-globine gene), which allows to control the presence of cellular material in the sample. If the sample is not correctly prepared or it is an insufficient quantity of epithelial cells the Internal Control will not be detected.

A negative control of extraction (NCE), positive control of extraction (PCE), negative amplification control (NCA), positive amplification control (C+) are required for every run to verify that the specimen preparation, the amplification and the detection steps are performed correctly.

If the controls are out of their expected range (see table Results for Controls), all of the specimens and controls from that run must be processed beginning from the sample preparation step.

## 10. TROUBLESHOOTING

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

1. The presence of any Ct value in JOE/Yellow/HEX/Cy3, FAM/Green, and ROX/Orange/Texas Red channels in the results grid for the Negative Control of Amplification (NCA) and for the Negative Control of Extraction (C-) in JOE/Yellow/HEX/Cy3 channel indicates contamination of reagents or samples. In this case, PCR analysis should be repeated for all samples where CMV DNA was detected starting from the DNA extraction stage.
2. If, for qualitative analysis, the Ct value in the results grid for the Positive Control of Amplification (QS2) in JOE/Yellow/HEX/Cy3 (CMV), FAM/Green, or ROX/Orange/Texas Red channels is absent, it is necessary to repeat amplification for all samples where CMV DNA was not detected.
3. If the Ct value in the results grid for the Positive Control of Extraction (Positive Control DNA CMV and human DNA) in JOE/Yellow/HEX/Cy3 (CMV), FAM/Green, or ROX/Orange/Texas Red channels is absent, the results of analysis of all samples are considered to be **invalid**. It is necessary to repeat PCR analysis for such samples.
4. If the Ct value for the sample in the JOE/Yellow/HEX/Cy3 channel is absent or exceeds the boundary Ct value and the Ct value for the sample is greater than the maximum Ct value for IC in FAM/Green and ROX/Orange channels, it is necessary to repeat the analysis starting from the DNA extraction stage. This error may be due to incorrect treatment of clinical material, which resulted in the loss of DNA, or to the presence of PCR inhibitors.
5. If the Ct value for the sample in the JOE/Yellow/HEX/Cy3 channel is absent or exceeds the boundary Ct value (> 38) and Ct value for the sample is less than the boundary Ct value in FAM/Green and ROX/Orange, the result is considered to be **equivocal**. It is necessary to repeat analysis of such samples in duplicate. If a reproducible positive Ct value is obtained, the result is considered to be **positive**; otherwise, the result is considered to be **equivocal**.

## 11. TRANSPORTATION

**CMV Real-TM Quant** PCR kit should be transported at 2–8 °C for no longer than 5 days.

## 12. STABILITY AND STORAGE

All components of the **CMV Real-TM Quant** PCR kit must be stored at -20°C when not in use. All components of the **CMV Real-TM Quant** PCR kit are stable until the expiration date on the label. The shelf life of reagents before and after the first use is the same, unless otherwise stated.



PCR-mix-1-FL *CMV* screen/monitor is to be kept away from light.

## 13. PRODUCT USE LIMITATIONS

All reagents may exclusively be used in in vitro diagnostics. Use of this product should be limited to personnel trained in the techniques of DNA amplification (EN375). Strict compliance with the user manual is required for optimal PCR results. Attention should be paid to expiration dates printed on the box and labels of all components. Do not use a kit after its expiration date.

## 14. QUALITY CONTROL

In accordance with Sacace's ISO 13485-Certified Quality Management System, each lot is tested against predetermined specifications to ensure consistent product quality.



## 15. SPECIFICATIONS

### 15.1 Sensitivity

Linear range of **CMV Real-TM Quant** PCR kit is **500–10.000.000 copies/ml**. If the result is greater than 500.000 copies/ml, it is indicated as ***the result is more than 10.000.000 CMV DNA copies/ml***. If the result is less than 500 copies/ml, it is indicated as ***the result is less than 500 CMV DNA copies/ml***.

The analytical sensitivity of **CMV Real-TM Quant** PCR kit is given in the table below.

Type of clinical material	Nucleic acid extraction kit	Sensitivity
Peripheral blood plasma, amniotic fluid, cerebrospinal fluid (liquor), saliva, oropharyngeal swabs, urine samples, bronchoalveolar lavage	DNA/RNA-prep	400 copies/ml
Whole human blood, white blood cells, viscera biopsy material	DNA/RNA-prep	5 <i>CMV</i> DNA copies per 10 <sup>5</sup> cells

### 15.2 Specificity










**CMV Real-TM Quant** PCR kit is intended for human cytomegalovirus (*CMV*) DNA detection. Specific activity of **CMV Real-TM Quant** PCR kit was confirmed in studies of the *CMV* reference strain AD 169 as well as by analyzing clinical material with subsequent confirmation of results by sequencing the amplification fragments. The activity of the PCR kit components with respect to DNA of other viruses (Epstein-Barr virus, herpes simplex virus types 1 and 2, human herpes virus types 6 and 8, Varicella Zoster Virus, Parvovirus B19, and others), bacterial pathogens (*Staphylococcus aureus*, *Streptococcus pyogene*, *Streptococcus agalactiae*, and others), and human DNA is absent. The clinical specificity of **CMV Real-TM Quant** PCR kit is 100%.

## REFERENCES

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## KEY TO SYMBOLS USED

	List Number		Caution!
	Lot Number		Contains sufficient for <n> tests
	Expiration Date		Version
	Store at	<b>NCA</b>	Negative Control of Amplification
	Manufacturer	<b>C-</b>	Negative control of Extraction
	Consult instructions for use	<b>C+</b>	Positive Control of Amplification
		<b>IC</b>	Internal Control

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