



PROFTECH
SPÓLKA Z O.O.



AB 994

Research laboratory
accredited by PCA, Nr AB
994

Scopes of accreditation:

- concentration and mass measurements of flow of fine particles
- measurements of concentration and mass flow of SO₂, NO_x, CO
- concentration measurements of CO₂, O₂
- concentration and mass flow measurements of OWO
- sampling for mass concentration determination of PCDD/PDF and dioxin type PCB
- sampling for concentration determination of (As; Cd; Cr; Co; Cu; Mn; Ni; Pb; Sb; Ti; V)
- sampling for concentration determination of Hg
- sampling and determination of concentration and mass flow of HCl
- sampling and determination of concentration and mass flow of HF
- sampling for determining the concentration of individual gaseous organic compounds
- calibration of Automated Monitoring systems,
- QAL2 procedure
- annual performance test of Automated Monitoring Systems, AST procedure
- noise measurement from machinery, installations and industrial plants

Chorzów, July 21st 2020
Our ref. No.: PW/21/07/20

Report No PW/21/07/20

on concentration measurements of dioxins and furans emitted into environment from flue gas channel located at UAB KAUNO KOGENERACINĖ JĖGAINĖ, Veterinarų g. 19, Biruliškių k., LT-54469 Kauno raj., Lithuania.

Client name and address:

**UAB KAUNO KOGENERACINĖ
JĖGAINĖ,**
Veterinarų g. 19, Biruliškių k.,
LT-54469 Kauno raj.

Developed by:

mgr Grzegorz Bortel

Calculation and data transfer checked by:

inż. Dariusz Guja

Verified by:

inż. Dariusz Guja

Copy number: 1/4...

ul. Kurta Aldera 44
41-506 Chorzów
tel/fax: 0 32 247 37 24

www.proftech.com.pl
e-mail: proftech@proftech.com.pl

NIP: 627 252 46 31
KRS: 0000773369

bank account : PKO BANK POLSKI S.A. O/Katowice : IBAN PL62 1440 1172 0000 0000 0353 4332

Test Report No PW/21/07/20

List of contents:

- 1. PURPOSE AND SCOPE OF THE REPORT**
- 2. BASIS OF MEASUREMENTS EXECUTION**
- 3. MEASUREMENT TEAM**
- 4. MEASUREMENT RESULTS SUMMARY**
- 5. DESCRIPTION OF THE MEASUREMENT METHOD**
- 6. MEASUREMENT RESULTS**
- 7. MEASUREMENT DEVICES**
- 8. ANALYSIS RESULTS**
- 9. CERTIFICATE OF ACCREDITATION**
- 10. MEASUREMENT PLANE SCHEME**

Test Report No PW/21/07/20**1. PURPOSE AND SCOPE OF THE REPORT**

Purpose of executed measurements was to determine the concentration and emission of dioxins and furans emitted to environment from flue gas channel located at at UAB KAUNO KOGENERACINĖ JĖGAINĖ, Veterinarų g. 19, Biruliškių k., LT-54469 Kauno raj., Lithuania.

Measurements range:

- PCDD/DF emission and concentration.

The measurements were carried out in accordance with the sampling plan and the described sampling methods.

Operating parameters of the technological installation was obtained from the customer's representative.

2. BASIS OF MEASUREMENTS EXECUTION

The measurements were taken according to the Contract No 2020-KKJ-05 dated March 31st 2020, our reference number PP/15/03/20.

3. MEASUREMENT TEAM

The measurements taken on June 25th 2020 were executed by the following team:

- Grzegorz Bortel specialist- measurement team leader,
- Bartek Glik specialist,
- Karol Sodo technician.
-

4. MEASUREMENT RESULTS SUMMARY

Below are presented measurement results summary, full measurement results are presented in chapter no 6, at page 8.

Concentration of the substance in the gas in the conventional conditions O2 ref. 11%	PCDDF	ng/m3	0,002
Emission limits	PCDDF	ng/m3	0,1
Transgression	PCDDF	ng/m3	-

Test Report No PW/21/07/20

5. DESCRIPTION OF THE MEASUREMENT METHOD**Measurement of the gas volumetric flow**

The flow rate was determined according to ISO Standard PN-EN ISO 16911-1:2013 „Stationary source emissions - Manual and automatic determination of velocity and volume flow rate in ducts - Part 1: Manual reference method". Gravimetric dust monitor type Megasystem APIS X-1 and type "S" Pitot tube were used for the measurements. Measurement is accredited.

Accreditation range: differential pressure: > 5 Pa

Measurement O₂ content

The concentration of O₂ was determined using gas analyzer HORIBA PG-350 EHR equipped with testing probe 2000 mm long. The measurements were taken according to the procedure described in measurement unit as well as to Polish Standard PN-EN 14789:2006 "Stationary source emissions - Determination of volume concentration of oxygen O₂ - Reference method - Paramagnetism". Measurement is accredited.

Accreditation range: O₂ content: 3-21%

Measurement CO₂ content

The concentration of CO₂ was determined using gas analyzer HORIBA PG-350 EHR equipped with testing probe 2000 mm long. The measurements were taken according to the procedure described in measurement unit as well as to Polish Standard PN-ISO 10396:2001 "Stationary Source Emissions - Sampling For The Automated Determination Of Gas Concentrations ". Measurement is accredited.

Accreditation range: CO₂ content: 0,1-20%

Measurement moisture content

Moisture content was determined using condensation-absorption method. The measurements were taken according to Polish Standard PN-EN 14790:2017. Measurement is accredited.

Accreditation range: H₂O content: 29-250 g/m³

Test Report No PW/21/07/20

PCDD+PCDF sampling and determination

PCDD/DF samples were taken according to the requirements of Polish Standard PN-EN 1948-1:2006 „ Stationary source emissions - Determination of mass concentration of PCDDs/PCDFs and dioxin-type PCBs - Part 1: Sampling of PCDDs/PCDFs”.

The three stages of PCDD/DF concentration and emission determination:

Stage I - sampling

For the determination of mass concentration of PCDD/DF proper sampling plays important role that affects following stages of the testing. The sampling were performed by means of the filtration and condensation method using PCDD/DF sampling system conformed to European Standard PN-EN 1948-1:2006.

The following page shows the schematic diagram of the sampling system.

Stage II - laboratory analysis

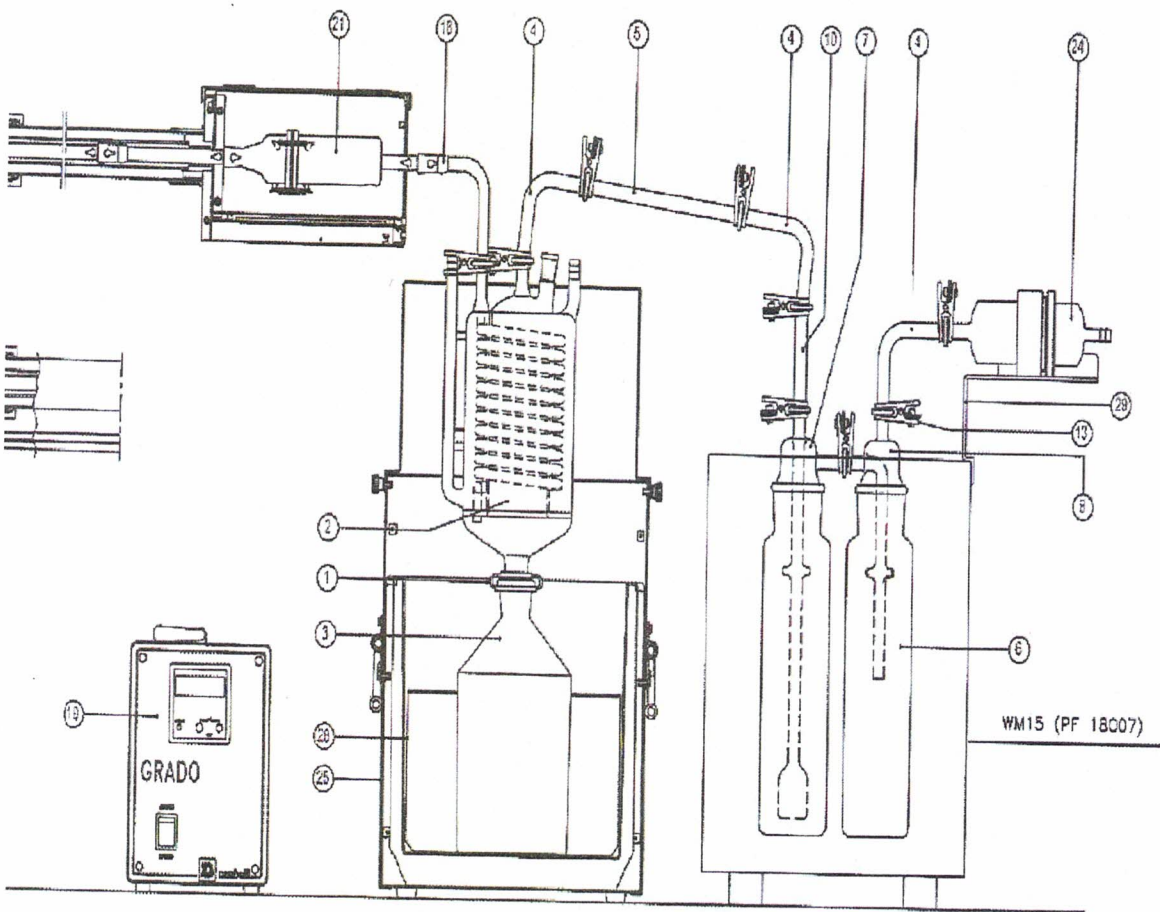
The samples were analysed at the ALS Czech Republic, s.r.o accredited laboratory following the CSN EN 1948-2,3 methodology: The determination of polychlorinated dibenzo-p-dioxine, dibenzofurans in emission samples with the method of isotop dillution using HRGC/HRMS.

The dioxin and furans analyses were conducted at the ALS Czech Republic, s.r.o. Laboratory, specifically accredited for the test by the Český Institut Pro Akreditaci, o.p.s. , Nr L 1163.

Stage III - development and the results and discussion

The last stage includes results collection from the previous stages, emission calculation and PCDD/DF concentration as well as comparison to the standards in force.

Test Report No PW/21/07/20



3. condensation pot
6-8. scrubbers
16. holding springs
21. filter casing
26. heated probe

4,18. aspiration path - elbows
9. aspiration path - probe tube
17. aspiration controller
22. yoke
28. cooler coil

11,12,14,15. - aspiration endings
19. temperature controller
24. gas dryer
29,30. support

Test Report No PW/21/07/20

6. MEASUREMENT RESULTS

Test Report No PW/21/07/20

- 1) Plant or unit name: **Combined Heat and Power Plant**
- 2) Flue gases cleaning unit: **bag filters, activate carbon, hydrated lime, scrubber**
- 3) Emission source load during measurements: **~65,9 MW**
- 4) Fuel type or material mass flow in process: **85% municipal waste, 15% non – hazardous industrial waste / waste code: 19 02 03;**
- 5) Location of sampling and measurements: **in duct, after flue gases cleaning unit**

Measurement reference number		25-06-01		X	X	
Date of measurement		25.06.2020				
Measurement time range		10:15-16:19				
Scope of test		Unit	Results	Uncertainty +/-	Method	
Meteorological conditions	Atmospheric pressure		hPa	1018,3	0,9	PN-Z-04030-7:1994
	Air temperature		oC	25	X	
Cross-section	Diameter		m	2,00		
	Area		m2	3,14		
The parameters of gas in line	Temperature		oC	60	0,590	
	Static pressure		Pa	34	0,340	
	Differential pressure		Pa	65	0,590	
	Gas moistness grade X		kg/kg	0,140	0,003	
	Average velocity		m/s	9,6	0,9	
	Chemical composition	O2	%	7,7	0,4	
		CO2	%	11,2	0,6	PN-ISO 10396:2001
	Wet gas density during testing		kg/m3	1,023	X	PN-EN 14790:2006
	Gas density in normal conditions		kg/m3 N	1,242		PN-EN 14790:2006
	Gas density in conventional conditions		kg/m3 U	1,344		PN-EN 14790:2006
Concentration in the gas at measurement conditions	PCDDF*		ng/m3	0,002	0,001	PN-EN 1948:2006
Concentration in the gas at normal conditions	PCDDF*		ng/m3	0,003	0,001	PN-EN 1948:2006
Concentration of the substance in the gas in the conventional conditions	PCDDF*		ng/m3	0,003	0,001	PN-EN 1948:2006
Concentration of the substance in the gas in the conventional conditions O2 ref. 11%	PCDDF*		ng/m3	0,002	0,001	PN-EN 1948:2006
Gas volume flow	measurement conditions		m3/h	108858	13654	PN-EN ISO 16911-1:2013
	normal conditions		m3N/h	89690	11259	
	conventional conditions		m3U/h	73557	9669	
	conventional conditions O2 ref. 11%		m3U/h	97831	14704	
The emission obtained by measuring	PCDDF*		ng/h	205,96	68,68	PN-EN 1948:2006
Emission limits	PCDDF*		ng/m3	0,1	X	X
Transgerssion	PCDDF*		ng/m3	-		

*- the results obtained from the subcontractor (accredited)

Test Report No PW/21/07/20Notes:

Normal conditions designate the temperature of 273 K and pressure of 101,3kPa, defining normal cubic meter m³N. The conventional conditions designate the temperature of 273K, pressure of 101,3 kPa and dry gases (steam contents less than 5 g/kg of flue gas), defining conventional cubic meter, m³U

The specified expanded uncertainty comes from standard uncertainty multiplied by expansion coefficient k = 2, which provides 95% level of confidence for normal distribution. Uncertainty takes into account the sampling and analysis.

Registry of samples delivered to the laboratory: P/01/07/20, P/02/07/20
Date of delivery to the laboratory: 26.06.2020
Date of analysis: 26.06 - 20.07.2020

Field blanks:

ID/ number of sample	Type of substance	The criterion of the blank [ng/m ³] 11%O ₂	The value of the blank [ng/m ³] 11% O ₂	Result [+/-]
P/02/07/20	PCDD/DF	0,01	0,0015	+

Work parameters of measurement system:**PCDD/DF (PN-EN 1948:2006):**

sampling method: condensation - adsorption method
filter parameters: 19 x 90 mm, filter efficiency: 99,998 %
sampling train: 2 measurement axis
oxygen reference : 11 %
time of dioxins and furans measurement: 10:15 – 16:19 (364,2 min)
nozzle diameter: 8 mm
probe temperature: 120 °C
scrubbers temperature 4 °C
aspired gas volume 7,808 m³
average sampling flow 21,4 l/min
isokinetic ratio: 96,6 %
leak test: + / +
gas meter temperature 35 °C
gas meter pressure 0 bar
spiking pattern: filter surface
absorption solution: 100 ml H₂O dest. + 50 ml 2-etoksyetanol
recovery: 54 % ¹³C₁₂-1,2,3,7,8-PECDF, />50%/
58 % ¹³C₁₂-1,2,3,7,8,9-HxCDF, />50%/
62 % ¹³C₁₂-1,2,3,4,7,8,9 HpCDF. />50%/
TEQ sample mass: 0,019 ng

H₂O (PN-EN 14790:2017)

sampling train: 2 measurement axis
sampling equipment: titanium sampling train
heated probe 2,0 m long
sampling pump: PT-01
cartridge: K/04/06/20
number of samplings: 1
sampling time: 31 min
sampling volume: 2,0 l/min
H₂O mass: 10,08 g
absorption efficiency: 97,5 %

Test Report No PW/21/07/20**7. MEASUREMENT DEVICES**

Name of measuring device		X1- Apis
Type of measuring device		Isokinetic sampler S/N 0142
Certificate	Calibration No	824-2373/19 824-2374/19 824-2372/19 824-2375/19 G-106/20-66/20
Issued by		INTROL Sp. z o.o. KATOWICE ZAP BESTWINKA
Date of issue the certificate of calibration		27.08.2019 28.08.2019 11.03.2020
Expiration date of the certificate of calibration		-

Name of measuring device		HORIBA
Type of measuring device		PG-350E-HR
Certificate	Calibration No	63/1/AW/18
Issued by		Laboserwis Sp. z o.o. Katowice
Date of issue the certificate of calibration		13.03.2018
Expiration date of the certificate of calibration		-

Name of measuring device		Sampler
Type of measuring device		PT-01
Certificate	Calibration No	851-2463/19 786-2245/19 G-360/19-224/19 R-286/16-186/16
Issued by		INTROL Sp. z o.o. KATOWICE ZAP BESTWINKA
Date of issue the certificate of calibration		29.08.2019 12.08.2019 08.08.2019
Expiration date of the certificate of calibration		-

Test Report No PW/21/07/20

7. ANALYSIS RESULTS



Attachment no. 1 to the Certificate of Analysis for work order PR2064079

Sample: P/01/07/20

Measurement results PCDD/Fs:

Sample: P/01/07/20		Final extract [µl]: 60			
		Injection volume [µl]: 4			
		Acquisition date [d.m.y h:m]: 12.7.20 0:11			
2,3,7,8-PCDD/Fs	Result [ng/sample]	Limit of Detection [ng/sample]	Limit of Quantification [ng/sample]	¹ I-TEFs	I-TEQ Upperbound [ng/sample]
2,3,7,8-TCDD	< 0.0044	0.0044	0.0088	1	0.0044
1,2,3,7,8-PeCDD	< 0.0056	0.0056	0.011	0.5	0.0028
1,2,3,4,7,8-HxCDD	< 0.0092	0.0092	0.018	0.1	0.00092
1,2,3,6,7,8-HxCDD	< 0.0092	0.0092	0.018	0.1	0.00092
1,2,3,7,8,9-HxCDD	< 0.0092	0.0092	0.018	0.1	0.00092
1,2,3,4,6,7,8-HpCDD	< 0.021	0.021	0.042	0.01	0.00021
OCDD	< 0.025	0.025	0.05	0.001	0.000025
2,3,7,8-TCDF	< 0.0049	0.0049	0.0098	0.1	0.00049
1,2,3,7,8-PeCDF	< 0.0045	0.0045	0.009	0.05	0.00022
2,3,4,7,8-PeCDF	< 0.0045	0.0045	0.009	0.5	0.0022
1,2,3,4,7,8-HxCDF	< 0.018	0.0089	0.018	0.1	0.0018
1,2,3,6,7,8-HxCDF	< 0.018	0.0089	0.018	0.1	0.0018
1,2,3,7,8,9-HxCDF	< 0.0089	0.0089	0.018	0.1	0.00089
2,3,4,6,7,8-HxCDF	< 0.0089	0.0089	0.018	0.1	0.00089
1,2,3,4,6,7,8-HpCDF	< 0.047	0.023	0.047	0.01	0.00047
1,2,3,4,7,8,9-HpCDF	< 0.023	0.023	0.047	0.01	0.00023
OCDF	< 0.057	0.029	0.057	0.001	0.000057
I-TEQ from quantified 2,3,7,8-PCDD/Fs - "Lowerbound"					0
I-TEQ from 2,3,7,8-PCDD/Fs - "Mediumbound"					0.0096
Maximum possible I-TEQ - "Upperbound"					0.019
PCDDs	Result [ng/sample]	PCDFs	Result [ng/sample]		
Tetra-CDDs	< 0.097	Tetra-CDFs	< 0.19		
Penta-CDDs	< 0.079	Penta-CDFs	< 0.13		
Hexa-CDDs	< 0.092	Hexa-CDFs	< 0.14		
Hepta-CDDs	< 0.042	Hepta-CDFs	< 0.094		
OCDD	< 0.025	OCDF	< 0.057		

¹I-TEF according to NATO.

Limits of quantification are defined as double of the detection limits.

The limit of detection is defined as the amount of analyte producing a signal with $S/N \geq 3$.

The value of the detection limit is mentioned as the actual value at the acquisition date.

Measurement uncertainty is expressed as a double ($k=2$) relative standard deviation (RSD%), and corresponds to 95% confidence interval.

Estimation of uncertainty of each 2,3,7,8-PCDD/F congener is 30% and total I-TEQ is 20%.

These values were ensured by analyses of certified reference material under conditions of internal reproducibility.

Results marked with "<" are below limit of detection or quantification.

"Lowerbound" and "Upperbound" are levels defined in Regulation 2017/644 and EN 1948-4.

"Mediumbound" is levels defined in Regulation 2017/644.

Test Report No PW/21/07/20



Attachment no. 1 to the Certificate of Analysis for work order PR2064079

Sample:

P/01/07/20

Standards recovery:

Sample:		P/01/07/20			
		Final extract [µl]:		60	
		Injection volume [µl]:		4	
		Acquisition date [d.m.y h.m]:		12.7.20 0:11	
Extraction standard	Recovery [%]	Acceptable range [%]		Accept. rec. with respect to	
		Basic	Extended	basic range	extended range
PCDDs					
13C12 - 2,3,7,8-TCDD	54	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,7,8-PeCDD	53	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,7,8-HxCDD	72	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,6,7,8-HxCDD	93	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,6,7,8-HpCDD	92	40 - 130	20 - 150	YES	-
13C12 - OCDD	60	40 - 130	20 - 150	YES	-
PCDFs					
13C12 - 2,3,7,8-TCDF	53	50 - 130	30 - 150	YES	-
13C12 - 2,3,4,7,8-PeCDF	59	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,7,8-HxCDF	96	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,6,7,8-HxCDF	86	50 - 130	30 - 150	YES	-
13C12 - 2,3,4,6,7,8-HxCDF	55	50 - 130	30 - 150	YES	-
13C12 - 1,2,3,4,6,7,8-HpCDF	96	40 - 130	20 - 150	YES	-
13C12 - OCDF	61	40 - 130	20 - 150	YES	-
Sampling standard	Recovery [%]	Acceptable range [%]		Rec. in range?	
13C12-1,2,3,7,8-PeCDF	54	> 50		YES	
13C12-1,2,3,7,8,9-HxCDF	58	> 50		YES	
13C12-1,2,3,4,7,8,9-HpCDF	62	> 50		YES	

Test Report No PW/21/07/20

9. CERTIFICATE OF ACCREDITATION

POLSKIE CENTRUM AKREDYTACJI
POLISH CENTRE FOR ACCREDITATIONSygnatariusz EA MLA
EA MLA SignatoryCERTYFIKAT AKREDYTACJI
LABORATORIUM BADAWCZEGO
ACCREDITATION CERTIFICATE OF TESTING LABORATORY
Nr AB 994

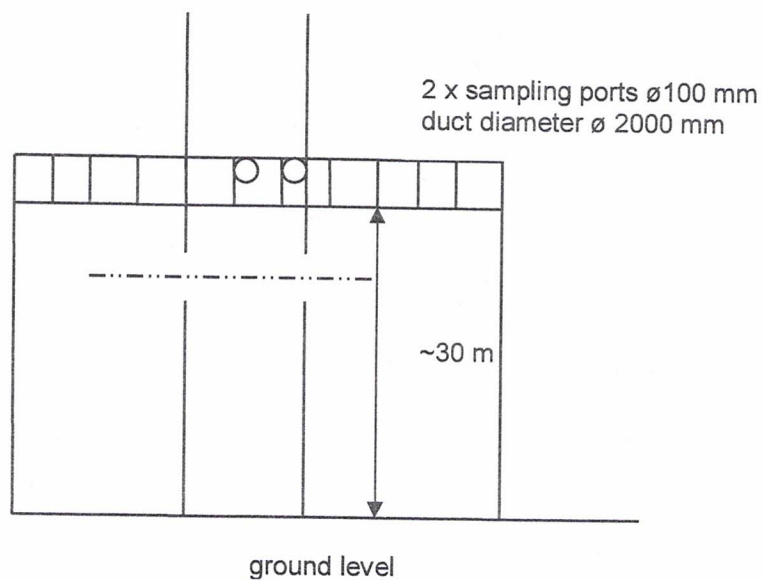
Powierza się, że. / This is to confirm that:

„PROFTECH” Sp. z o.o.
ul. Kurta Aldera 44, 41-506 Chorzówspełnia wymagania normy PN-EN ISO/IEC 17025:2018-02
meets requirements of the PN-EN ISO/IEC 17025:2018-02 standardAkredytowana działalność jest określona w Zakresie Akredytacji Nr AB 994
Accredited activity is defined in the Scope of Accreditation No AB 994Akredytacja pozostaje w mocy pod warunkiem przestrzegania
wymagań jednostki akredytującej określonych w kontrakcie Nr AB 994
This accreditation remains in force provided the Laboratory observes
the requirements of Accreditation Body defined in the Contract No AB 994Akredytacji udzielono dnia 30.01.2009 r.
Accreditation was granted on 30.01.2009DYREKTOR
POLSKIEGO CENTRUM AKREDYTACJI
LUCYNA OLSBORSKA

Warszawa, dnia 9 grudnia 2019 roku

Test Report No PW/21/07/20

10. MEASUREMENT PLANE SCHEME



Approved by

DYREKTOR
.....
Name and Signature **Dariusz Guja**

END OF REPORT