Vibration Measurements in the Mining Industry Applying the Software Install Application to the Kosovo Energy Corporation

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Abstract
The assessment of specific impacts on the environment is a preventive measure for environmental protection which is based on the definition and proposal of measures that can prevent harmful effects, reduce or eliminate them. In the physical sense, vibration is the oscillating motion of an object with the effect of internal or external forces applied to it. People who touch a vibrating surface or object will feel these vibrations. In general, there are two types of vibration exposure. The first are the vibrations of the hands and arms transmitted by the held parts of tools or machinery. The second are whole-body vibrations transmitted from a seat or surface to a motorized car. The risk of injury to workers exposed to vibration varies depending on the size, frequency, type, duration of exposure, and organ affected. The purpose of this paper is to review the measurements of vibrations in the Kosovo Energy Corporation in the mine Sibovc Southwest, where coal with a rotary excavator is exploited and the evaluation of vibrations for working conditions for workers working in that environment and improving working conditions for the measurement of vibrations we have used the device Minimate DS 078, the purpose of such environmental impact assessment is to collect data and predict the harmful impacts on the environment, namely the impact on water, air, soil, life and health of as well as identify and propose measures that could prevent, reduce or eliminate altogether.

Keywords:
Environment, Vibrations, Software, Excavator

1. Introduction

Vibration measurements were performed at the Kosovo Energy Corporation, respectively at the Sibovci South mine. The measurements were made in 2021. Vibration measurements were made at four measuring points. During the measurements at work were five rotary excavators for coal excavation for the production of electricity with initials: Er - 1B, Er - 3B, Er. - 4B, Er. -4B, and Er. -6B.

Working methodology: Vibration measurements were performed according to EU Standard no. 44/2002.Vibration measurement was performed with the instrument Vibration meter "INSTATEL" Minimate DS 078 "of Canadian production. The measurement methods and elements are given in the following table [1]:

Table 1: Measurement methods, Typology of measurements [2]

Oscillation level measurement method, typology	
When used	During the operation of PKX-Main Mining Equipment
Type of monitoring	Individual, momentary
Measurement extension time	L = 10 (sec)
Monitoring conditions: climatic conditions	The weather killed you with rain
Location of measurements	The western part of the mine SJP (Grabovc), as well as the eastern part SJP (Hade) sensitive and mandatory locations.
Development of measurements	27.01.2021: Measurement "1" 12:01 min Measurement "2" 12:10 min Measurement "3" 12:27 min Measurement "4" 12:35 min
Method analysis	Comparison of measured values with allowed ones

Table 2: Measurement V -1 western part of the mine SJP Grabovc village [3]

1.	Measurement point	Types of measurements	Measured values
2.	V - 1 Coordinates 7500382 4723776	1. transversal (X)	Measured 0.699 mm/s;
		2. vertical (Y)	Measured 0.318 mm/s;

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		3. longitudinal (Z)	Measured 0.318 mm/s;
3.	Vibration calculation equation: $Vr = \sqrt{V t 2 + V v 2 + V l 2}$ (mm/s) ku janë Vt – speed transverzal Vv – speed verticale Vl - speed longiudinal		Matura Values 0.831 mm/sec
			Allowed values 6.00 mm/sec

Table 3: Measurement V - 2 western part of the mine SJP Grabovc village [4]

1.	Measurement point	Types of measurements	Measured values
2.	V - 2 Coordinates 7500382 4723776	1. transversal (X)	Measured 0.381 mm/s;
		2. vertical (Y)	Measured 1.02 mm/s;
		3. longitudinal (Z)	Measured 0.191 mm/s;
3.	Vibration calculation equation: $Vr = \sqrt{V t 2 + V v 2 + V l 2}$ (mm/s) Where are Vt – speed transverzal Vv – speed verticale Vl - speed longiudinal		Matura Values 1.105mm/sec
			Allowed values 6.00 mm/sec

Table 4: measurement V - 3 northern part of the mine. [5]

1.	Measurement point	Types of measurements	Measured values
2.	V - 3 Coordinates 7500382 4723776	1. Ttransversal (X)	Measured 0.381 mm/s;
		2. Vertical (Y)	Measured 0.254 mm/s;
		3. Longitudinal (Z)	Measured 0.318 mm/s;
3.	Vibration calculation equation: $Vr = \sqrt{V t 2 + V v 2 + V l 2}$ (mm/s) Where are Vt – speed transverzal Vv – speed verticale Vl - speed longiudinal		Matura Values 0.557 mm/sec
			Allowed values 6.00 mm/sec

Table 5: Measurement V - 4 southern part of the mine. [6]

1.	Measurement point	Types of measurements	Measured values
2.	V - 4 Coordinates 7500382 4723776	1. Transversal (X)	Measured 0.399 mm/s;
		2. Vertical (Y)	Measured 0.231 mm/s;
		3. Longitudinal (Z)	Measured 0.325 mm/s;
3.	Vibration calculation equation: $Vr = \sqrt{V t 2 + V v 2 + V l 2}$ (mm/s) Where are Vt – speed transverzal Vv – speed verticale Vl - speed longiudinal		Matura Values 0.584 mm/sec
			Allowed values 6.00 mm/sec

Fig. 1 Excavator while working on coal [7]

Fig. 2 Satellite images of rotor excavators while working on coal mining [8]

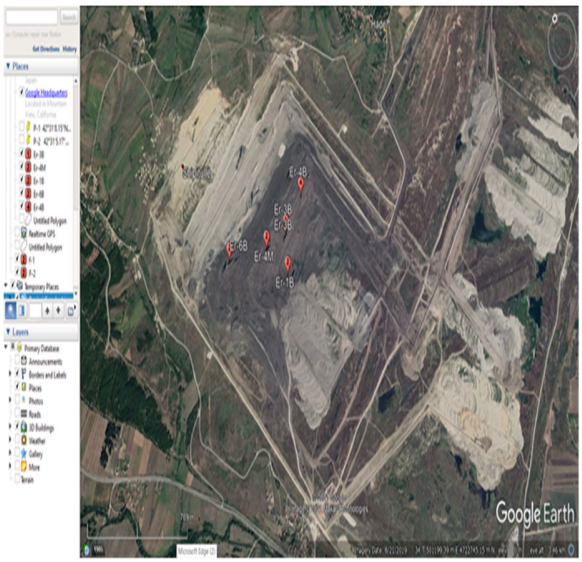


Fig. 3 Satellite images of the mine

2. Measurements

The method of measuring the level of oscillation-vibration, typology for 2021.

Table 6: Vibration measurements during 2021

Index number	Year 2021	Measurement point #1 (mm/sec)	Measurement point #2 (mm/sec)	Measurement point #3 (mm/s)	Measurement point #4 (mm/sec)
1	January	0.342	1.410	0.741	1.900
2	February	0.342	1.410	0.741	1.900
3	March	0.064	0.156	0.142	0.064
4	April	0.059	0.213	0.489	0.963
5	May	0.078	0.485	0.879	1.020
6	June	0.079	0.496	0.852	0.987
7	July	0.457	1.448	0.684	0.901
8	August	1.003	0.291	0.775	0.262
9	September	0.569	0.412	0.561	0.090
10	October	0.371	0.342	0.110	1.440
11	November	0.371	0.342	0.110	1.440
12	December	0426	0.467	0.298	0.311
	Allowed	**6 (mm/sec)**			

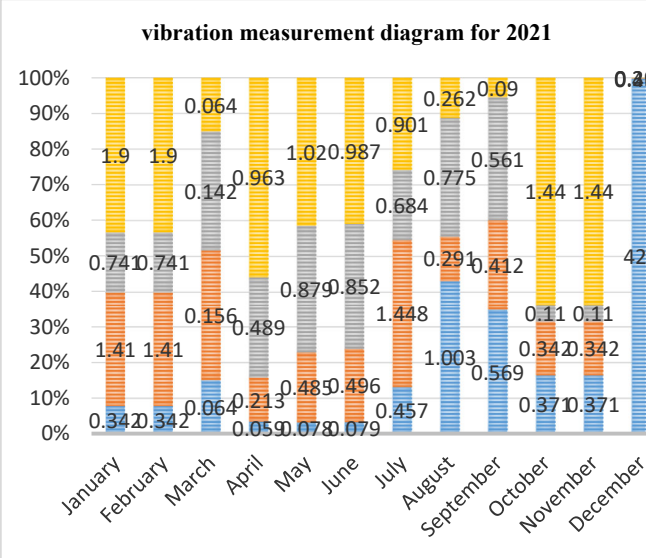
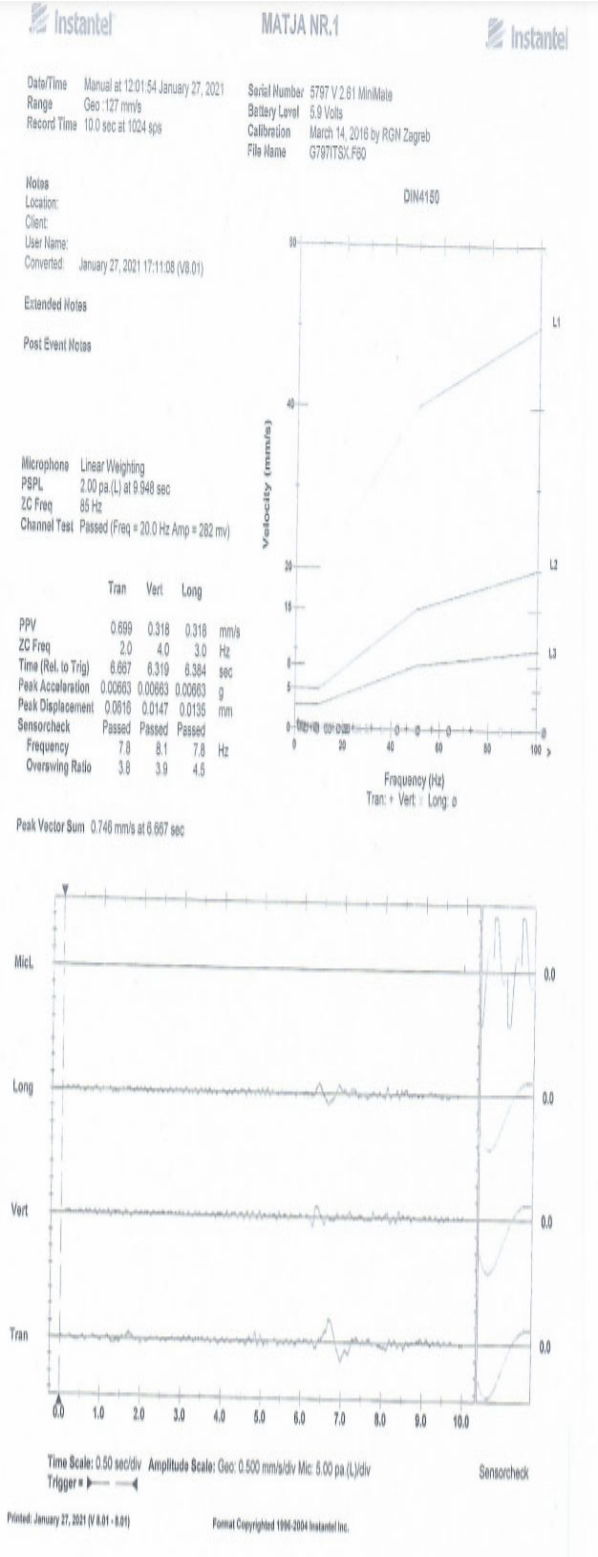
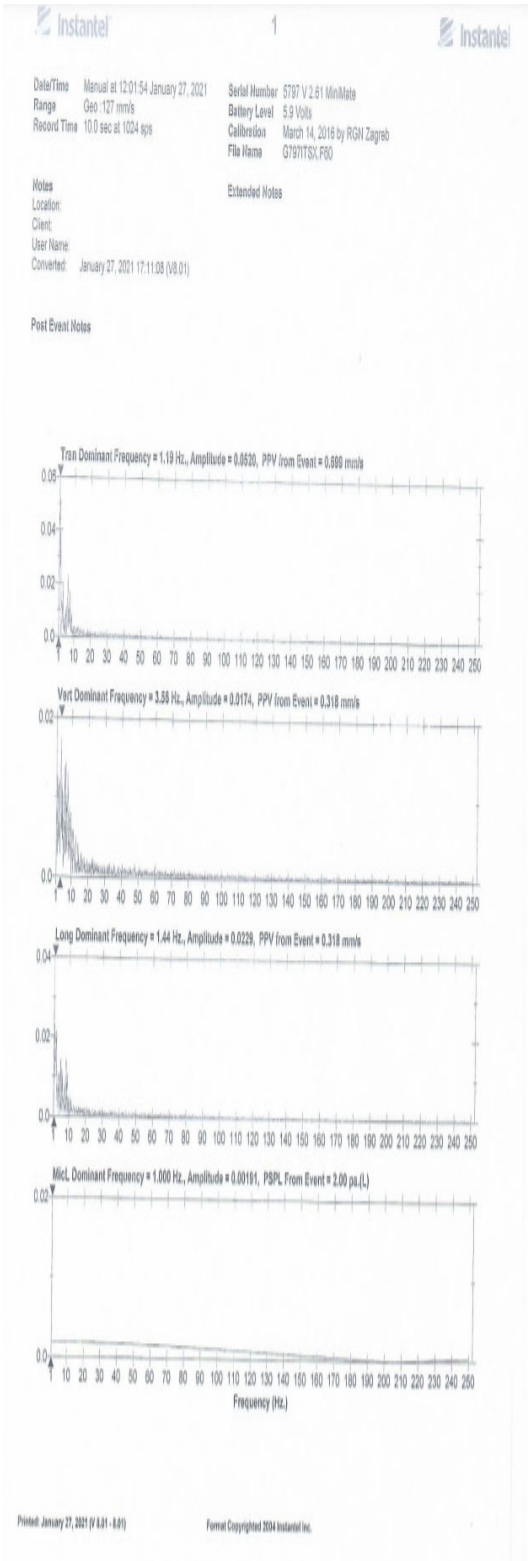


Fig. 4 Measurement diagram for 2021 in the mine Sibovc S outh-west-KEC





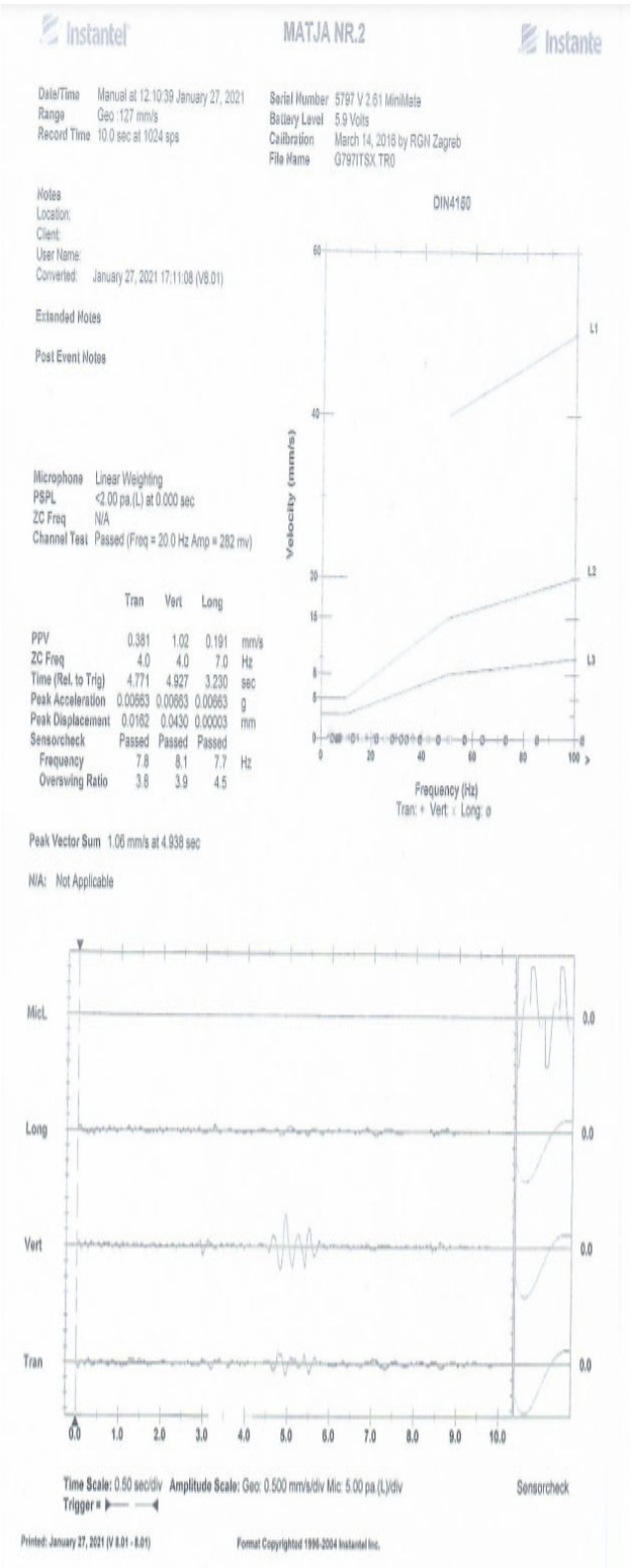
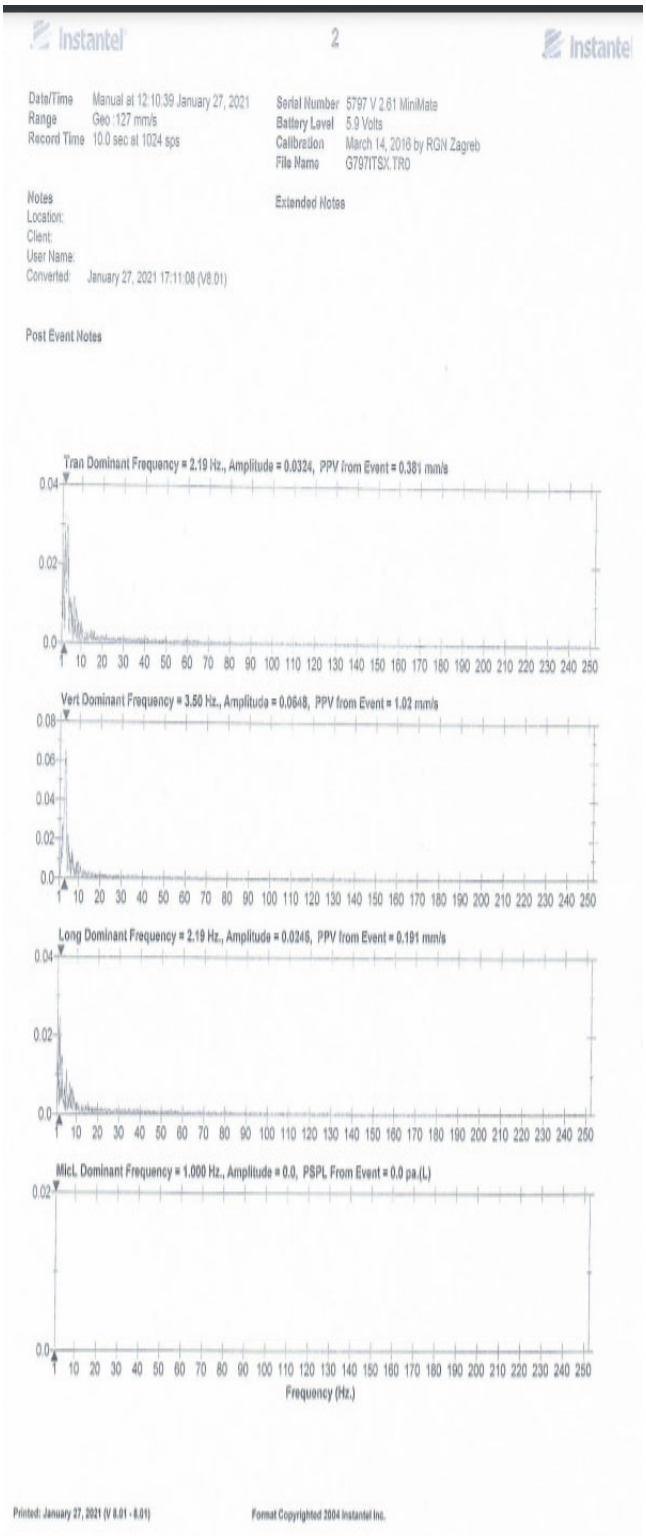


Fig. 5 Measurement number 1



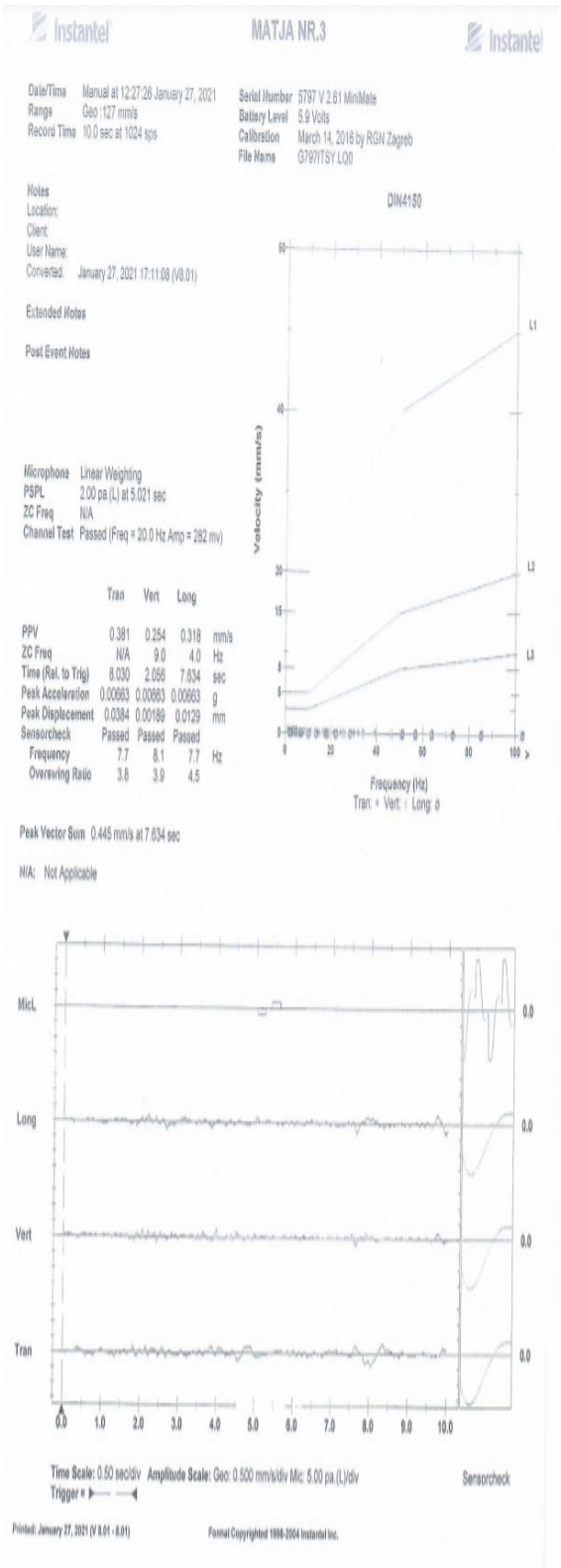


Fig. 6 Measurement number 2

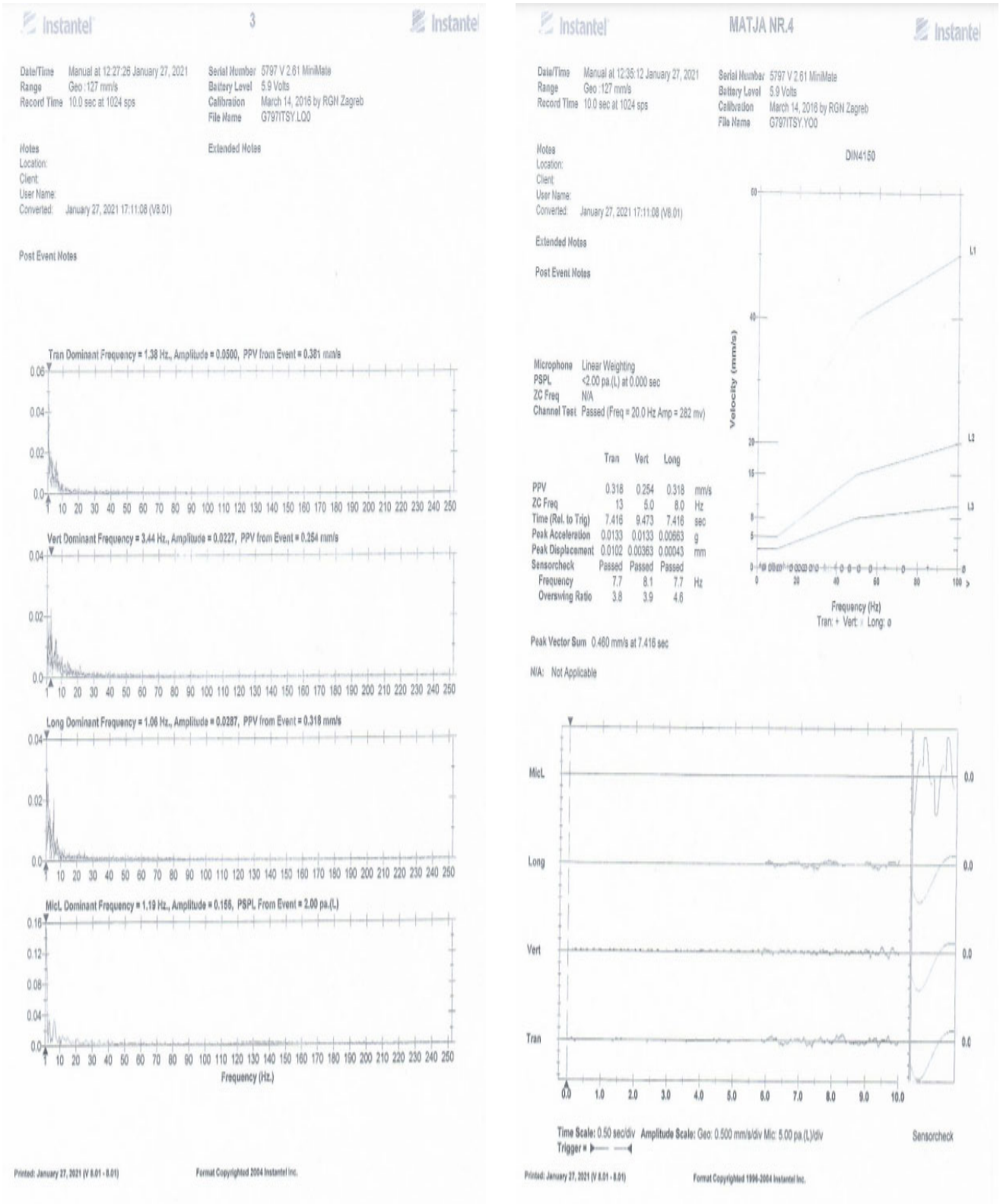


Fig. 7 Measurement number 3

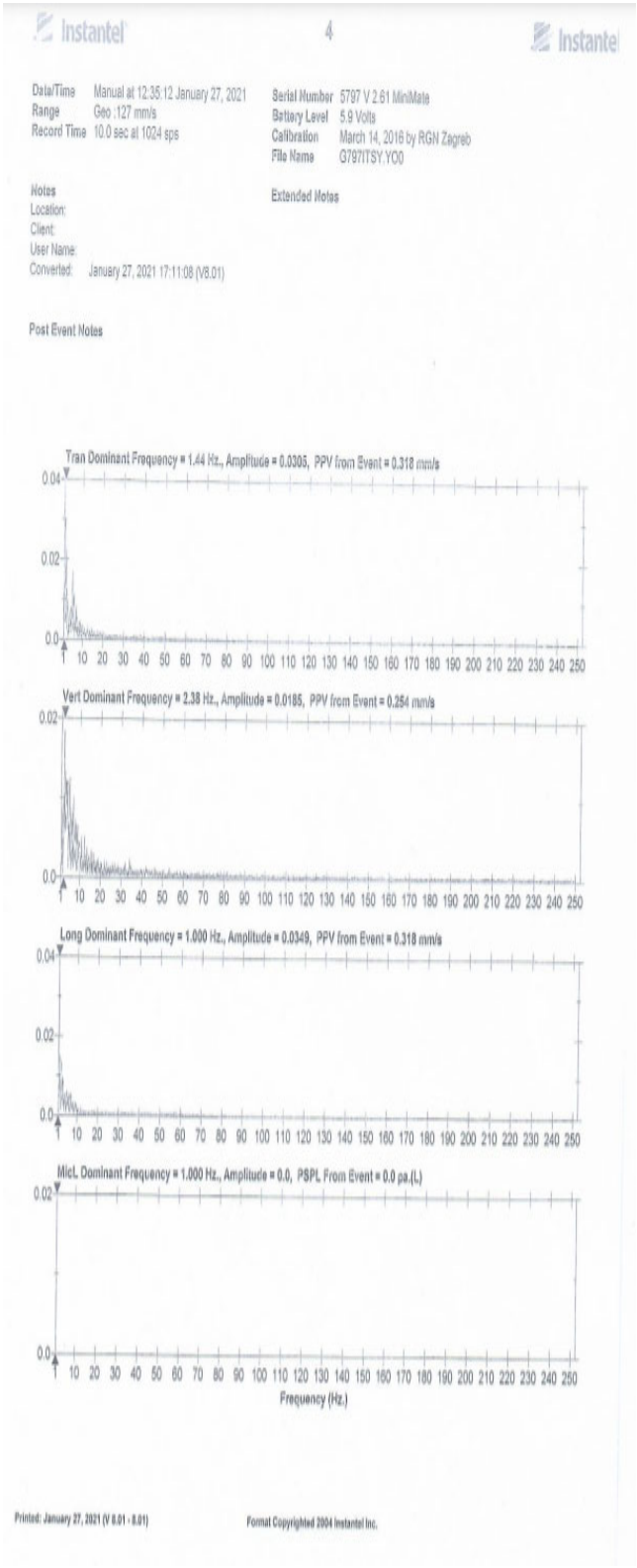


Fig. 8 Measurement number 4

Table 7: Types of measurements: T-transversal, V-vertical, L-lungtidionale

Measuring parameters	Unit measuring	Measuring nr# 1		
		T	V	L
PPV	mm/s	0.699	0.318	0.318
Frequencies	Hz	2.0	4.0	3.0
Length of time measured	Sec	6.667	6.319	6.384
Peak access	g	0.0663	0.0663	0.0663
Peak shift	mm	0.0616	0.0147	0.0135
Frequencies	Hz	7.8	8.1	7.8
Overload ratio	-	3.8	3.9	4.5

Measuring nr #2			Measuring nr #3		
T	V	L	T	V	L
0.318	1.02	0.191	0.381	0.254	0.318
4.0	4.0	7.0	3.9	9.0	4.0
4.771	4.927	3.230	8.03	2.056	7.634
0.0663	0.0663	0.0663	0.0663	0.0663	0.0663
0.0162	0.0430	0.00003	0.0384	0.00189	0.0129
7.8	8.1	7.7	7.7	8.7	7.7
3.8	3.9	4.5	3.8	3.9	4.5

Measuring nr# 4		
T	V	L
0.318	0.254	0.318
1.3	5.0	8.0
7.416	9.473	7.416
0.0133	0.0133	0.0663
0.0102	0.00363	0.00043
7.7	8.1	7.7
3.8	3.9	4.6

3. Conclusion

Table 7 shows the most important data obtained from the software device for the four measurements in the mine, with the measurement technique it can be seen that none of the four measurements have exceeded the measurement parameters distributed throughout the mine. The measured results and comparison with other measurement measurements of earlier years are very close to those of measurements for 2021.

The graphs show a comparison between the mean values of the measurement time and the comparative results of the measurements from the vibration source are within the allowable limits.

Based on the measured values, presented in tables 1, 2, 3 and 4 given in this paper we can conclude that the measured values in tables no. 1, no. 2, no. 3, and no. 4 are allowed,

based on standard no. 44/2002 / EU. The time when we performed the measurements according to the report of the dispatcher at work were the following excavators: Er - 1B, Er - 3B, Er. - 4B, Er.-4B, and Er.-6B. The diagrams are also attached to the measurement report by the software device.

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[8] Projects and measurements taken at the INKOS Institute, Kosovo