Development–Training-Consultancy

Environmental Baseline Measurements Report (Daytime)

For

Upgrading the Railway line between Tanta- El Mansoura – Damietta

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Final Report

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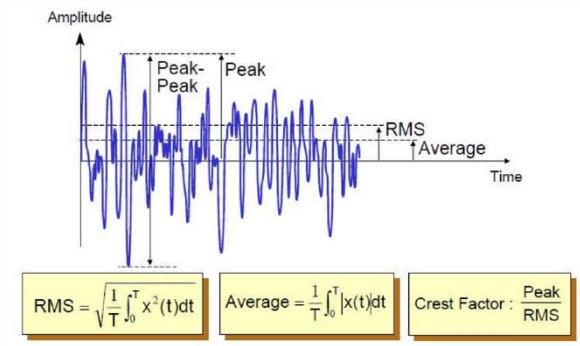
Table of Contents

LIST OF ACRONYMS AND ABBREVIATION

CO	Carbon Monoxide
°C	Celsius
µg/m³	Microgram per cubic meter
Cm³	Cubic meters
dB	Decibel
Ft²	Square Feet
mg/L	Milligram per litter
N/A	Not Available
NO_2	Nitrogen Dioxide
PM_{10}	Particulate Matter
Ppb	Part Per Billion
Ppm	Part Per Million
SO_2	Sulfur Dioxide
TSP	Total Suspended Particulate
RMS	Root-mean-square (RMS = 0.707 peak - V = spectral peaks) $.707\sqrt{V_1^2+V_2^2+V_3^2+\ldots V_n^2}$



Spectrum	Spectrum of vibrations

1. Introduction

This report is prepared according to the request of EcoConServ Environmental Solutions for conducting baseline measurements along the railway line between Tanta - El Mansoura – Damietta during the daytime.

Air quality, noise and vibration levels monitoring are carried out as part of the environmental baseline description of the proposed project of upgrading the railway line between Tanta - El Mansoura – Damietta (including the doubling between El Mansoura and Damietta) along five consecutive days (From Sunday 6th of September 2020 to Thursday 10th of September 2020).

Air quality monitoring are undertaken for the pollutants of primary concerns (NO_2, SO_2, CO, T.S.P and PM_{10}); in order to better characterize the ambient air quality, as part of the environmental measurements required. Where, eight hours average measurements of one-hour interval were conducted for carbon monoxide (CO), nitrogen dioxide (NO_2), Sulphur dioxide (SO_2), Total Suspended Particulates (T.S.P) and Particulate Matter (PM_{10}), for ten specific locations, where the air quality complies with the national and international guidelines for all the analysed parameters. The site-specific air quality measurements had conducted using Standard ambient air quality monitoring instruments under the supervision of experienced specialists. Noise levels had been measured at the same ten locations with eight hours average measurements of one-hour interval were conducted as per the international standard using 1 Device Bruel & Kjaer (B&K) Modular Precision Sound Analyzer Type 2238, 1 Device Bruel & Kjaer (B&K) Modular Precision Sound Analyzer Type 2245 the world's leading company in noise measurement, located in Denmark.

Vibration spot levels at the same locations with eight hours average of one-hour interval were measured as per the international standard using COMPASS Monitoring System – Type 3540, Bruel & Kjaer Vibra. While vibration simulation have been conducted using the vb8 analyzer.

2. Objectives

The overall objectives of this measurement are to:

- Assess/confirm compliance of the air quality in the ambient environment, noise and vibration levels with relevant national and international guidelines;
- Identify any non-compliance issues, if any; and
- Provide general conclusions based on analysis results.

3. Scope of Work

The scope of work of the present measurements includes the sampling and analysis of ambient air quality, noise and vibration levels to distinguish their compliance levels before starting the project activities. The baseline measurements were conducted in ten locations along the railway line between Tanta – El Mansoura - Damietta.

4. Sampling Strategy

The selection of the measurement locations were based on the following parameters:

- The nearest sensitive receptors located along the railway line between Tanta – El Mansoura – Damietta including the area between El Mansoura and Damietta (where the double track will be constructed);
- The nearest potential source of air emissions as well as all the areas of high noise and vibration potential;
- The minimum and maximum noise levels that could occur.

The measurements were conducted along five consecutive days for one-hour average results of 8-hour to cover the different conditions that occurred along the day such as:

- ***Baseline Condition:*** – Without passage of trains
- ***Condition II:*** With passage of one train

- ***Condition III:*** With passage of two trains simultaneously (Which is the worst case scenario in the current railway line between Tanta and El Mansoura and considered as forecast for the new doubling project between El Mansoura and Damietta).

5. Measurements Plan & Locations

The following table shows the baseline measurements' plan including the GPS coordinates of each measurement point and its relevant station.

Railway Current Conditions	Point #	Station Name	Kilometric Reference	GPS Coordinates	Air Quality (8 hours)	Noise and Vibration Levels (8 hours)		
						No Train	One Train	Two Trains simultaneously
Double Railway Line	1	El Ragddya	8.34	30°49'53.00"N 31° 2'52.00"E	√	√	√	√
	2	Mahlet Rawh	14.80	30°52'25.50"N 31° 5'5.43"E	√	√	√	√
	3	El Mahala El Kobra	27.65	30°58'11.00"N 31°10'15.60"E	√	√	√	√
	4	Samannoud	35.24	30°57'48.79"N 31°14'44.21"E	√	√	√	√
	5	El Mansoura	54.60	31° 2'26.00"N 31°23'7.60"E	√	√	√	√
Single Railway Line	6	Battra	66.357	31° 7'16.99"N 31°25'8.75"E	√	√	√	
	7	Sherbine	75.66	31°11'28.00"N 31°31'41.60"E	√	√	√	
	8	Ras Al Khaleej	82.23	31°14'49.00"N 31°37'5.66"E	√	√	√	
	9	Taftish Kafr Saad	101.649	31°19'9.75"N 31°39'22.36"E	√	√	√	
	10	Damietta	116.179	31°25'21.00"N 31°48'8.60"E	√	√	√	

The below figure shows the location of the baseline measurements.

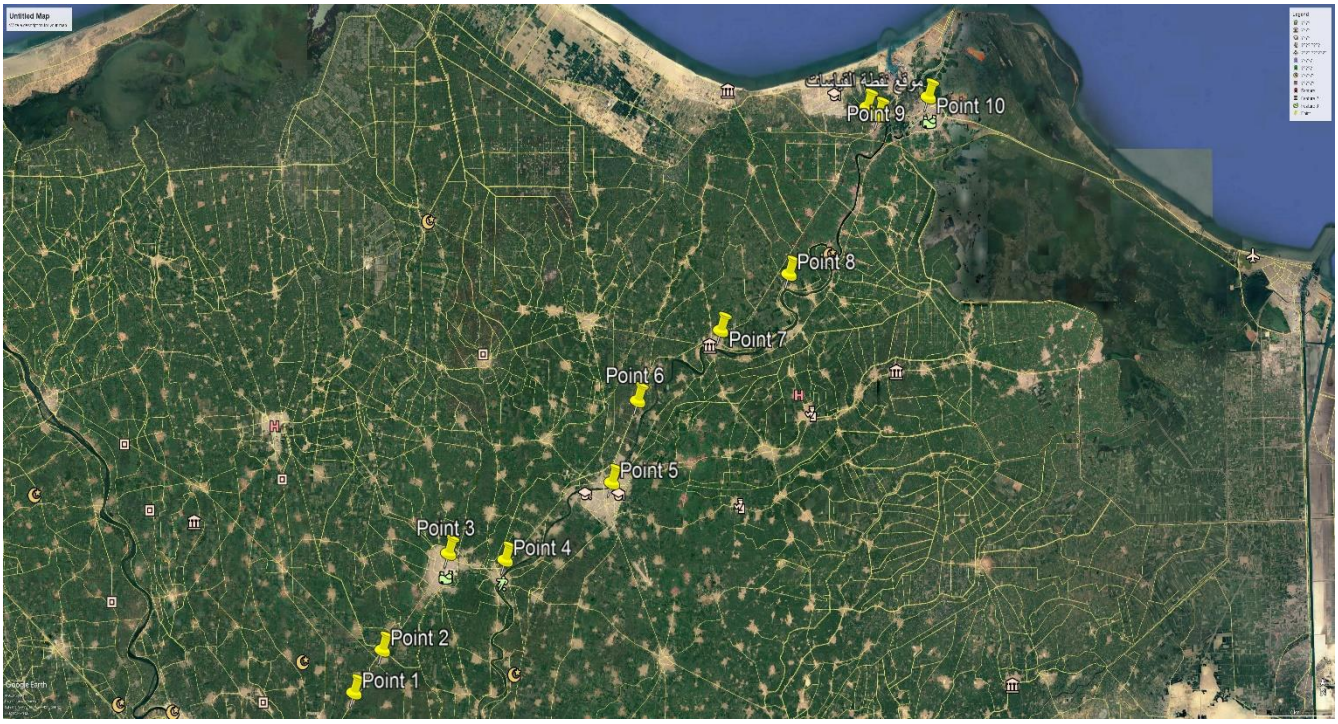


Figure 1: Satellite map showing the location of the baseline measurements

6. National Legislation and International Standards

The following tables present the national and international legislations and standards that are used as a reference to compare the analysis results and identify its compliance status.

6.1 Ambient Air Quality

6.1.1 National Permissible Limits

The following table shows the maximum permissible air quality limits as per the Egyptian laws and regulations.

Table 1: Maximum limits of outdoor air pollutants (ambient air quality) – Residential Urban area

Annex 5-ER Law 4/1994 (as amended by decree No. 710/2012)					
Pollutant	**Carbon Monoxide (CO)**	**Sulfur Dioxide (SO_2)**	**Nitrogen Dioxide (NO_2)**	**Total Suspended Particulate (TSP)**	**Particulate Matter (PM_{10})**
Average Period	1 hour	1 hour	1 hour	1 hour	1 hour
Maximum Limit Value (µg/m³)	30 mg/m³	300	300	-----	-----
Average Period	8 hour	8 hours	8 hours	8 hours	8 hours
Maximum Limit Value (µg/m³)	10 mg/m³	----	----	-----	-----

6.1.2 International Permissible Limits (IFC Guidelines)

As per the general Environmental, Health and Safety guidelines[1], the ambient air emissions should be compliant with the limits stated in the below table.

Table 2: Ambient Air Quality Limits as per the IFC general Environmental, Health and Safety guidelines

Pollutant	Average Period	Guideline Value in µg/m³
Sulfur Dioxide (SO_2)	1 hour 8 hours	NA NA

[1] https://www.ifc.org/wps/wcm/connect/4e01e089-ad1a-4986-b955-e19e1f305ff0/1-1%2BAir%2BEmissions%2Band%2BAmbient%2BAir%2BQuality.pdf?MOD=AJPERES&CVID=ls0KF2J

Pollutant	Average Period	Guideline Value in µg/m³
	24 hours	20
Nitrogen Dioxide (NO_2)	1 hour 8 hours 24 hours	200 NA NA
Particulate Matter (PM_{10})	1 hour 8 hours 24 hours	NA NA 50
Particulate Matter ($PM_{2.5}$)	1 hour 8 hours 24 hours	NA NA 25

6.2 Ambient Noise Levels

6.2.1 National Permissible Limits

The following table shows the maximum limits of noise level exposure in different areas pursuant to the Council of Ministers Resolution No. 1095/2011 amended by decree number 710/2012.

Table 3: Maximum permissible noise level limits – Residential Area

Table 3-Annex 7- ER of Law 4/1994 (as amended by Decrees No. 1095/2011 and 710/2012)		
Area Type	Maximum Permissible Equivalent Noise Level [dB (A_{eq})]	
	(Day) (7 am – 10 pm)	Night (10 pm – 7 am)
Residential areas that are located adjacent to roads which width is less than 12 m, and have some workshops, commercial activities, administrative activities, or recreational activities..., etc.	65 dB	55 dB

6.2.2 International Permissible Limits (IFC Guidelines)

As per the general Environmental, Health and Safety guidelines[2], the noise limits should not exceed the limits presented in the following table:

Table 4: Noise limits as per IFC guidelines

Location Category	Limits in decibels, dB(A)	
	(Day) (7 am – 10 pm)	Night (10 pm – 7 am)
Residential institutional, educational	55 dB	45 dB

6.3 VIBRATION LIMITS

The following are the threshold limits of exposure to vibration according to Ministerial Decree 211/2003 (Table 10).

Table 5: The threshold limits of exposure to vibration according to Ministerial Decree 211/2003

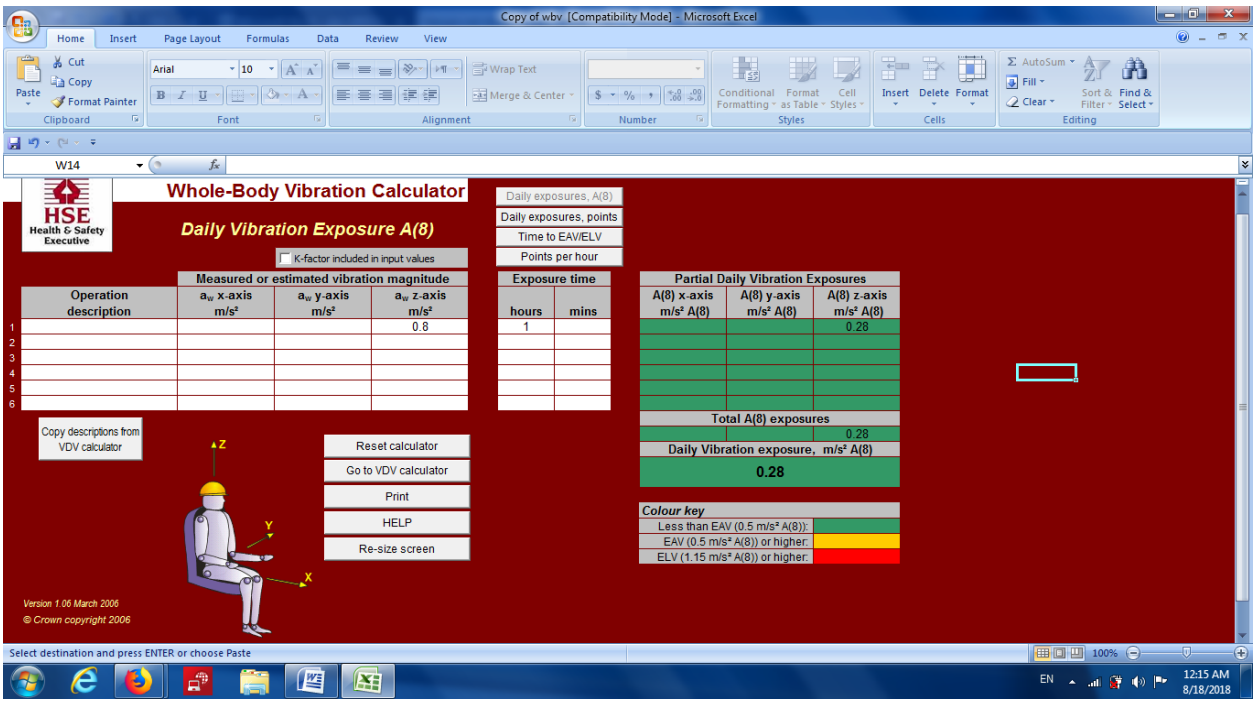
Daily exposure period	The square root of the dominant effect of any axis of the daily exposure period of the three axes, which should not be exceeded (m/s^2)
4 hours and less than 8 hours	4
2 hours and less than 4 hours	6
An hour and less than 2 hours	8
less than an hour	12

The yellow-highlighted row represents the appropriate vibration level limit according to the number of hours of exposure to the selected machines.

[2] https://www.ifc.org/wps/wcm/connect/4a4db1c5-ee97-43ba-99dd-8b120b22ea32/1-7%2BNoise.pdf?MOD=AJPERES&CVID=ls4XYBw

Other Relevant Vibration Standards

- Health and Safety "The Control of Vibration at Work Regulations 2005 no.1093"[3]
  - For whole body vibration, the daily exposure action value (EAV) is 0.5 m/s^2. If exceeded, action must be taken to reduce workers' exposure to vibration. The daily exposure limit value (ELV) is 1.15 m/s^2, which must not be exceeded.
  - Daily vibration exposure is calculated based on the model below[4]. The input to the model are the measured vibration and the exposure time. The output is the daily vibration exposure denoted as A (8) and is also given a colour indicating how compliant it is with the previously stated threshold values (EAV and ELV).



- ISO/TC 108/SC 4 - Human exposure to mechanical vibration and shock
- ISO 2631-5:2004 - Mechanical vibration and shock -- evaluation of human exposure to whole-body vibration -- part 5: method for evaluation of vibration containing multiple shocks

[3] http://www.legislation.gov.uk/uksi/2005/1093/pdfs/uksi_20051093_en.pdf
[4] http://www.hse.gov.uk/vibration/wbv/wbv.xls

7. ANALYSIS RESULTS

7.1 Air Quality Measurement Results

Ten locations were samples over 8 hours for air quality. The parameters measured are Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), Total Suspended Solids (TSP) and Particulate Matter (PM_{10}). The following table shows the measurements results for the air quality based on one-hour average results for 8 hours continuous measurements, compared with the maximum permissible limits in the Egyptian Environment Law as well as the international guidelines and standards.

Table 6: Air measurements (Hourly average results (µg/m³)) for Point (1) - El Ragddya– Double Track Railway Station

Time	Condition	NO_2	SO_2	CO (mg/m³)	PM_{10}	T.S.P
09:00 AM	One train	5.4	1.4	4.6	58	111
10:00 AM	Two trains	16.1	3.2	4.6	127.4	138
11:00 AM	One train	5.7	1.1	4.5	60.1	117
12:00 PM	One train	5.2	1.3	4.5	61.2	118.5
1:00 PM	No train	2.6	0.6	4.6	56.7	106.4
2:00 PM	One train	5.6	1.3	4.6	62.6	113.3
3:00 PM	One train	5.6	1.2	4.7	58.2	119.7
4:00 PM	Two trains	12.8	3.5	4.8	126.1	144.9
Average		**7.38**	**1.7**	**4.61**	**76.29**	**121.1**
National Limits (µg/m³)		**300**	**300**	**30 (mg/m³)**	-----	-----

Table 7: Air measurements (Hourly average results (µg/m³)) for Point (2) - Mahlet Rawh – Double Track Railway Station

Time	Condition	NO_2	SO_2	CO (mg/m³)	PM_{10}	T.S.P
09:00 AM	Two trains	10.9	2.4	4.8	144	181.3
10:00 AM	No train	1.8	0.8	5	76	111.2
11:00 AM	One train	7.7	1.9	4.9	123.1	142.5
12:00 PM	No train	1.7	0.8	5	83	116.7
1:00 PM	No train	1.1	0.6	5	85	130
2:00 PM	No train	1	0.8	5.1	96	134.4
3:00 PM	One train	7.8	1.2	5.2	102.8	147.1
4:00 PM	Two trains	10.7	0.7	5.2	195.1	187.4
Average		**5.34**	**1.15**	**5.03**	**113.13**	**143.83**
National Limits (µg/m³)		**300**	**300**	**30 (mg/m³)**	-----	-----

Table 8: Air measurements (Hourly average results (µg/m³)) for Point (3) - El Mahala El Kobra – Double Track Railway Station

Time	Condition	NO_2	SO_2	CO (mg/m³)	PM_{10}	T.S.P
09:00 AM	Two trains	5.7	1.6	5.3	97.6	101.5
10:00 AM	No train	3.2	0.9	5.4	53.3	72.4
11:00 AM	Two trains	5.2	1.3	5.5	87.2	133
12:00 PM	No train	3.1	1.2	5.5	50.5	66.6
1:00 PM	No train	3.8	1.1	5.5	32.2	58.9

Time	Condition	NO_2	SO_2	CO (mg/m^3)	PM_{10}	T.S.P
2:00 PM	No train	1.8	1	5.6	38.4	42.7
3:00 PM	Two trains	4.6	1.5	5.6	92.3	101
4:00 PM	No train	2.1	0.6	5.7	58.3	42.8
Average		**3.69**	**1.15**	**5.51**	**63.73**	**77.36**
National Limits ($\mu g/m^3$)		**300**	**300**	**30 (mg/m^3)**	-----	-----

Table 9: Air measurements (Hourly average results ($\mu g/m^3$)) for Point (4) - Samannoud – Double Track Railway Station

Time	Condition	NO_2	SO_2	CO (mg/m^3)	PM_{10}	T.S.P
09:00 AM	No train	1.4	0.6	4.9	64.2	124.3
10:00 AM	One train	6.1	1	5	80.9	138.2
11:00 AM	No train	3.8	0.6	5	56.6	86
12:00 PM	No train	1.4	0.7	5	83.1	114.8
1:00 PM	No train	0.4	0.6	5.1	78	139.7
2:00 PM	Two trains	8.8	0.7	5.1	86.4	141.4
3:00 PM	No train	2	0.6	5.2	79.1	105
4:00 PM	Two trains	5.5	1.1	5.2	87.1	146.2
Average		**3.68**	**0.69**	**5.06**	**75.47**	**124.45**
National Limits ($\mu g/m^3$)		**300**	**300**	**30 (mg/m^3)**	-----	-----

Table 10: Air measurements (Hourly average results ($\mu g/m^3$)) for Point (5) - El Mansoura – Double Track Railway Station

Time	Condition	NO_2	SO_2	CO (mg/m^3)	PM_{10}	T.S.P
09:00 AM	No train	2.5	1.1	5.3	42.9	81.6
10:00 AM	One train	6.9	1.2	5.4	57.6	102.5
11:00 AM	No train	2.2	0.4	5.5	49.1	101.2
12:00 PM	One train	5.5	1.5	5.4	57.3	112
1:00 PM	No train	4.1	1	5.6	44.4	81.7
2:00 PM	No train	2.4	0.6	5.6	48.2	89.7
3:00 PM	One train	5.4	1.4	5.6	58	139.12
4:00 PM	Two trains	11.9	1.6	5.7	102.3	177.4
Average		**5.11**	**1.10**	**5.51**	**57.48**	**110.65**
National Limits ($\mu g/m^3$)		**300**	**300**	**30 (mg/m^3)**	-----	-----

Table 11: Air measurements (Hourly average results ($\mu g/m^3$)) for Point (6) - Al-Battra – Single Track Railway Station

Time	Condition	NO_2	SO_2	CO (mg/m^3)	PM_{10}	T.S.P
09:00 AM	No train	2.8	0.9	4.8	59.8	69.4
10:00 AM	One train	5.1	0.5	5	83	152.8
11:00 AM	No train	1.6	0.7	5	57	118.9
12:00 PM	One train	4.1	0.6	5	102.9	189.1
1:00 PM	No train	1.3	0.6	5.1	61.5	124
2:00 PM	One train	4.1	0.6	5.1	93.1	171.1

Time	Condition	NO_2	SO_2	CO (mg/m^3)	PM_{10}	T.S.P
3:00 PM	No train	0.4	0.9	5.2	51.6	110.1
4:00 PM	One train	5.8	0.6	5.2	99.6	188.2
Average		**3.15**	**0.68**	**5.05**	**76.06**	**140.45**
National Limits ($\mu g/m^3$)		**300**	**300**	**30 (mg/m^3)**	-----	-----

Table 12: Air measurements (Hourly average results ($\mu g/m^3$)) for Point (7) - Sherbine – Single Track Railway Station

Time	Condition	NO_2	SO_2	CO (mg/m^3)	PM_{10}	T.S.P
09:00 AM	One train	3.8	0.8	5.4	60.1	128
10:00 AM	No train	3.4	1	5.3	36.9	79.1
11:00 AM	One train	5.4	0.4	5.6	64.2	131.4
12:00 PM	No train	2	1	5.4	47	45.5
1:00 PM	No train	1.8	1	5.6	55.2	97.8
2:00 PM	No train	2.1	1.1	5.6	45.3	78
3:00 PM	One train	3	0.9	5.6	79.7	187.1
4:00 PM	One train	5.9	0.6	5.7	74.7	181
Average		**3.43**	**0.85**	**5.53**	**57.89**	**115.99**
National Limits ($\mu g/m^3$)		**300**	**300**	**30 (mg/m^3)**	-----	-----

Table 13: Air measurements (Hourly average results ($\mu g/m^3$)) for Point (8) - Ras Al Khaleej – Single Track Railway Station

Time	Condition	NO_2	SO_2	CO (mg/m^3)	PM_{10}	T.S.P
09:00 AM	No train	2.2	0.7	4.8	55.8	68.14
10:00 AM	No train	3.4	0.5	4.9	57.2	59.4
11:00 AM	One train	4.8	0.8	5	129.6	178.9
12:00 PM	One train	3.1	0.6	5	100.5	140
1:00 PM	One train	3	0.6	5.1	105.1	168.2
2:00 PM	No train	2.7	0.9	5.1	58.1	65
3:00 PM	No train	1.3	0.9	5.2	53.9	70
4:00 PM	No train	0.9	0.7	5.2	56.5	52.12
Average		**2.68**	**0.71**	**5.04**	**77.09**	**100.22**
National Limits ($\mu g/m^3$)		**300**	**300**	**30 (mg/m^3)**	-----	-----

Table 14: Air measurements (Hourly average results ($\mu g/m^3$)) for Point (9) - Taftish Kafr Saad – Single Track Railway Station

Time	Condition	NO_2	SO_2	CO (mg/m^3)	PM_{10}	T.S.P
09:00 AM	No train	2.9	0.8	5.4	49.4	54.12
10:00 AM	No train	1.7	1.1	5.4	46.5	77.1
11:00 AM	One train	4.5	0.3	5.6	77.2	99.12
12:00 PM	One train	4.5	0.6	5.4	67.2	87.4
1:00 PM	One train	4.7	1.1	5.5	91.9	117.9
2:00 PM	One train	6.6	1	5.6	64.7	133.2
3:00 PM	No train	2.1	0.8	5.6	43	71.6

Time	Condition	NO_2	SO_2	CO (mg/m^3)	PM_{10}	T.S.P
4:00 PM	No train	1.9	0.5	5.7	48.9	88.4
Average		**3.61**	**0.78**	**5.53**	**61.10**	**91.11**
National Limits ($\mu g/m^3$)		**300**	**300**	**30 (mg/m^3)**	-----	-----

Table 15: Air measurements (Hourly average results ($\mu g/m^3$)) for Point (10) - Damietta – Single Track Railway Station

Time	Condition	NO_2	SO_2	CO (mg/m^3)	PM_{10}	T.S.P
09:00 AM	No train	2.8	0.7	4.6	48.9	72.3
10:00 AM	No train	1.2	1	4.59	56.4	79.5
11:00 AM	One train	5.3	1.3	4.56	94.4	172.6
12:00 PM	One train	5.9	1.3	4.57	66.9	108.2
1:00 PM	No train	2.8	1.2	4.62	44.7	74.8
2:00 PM	One train	5.1	1	4.7	88.1	101.1
3:00 PM	No train	2.3	1.1	4.8	62.2	81
4:00 PM	No train	3	1	4.9	59.3	69.1
Average		**3.55**	**1.08**	**4.67**	**65.11**	**94.83**
National Limits ($\mu g/m^3$)		**300**	**300**	**30 (mg/m^3)**	-----	-----

The analysis results of each parameter show that it comply with the allowable limits in the Egyptian law as well as the international standards and guidelines.

7.2 Ambient Noise Measurement Results (8 Hours)

With the aim of determining the background noise levels, and comparing it to the national, international laws, and standards, 10 ambient noise measurement points were measured onsite. The following tables show the analysis results of Ambient (8 Hours) Noise levels for the 10 points compared with the maximum permissible limits stated in the Egyptian law as well as the IFC standards.

Table 16: Analysis results for the noise levels at point (1) El Ragddya

Start Time	Condition	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA) Day Time (7 am – 10 pm)	
		LAI eq	LAF10	LAF50	LAF90	LAF95	LA peak	National	International
9:13AM	One Train	80.49	79.37	71.77	57.19	48.87	95.04	65	55
10:13AM	Two Trains	80.62	80.16	71.83	41.73	40.5	96.87		
11:13AM	One Train	79	78.96	68.34	51.15	45.61	94.66		
12:13PM	One Train	75.92	76.02	70.09	47.6	43.77	91.22		
1:13 PM	No train	75.09	74.33	63.07	40.45	39.26	97.14		
2:13 PM	One Train	78.53	76.82	66.38	40.79	37.82	94.12		
3:13PM	One Train	78.3	77.83	68.08	45.5	39.83	95.34		
4:13 PM	Two Trains	80.99	81.88	70.88	47.77	40.3	95.28		

Table 17: Analysis results for the noise levels at Point (2) Mahlet Rawh

Start Time	Condition	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA) Day Time (7 am – 10 pm)	
		LAI eq	LAF10	LAF50	LAF90	LAF95	LA peak	National	International
9:13AM	Two Trains	75.5	80.09	71.52	45.12	42.17	96.83	65	55
9:42 AM	No train	71.3	75.62	67.8	58.42	52.68	98.65		
10:42 AM	One Train	75.87	80.78	64.38	42.47	37.51	101.25		
11:42 AM	No train	71.17	75.93	45.55	34.16	32.74	99.52		
12:42 PM	No train	69.83	74.38	64.69	38.76	34.53	93.28		
1:42 PM	No train	57.79	60.03	44.47	32.72	31.49	95.51		
2:42 PM	One Train	75.95	80.5	71.86	60.4	51.27	100.92		
3:42 PM	Two Trains	75.26	79.83	70.86	60.3	59.1	99.75		

Table 18: Analysis results for the noise levels at Point (3) El Mahala El Kobra

Start Time	Condition	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA) Day Time (7 am – 10 pm)	
		LAI eq	LAF10	LAF50	LAF90	LAF95	LA peak	National	International
9:35 AM	Two Trains	76.13	80.37	72.2	52.37	45.65	100.92	65	55
10:35 AM	No train	76.11	79.04	75.14	70.45	67.69	96.71		
11:35 AM	Two Trains	76.81	81.37	72.03	52.69	47.98	109.29		
12:35 PM	No train	74.78	79.39	70.36	49.01	45.54	97.9		
1:35 PM	No train	75.1	79.25	72.82	53.1	45.95	104.24		
2:35 PM	No train	76.06	78.87	75.24	71.09	69.4	96.24		
3:35 PM	Two Trains	77.69	82.26	73.98	60.13	51.62	100.11		
4:35 PM	No train	75.05	77.94	74.09	69.77	68.24	95.08		

Table 19: Analysis results for the noise levels at Point (4) Samannoud

Start Time	Condition	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA) Day Time (7 am – 10 pm)	
		LAI eq	LAF10	LAF50	LAF90	LAF95	LA peak	National	International
10:01 AM	No train	73	77.06	68.33	52.43	50.36	109.77	65	55
11:01 AM	One Train	77.45	81.16	76.09	53.3	46.72	99.81		
12:01 PM	No train	77.03	80.39	75.98	66.26	61.65	99.52		
1:01 PM	No train	76.48	79.88	75.42	66.54	61.86	99.02		
2:01 PM	No train	76.78	80.23	75.67	64.73	48	99.22		
3:01 PM	Two Trains	80	83.52	78.75	69.46	63	101.15		
4:01 PM	No train	76.54	80.09	75.38	63.45	46.57	100.39		
5:01 PM	Two Trains	77.55	82.05	74.58	48.87	47.96	100.93		

Table 20: Analysis results for the noise levels at Point (5) El Mansoura

Start Time	Condition	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA) Day Time (7 am – 10 pm)	
		LAI eq	LAF10	LAF50	LAF90	LAF95	LA peak	National	International
9:12 AM	No train	77.53	81	76.38	64.94	46.66	102	65	55
10:12 AM	One Train	77.71	81.89	75.32	50.82	47.09	105.65		
11:12 AM	No train	77.62	81.22	76.08	52.04	48.77	101.15		
12:12 PM	One Train	77	79.82	76.51	67.92	64.18	107.99		
1:12 PM	No train	75.95	78.95	75.05	63.82	55.06	117.36		
2:12 PM	No train	74.46	78.33	70.2	56.68	51.84	112.11		
3:12 PM	One Train	78.26	81.84	75.07	51.26	48.72	105.92		
4:12 PM	Two Trains	83	87.41	79.54	55.41	52.53	108.9		

Table 21: Analysis results for the noise levels at Point (6) El Battra

Start Time	Condition	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA) Day Time (7 am – 10 pm)	
		LAI eq	LAF10	LAF50	LAF90	LAF95	LA peak	National	International
8:06 AM	No train	76.95	80.58	75.35	65.85	63.8	111.41	65	55
9:06 AM	One Train	76.35	79.73	74.67	62.97	55.2	112.94		
10:06 AM	No train	75.23	78.86	73.99	49.44	46.08	108.27		
11:06 AM	One Train	76.09	79.17	75.28	66.54	61.06	109.11		
12:06 PM	No train	74.88	79.21	71.96	50.2	46.2	110.67		
1:06 PM	One Train	75.72	81.06	69.92	60.57	56.8	103.45		
2:06 PM	No train	71.31	75.37	69.44	55.92	46.95	108.52		
3:06 PM	One Train	77.58	81.9	74.03	63.12	59.96	112.85		

Table 22: Analysis results for the noise levels at Point (7) Sherbin

Start Time	Condition	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA) Day Time (7 am – 10 pm)	
		LAI eq	LAF10	LAF50	LAF90	LAF95	LA peak	National	International
10:04 AM	One Train	81.79	88.11	87.04	76.11	55.56	51.5	65	55
11:00 AM	No train	74.82	81.32	78.36	70.73	56.44	52.4		
12:00 PM	One Train	83.61	88.32	87.56	82.44	55.2	52.12		
1:00 PM	No train	77.7	82.21	81.47	77.05	45.14	44.53		
2:00 PM	No train	77.58	82.3	81.52	76.75	44.65	44.39		
3:00 PM	No train	77.9	81.34	80.79	77.24	49.02	47.35		
4:05 PM	One Train	85.26	88.92	88.42	85.07	54.63	52.4		
5:00 PM	One Train	83.54	88.98	88.09	79.46	55.8	51.67		

Table 23: Analysis results for the noise levels at Point (8) Ras Al Khaleej

Start Time	Condition	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA) Day Time (7 am – 10 pm)	
		LAI eq	LAF10	LAF50	LAF90	LAF95	LA peak	National	International
9:00 AM	No train	77.44	81.01	74.59	49.65	44.17	116.73	65	55
10:00 AM	No train	79.19	83.46	74.62	50.6	43.78	116.73		
11:00 AM	One Train	80.88	85.16	77.96	65	58.2	102.92		
12:00 PM	One Train	81.88	86.44	76.11	51.28	47.84	111.4		
1:00 PM	One Train	83.93	87.38	82.6	75.22	68.1	104.24		
2:00 PM	No train	75.55	79.11	74.62	45.28	44.05	97.64		
3:00 PM	No train	80.47	85.11	77.48	45.76	44.42	101.97		
4:00 PM	No train	80.68	84.24	79.65	46.14	45.27	100.8		

Table 24: Analysis results for the noise levels at Point (9) Taftish Kafr Saad

Start Time	Condition	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA) Day Time (7 am – 10 pm)	
		LAI eq	LAF10	LAF50	LAF90	LAF95	LA peak	National	International
8:00 AM	No train	79.44	80.56	69	49.17	42.37	100.42	65	55
9:00 AM	No train	80.04	81.71	68.22	44.96	42.84	98.96		
10:00 AM	One Train	85.32	83.9	79.1	67.47	44.34	101.74		
11:00 AM	One Train	85.96	84.35	80.26	74.09	71.28	100.98		
12:00 PM	One Train	85.08	84.59	78.79	68.25	61.52	111.36		
1:00 PM	One train	86.05	86.57	79.56	66.56	57.5	101.57		
2:00 PM	No train	73.79	72.28	68.25	52.9	41.66	88.31		
3:00 PM	No train	73.32	71.8	66.8	51.93	40.18	90.75		

Table 25: Analysis results for the noise levels at Point (10) Damietta

Start Time	Condition	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA) Day Time (7 am – 10 pm)	
		LAI eq	LAF10	LAF50	LAF90	LAF95	LA peak	National	International
8:06 AM	No train	77.21	81.12	75.72	43.34	42.81	98.06	65	55
9:06 AM	No train	78.1	81.92	74.89	48.19	44.61	112.03		
10:06 AM	One Train	79.11	81.85	75.71	44.37	43	116.21		
11:06 AM	One Train	81.39	83.64	77.91	61.82	47.24	116.21		
12:06 PM	No train	77.57	80.72	76.68	50.2	44.51	97.09		
1:06 PM	One train	78.13	82	76.37	43.95	43.13	97.07		
2:06 PM	No train	76.93	80	76.38	58.8	45.76	96.94		
3:06 PM	No train	77.88	83.3	69.71	47.17	45.78	101.25		

The results showed that the noise levels are over the maximum permissible limits according to the national, international laws, and standards and exceed the IFC guidelines.

It is noted that the assessment areas are very crowded (urban areas). The surrounding environment includes several sources of noises such as road traffic, level crossings, movement of vehicles, buses, train horns, etc.

7.3 Vibration Spot Measurements Acceleration m/s² Results

With the aim of measuring the spot vibration onsite during the daytime in the three different conditions of the train passing, ten samples were collected to measure the spot vibrations during daytime. The following tables show the analysis results of Spot vibration (8 Hours) for the 10 points compared with the maximum permissible limits stated in the national law.

Table 26: Analysis results for the spot vibration levels at point (1) El Ragddya

Start Time	Condition	Acceleration (m/s²)	National Limits m/s²
9:13AM	One Train	21.0584	12
10:13AM	Two Trains	116.101	
11:13AM	One Train	40.011	
12:13PM	One Train	15.013	
1:13 PM	No train	0.0274	
2:13 PM	One Train	19.0211	
3:13PM	One Train	20.02	
4:13 PM	Two Trains	58.055	

Table 27: Analysis results for the spot vibration levels at Point (2) Mahlet Rawh

Start Time	Condition	Acceleration (m/s²)	Limits m/s²
9:42 AM	Two Trains	88.071	12
10:42 AM	No train	0.0253	
11:42 AM	One Train	25.049	
12:42 PM	No train	0.0312	
1:42 PM	No train	0.0332	
2:42 PM	No train	0.0204	
3:42 PM	One Train	31.077	
4:42 PM	Two Trains	78.064	

Table 28: Analysis results for the spot vibration levels at Point (3) El Mahala El Kobra

Start Time	Condition	Acceleration (m/s²)	Limits m/s²
9:35 AM	Two Trains	104.111	12
10:35 AM	No train	0.0409	
11:35 AM	Two Trains	79.055	
12:35 PM	No train	0.0301	
1:35 PM	No train	0.0477	
2:35 PM	No train	0.0397	
3:35 PM	Two Trains	65.044	
4:35 PM	No train	0.0503	

Table 29: Analysis results for the spot vibration levels at Point (4) Samannoud

Start Time	Condition	Acceleration (m/s²)	Limits m/s²
10:01 AM	No train	0.0243	12
11:01 AM	One Train	80.215	
12:01 PM	No train	0.0221	
1:01 PM	No train	0.0188	
2:01 PM	No train	0.0208	
3:01 PM	Two Trains	188.115	
4:01 PM	No train	0.0317	

Start Time	Condition	Acceleration (m/s²)	Limits m/s²
5:01 PM	Two Trains	320.36	

Table 30: Analysis results for the spot vibration levels at Point (5) El Mansoura

Start Time	Condition	Acceleration (m/s²)	Limits m/s²
9:12 AM	No train	0.0243	12
10:12 AM	One Train	76.202	
11:12 AM	No train	0.0237	
12:12 PM	One Train	70.212	
1:12 PM	No train	0.0333	
2:12 PM	No train	0.015	
3:12 PM	One Train	80.114	
4:12 PM	Two Trains	91.306	

Table 31: Analysis results for the spot vibration levels at Point (6) El Battra

Start Time	Condition	Acceleration (m/s²)	Limits m/s²
8:06 AM	No train	0.0278	12
9:06 AM	One Train	78.103	
10:06 AM	No train	0.0352	
11:06 AM	One Train	63.111	
12:06 PM	No train	0.0347	
1:06 PM	One Train	50.401	
2:06 PM	No train	0.0211	
3:06 PM	One Train	82.114	

Table 32: Analysis results for the spot vibration levels at Point (7) Sherbin

Start Time	Condition	Acceleration (m/s²)	Limits m/s²
10:00 AM	One Train	51.107	12
11:00 AM	No train	0.0318	
12:00 PM	One Train	41.2	
1:00 PM	No train	0.0232	
2:00 PM	No train	0.0251	
3:00 PM	No train	0.0254	
4:05 PM	One Train	71.17	
5:00 PM	One Train	38.1	

Table 33: Analysis results for the spot vibration levels at Point (8) Ras Al Khaleej

Start Time	Condition	Acceleration (m/s²)	Limits m/s²
9:00 AM	No train	0.0201	12
10:00 AM	No train	0.0234	
11:00 AM	One Train	80.316	
12:00 PM	One Train	70.0145	
1:00 PM	One Train	60.019	
2:00 PM	No train	0.0201	
3:00 PM	No train	0.0217	
4:00 PM	No train	0.0221	

Table 34: Analysis results for the spot vibration levels at Point (9) Taftish Kafr Saad

Start Time	Condition	Acceleration (m/s²)	Limits m/s²
8:00 AM	No train	0.0177	12
9:00 AM	No train	0.0254	
10:00 AM	One Train	34.213	
11:00 AM	One Train	20.101	
12:00 PM	One Train	20.206	
1:00 PM	One train	30.115	
2:00 PM	No train	0.0271	
3:00 PM	No train	0.0256	

Table 35: Analysis results for the spot vibration levels at Point (10) Damietta

Start Time	Condition	Acceleration (m/s²)	Limits m/s²
8:06 AM	No train	0.0201	12
9:06 AM	No train	0.0234	
10:06 AM	One Train	40.055	
11:06 AM	One Train	30.01	
12:06 PM	No train	0.0211	
1:06 PM	One train	55.087	
2:06 PM	No train	0.0217	
3:06 PM	No train	0.0221	

The results showed that in case of passing one train or two trains simultaneously, all the pointed are exceeding the applicable law limits.

7.4 Vibration Simulation Measurements Acceleration m/s² Results

Measurement of vibration long time wave form according to Vibration criteria for ISO 14837-1 Or train Vendor recommendation.

Tools, Setup and Abbreviations:

The vibration measurements were taken using Data collector/ Analyzer Series type GE VB-8, general Electric Bently nevada-Commtest is a Global leader in developing & producing vibration analysis & monitoring instruments. Commtest is dedicated to designing and producing outstanding data acquisition and analysis products for Portable solution, recognized world over for their innovation and value.

Commtest is one of the General Electric (USA) Bently Nevada Condition Monitoring Co. Commtest products give their users the confidence that their plant and machinery are operating within ISO 2372 and ISO 10816 international standards.

Commtest product line-up includes portable vibration data collectors, portable vibration analyzers, portable dedicated balancers, and permanent machinery surveillance systems, all sharing an intelligent user-friendly software interface.

Commtest's vb Series-Scout portable vibration data collectors, portable vibration analyzers, and portable dedicated balancers are the choice for many leading companies around the world and are engineered from the ground up to offer leading-edge reliability, accuracy and usability.

- Acceleration (g or m/s²) overall value for the 0.2 kHz & 1kHz band is measured at each point.

Technical Terms:

I. **Auto Spectrum:** An Auto Spectrum is calculated by multiplying a Fourier Spectrum by its complex conjugate. The Auto Spectrum has magnitude only, and its phase is zero. An Auto Spectrum can have either Linear (RMS) units or Power (MS) units.

II. **Closely Coupled Modes:** Two or more modes that appear as a single peak in any spectral measurement function. This occurs when two or more modes have frequencies close together and sufficiently high damping so that their resonance curves form a single peak.

III. **CMIF:** An acronym for Complex Mode Indicator Function. The CMIF is one of the mode indicator functions used for Multiple Reference curve fitting. CMIFs that are calculated from a Multiple Reference set of FRFs can be used to locate closely coupled modes and repeated roots. Modal participation factors are also calculated with the CMIFs, and are used in succeeding curve fitting steps.

IV. **CoMAC:** An Acronym for Coordinate Modal Assurance Criterion. CoMAC has values from 0 to 1, and indicates whether or not two different shape DOFs are the same. If CoMAC > 0.95, the shape components are the same. If CoMAC > 0.8, the shape components are similar. If CoMAC < 0. the shape components are different.

V. **Cross Spectrum**: A cross-channel measurement, calculated by multiplying the Fourier Spectrum of one signal by the complex conjugate of the Fourier Spectrum of another signal. For OMA, Cross spectra are typically calculated between two or more Roving responses and a (fixed) Reference response. Operating mode shapes can be extracted from a set of Cross spectra using FRF based curve fitting after a deconvolution window has been applied to them.

VI. **Cross-channel Measurement**: A measurement function that is calculated between two different simultaneously acquired signals. Examples are Transfer Functions, ODS FRFs, and Cross spectra.

VII. **DFT:** An acronym for Digital (or sampled) Fourier Transform. The forward FFT transforms a sampled time domain waveform into its equivalent DFT.

VIII. **DOF**: An acronym for Degree-Of-Freedom. A DOF includes a Point number & direction.

IX. **Driving Point**: The Point and direction (DOF) where excitation is applied to a structure. A driving point measurement has the same Roving and Reference DOFs.

X. **EDS**: An acronym for Engineering Data Shape, a general term for any type of data measured from or calculated for two or more points & directions on a machine, structure, or acoustic surface. Engineering data can be Scalar, Translational, or Rotational.

XI. **EMA**: An acronym for Experimental Modal Analysis. During an EMA, the test article is artificially excited with either an impactor or a shaker. The excitation force and one or more responses caused by the force are simultaneously measured, and a set of FRF measurements is calculated The FRFs are then curve fit to obtain a set of experimental modal parameters for the structure.

XII. **FFT**: An acronym for Fast Fourier Transform. The FFT is a numerical algorithm that transforms a uniformly sampled time domain signal into its equivalent DFT (Digital Fourier Transform). The Inverse FFT transforms the DFT into its equivalent sampled time domain signal.

XIII. **Fixed DOF**: A Fixed DOF on a structure model will not move during animation. Fixed DOFs are defined in the Animation Equations Tabs above the Points spreadsheet.

XIV. **Fixed Point**: A Fixed Point has no animation in all three Measurement Axes directions. Points are fixed by executing Draw | Animation Equations | Fix DOFs in the Structure window.

XV. Fourier Spectrum: A Fourier Spectrum is the forward FFT of a uniformly sampled time waveform.

XVI. **FRF**: An acronym for Frequency Response Function. An FRF is a cross-channel frequency domain measurement that defines the dynamic properties of a machine or structure between a response DOF and an excitation force DOF. It is defined as the ratio (response Fourier spectrum / force Fourier spectrum). Excitation force is typically measured with a load cell. Response motion is measured with an acceleration, velocity or displacement transducer. The FRF is a special case of a Transfer Function.

XVII. Measurement Axes: Each Point on a structure model has 3 Measurement Axes. Measurement Axes define the directions in which measurements were made at the Point.

XVIII. **MIMO model**: A Multiple Input Multiple Output frequency domain matrix model that contains all of the dynamic properties of a structure that relate its Inputs to its Outputs. The dynamic properties are contained in a Transfer function matrix. The Transfer function matrix is multiplied by Fourier spectra of multiple Inputs to obtain Fourier spectra of multiple Outputs.

XIX. Modal Model: A set of scaled mode shapes that can be used as a complete representation of the dynamics of a structure. Unit modal mass (UMM) scaling is one method of scaling that preserves the mass and stiffness properties of the structure.

XX. Mode Shape: Modes are used to characterize resonant vibration in structures. Each mode has natural frequency, damping value, and a mode shape. The mode shape is a standing wave deformation of the vibrating structure at its resonant (or modal) frequency.

XXI. Multiple Reference Test: Using two or more fixed exciters or fixed response transducers during a structural test. In a modal test, this is equivalent to measuring two or more rows or columns of the MIMO matrix model.

XXII. **Octave**: An octave is a frequency band where the highest frequency is twice the lowest frequency. Acoustic measurements are often acquired using 1/1, 1/3, or 1/12 octave bands.

XXIII. **ODS**: An acronym for Operating Deflection Shape. An ODS is the deformation of a machine or structure at two or more DOFs (points & directions) due to its own operation and/or externally applied forces. An ODS obtained from a set of time domain responses characterizes the deformation at a specific moment in time. An ODS obtained from a set of cross-channel frequency domain functions characterize the deformation at a specific frequency.

XXIV. **ODS FRF**: A cross-channel frequency domain measurement that is made from operating data. It requires the simultaneous acquisition of two signals, a Roving and a (fixed) Reference response. ODS's can be displayed in animation directly from a set of ODS FRFs. Operating mode shapes can be extracted from a set of ODS FRFs using FRF-based curve fitting after a Deconvolution window has been applied to them.

XXV. **OMA:** Acronym for Operating Modal Analysis or Operational Modal Analysis. An OMA is done when the excitation forces are not or cannot be measured. One or more reference (fixed) responses are used, and Cross spectra or ODS FRFs are calculated instead of FRFs. After Devolution windowing, FRF-based curve fitting can be applied to a set of these measurements to extract operating modal parameters.

XXVI. Operating Mode Shape: A mode shape obtained by curve fitting a set of cross-channel measurements which were calculated from operating (output only) data.

XXVII. **Reference DOF**: The fixed DOF in a set of cross-channel measurements. All cross-channel measurements should have a Roving and a Reference DOF, denoted as; Measurement DOF =

XXVIII. **Roving DOF**: Reference DOF.

XXIX. **Residue:** One of the three modal parameters (along with modal frequency & damping) obtained from FRF-based curve fitting. The modal residue is the constant numerator term in the partial

fraction form of an FRF, and carries the FRF engineering units multiplied by Hz or radians per second. Each mode has a Residue matrix associated with it. The rows and columns of the Residue matrix correspond to the same rows and columns of the FRF matrix model of the structure. The residues from one row or column of the Residue matrix define a Residue mode shape.

XXX. Residue Mode Shape: The Residues from any row or column of the Residue matrix for a mode. A fundamental assumption of EMA and OMA is that; "All rows and columns of the Residue matrix contain the mode shape, multiplied by one of its own components".

XXXI. **Roving DOF**: The DOF that changes in a set of cross-channel measurements. All cross-channel measurements should have a Roving and a (fixed) Reference DOF, denoted as; Measurement DOF = Roving DOF: Reference DOF.

XXXII. Stability Diagram: A graph of modal frequency & damping (or Pole) estimates from different curve fitting model sizes. Pole estimates from different model sizes that are within tolerance limits are said to be stable. When the Save Stable Groups, button is pressed on the Stability tab, each stable group average pole value is added to the Modal Parameters spreadsheet.

XXXIII. Transfer Function: A cross-channel frequency domain measurement between an Output signal and an Input Signal It is defined as the ratio (Output Fourier spectrum / Input Fourier spectrum). An FRF is a special case of a Transfer Function.

XXXIV. Transmissibility: A cross-channel frequency domain measurement typically made from operating data, when excitation forces cannot be measured. A Transmissibility is a special case of a Transfer function where the Output and Input units are the same. It is defined as the ratio (Output Fourier spectrum / Input Fourier spectrum). Operating mode shapes can be obtained from a set of Transmissibility's, calculated between two or more Roving responses and a (fixed) Reference response. A set of Cross spectra can be obtained by multiplying a set of Transmissibility's by a reference Auto spectrum

XXXV. Envelope Analysis (es): Shock pulses from rolling element bearing flaws, and modulated random noise signals from rolling element bearings

XXXVI. Dynamic stiffness measurements

XXXVII. Order Analysis is the art and science of extracting sinusoidal contents of measurements from acoustic-mechanical systems under periodic loading to Investigation of instabilities in rotating machinery (whirling, -----) & Diagnostics on machines running at varying or constant speed

XXXVIII. Signal Enhancement: Extraction of a periodically repeating signal from additive contaminating noise its application: Wave form analysis Reduce background noise, Enhance orders & Separaton of mechanical and electrical vibrations

Overall Reading & Analysis (Spectrum & time):

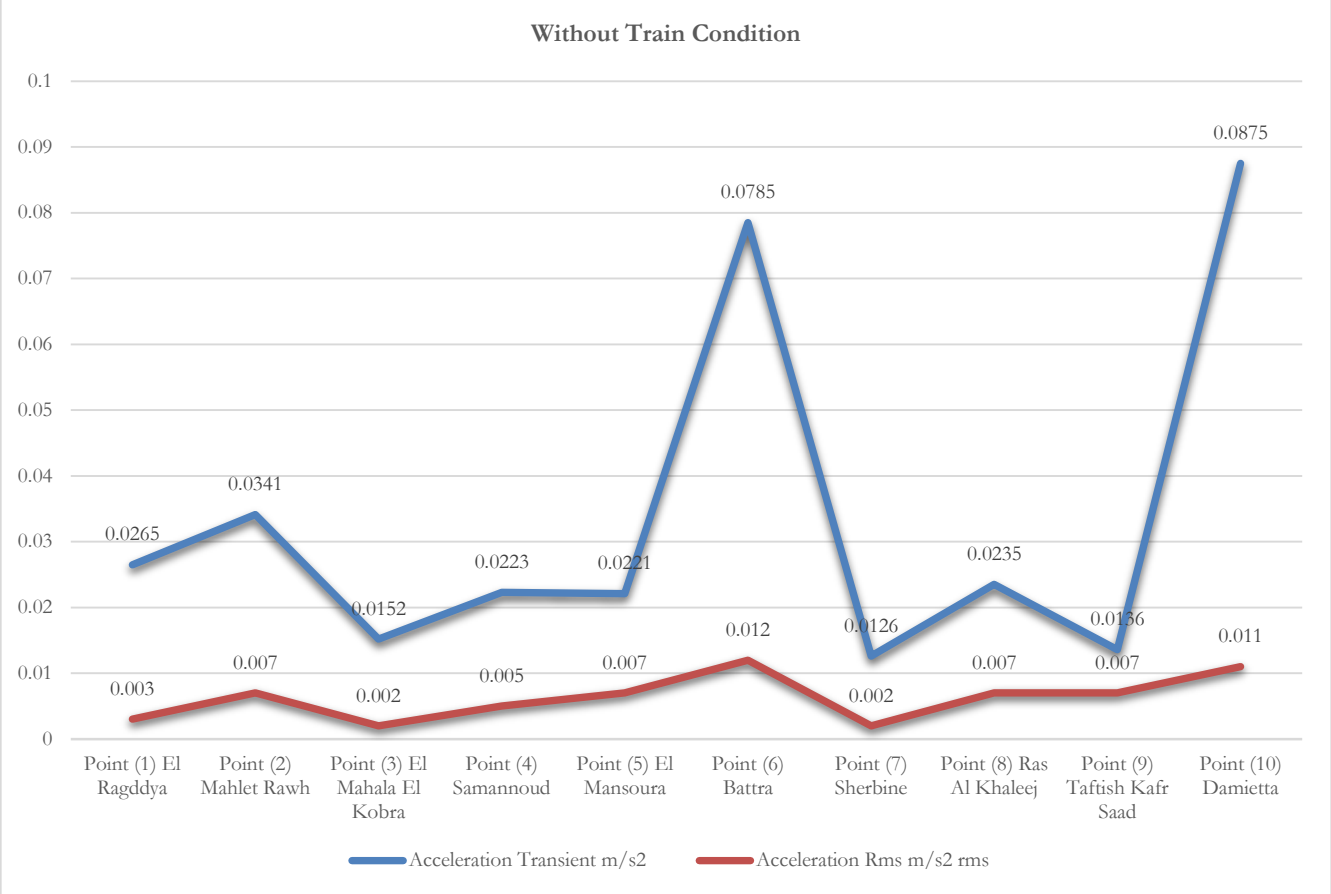
Condition-1 (No Train):

Table 36: Analysis results for the Vibration Simulation

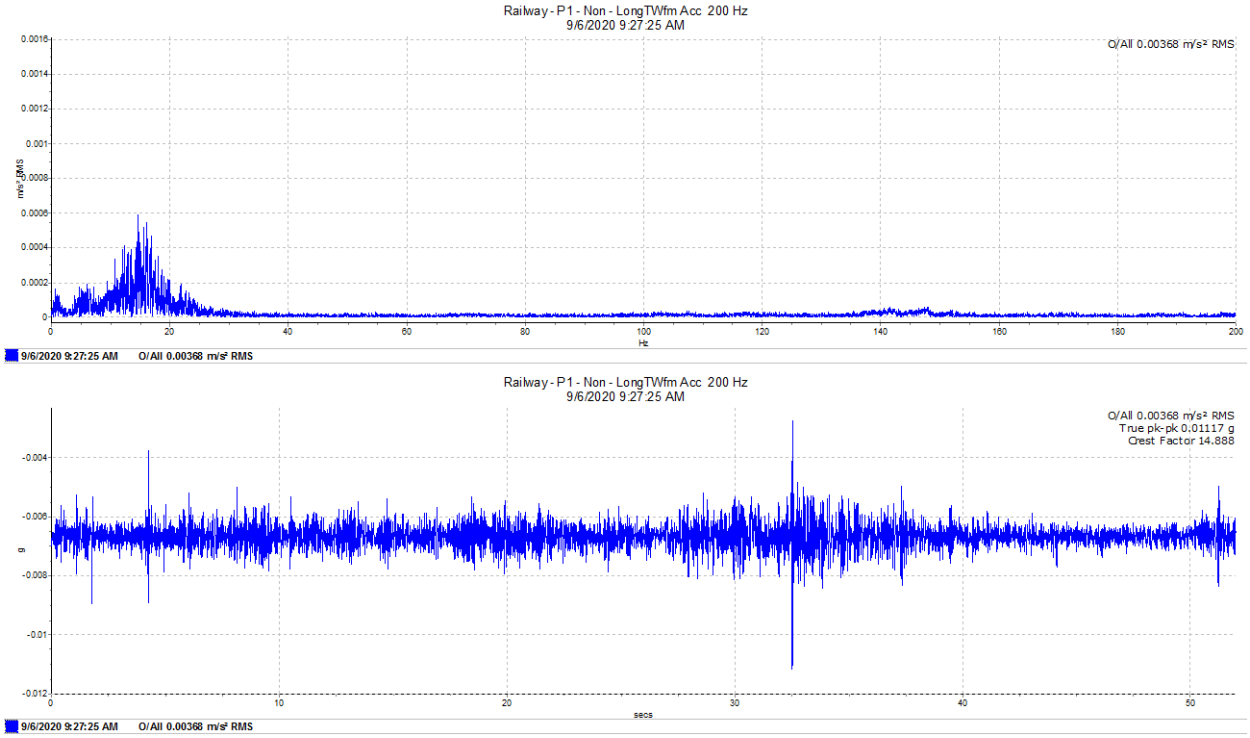
Location	Acceleration Transient m/s^2	Acceleration Rms m/s^2 rms
Point (1) El Ragddya	0.0265	0.003
Point (2) Mahlet Rawh	0.0341	0.007
Point (3) El Mahala El Kobra	0.0152	0.002
Point (4) Samannoud	0.0223	0.005
Point (5) El Mansoura	0.0221	0.007
Point (6) Battra	0.0785	0.012
Point (7) Sherbine	0.0126	0.002
Point (8) Ras Al Khaleej	0.0235	0.007

Point (9) Taftish Kafr Saad	0.0136	0.007
Point (10) Damietta	0.0875	0.011

The following figure shows the analysis results compared.

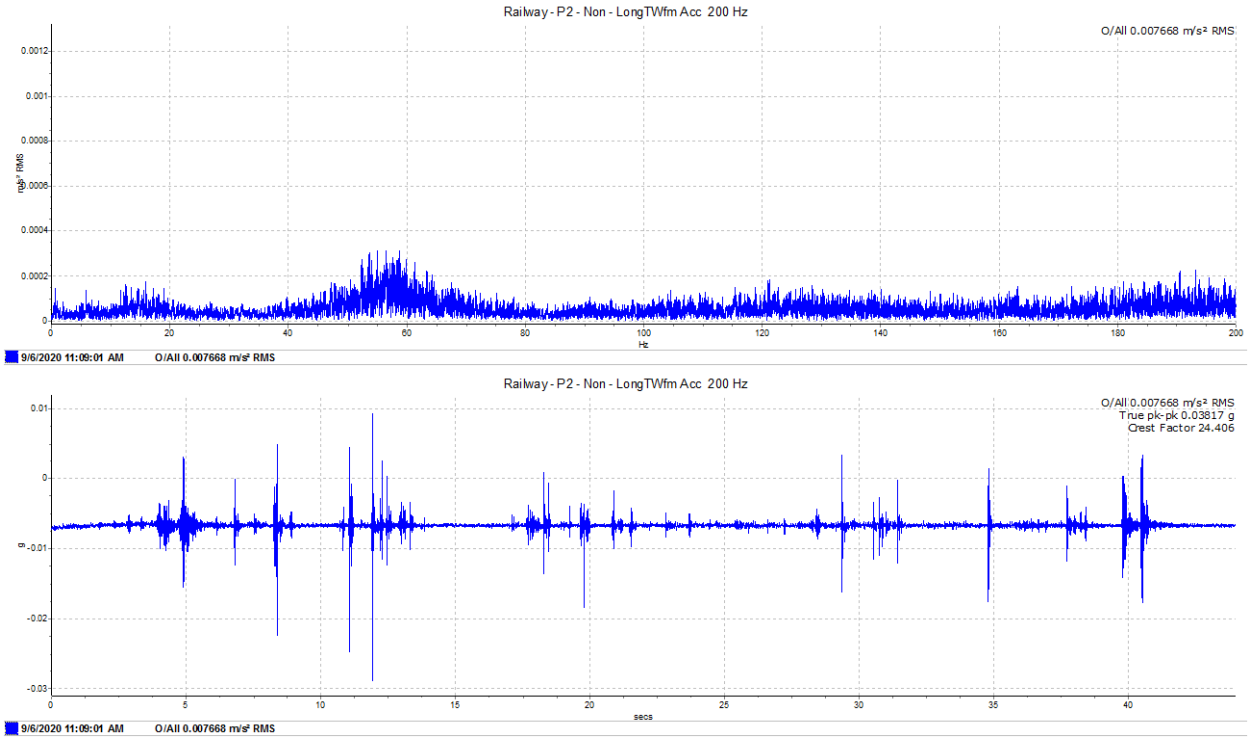


Point 1 El Ragddya:



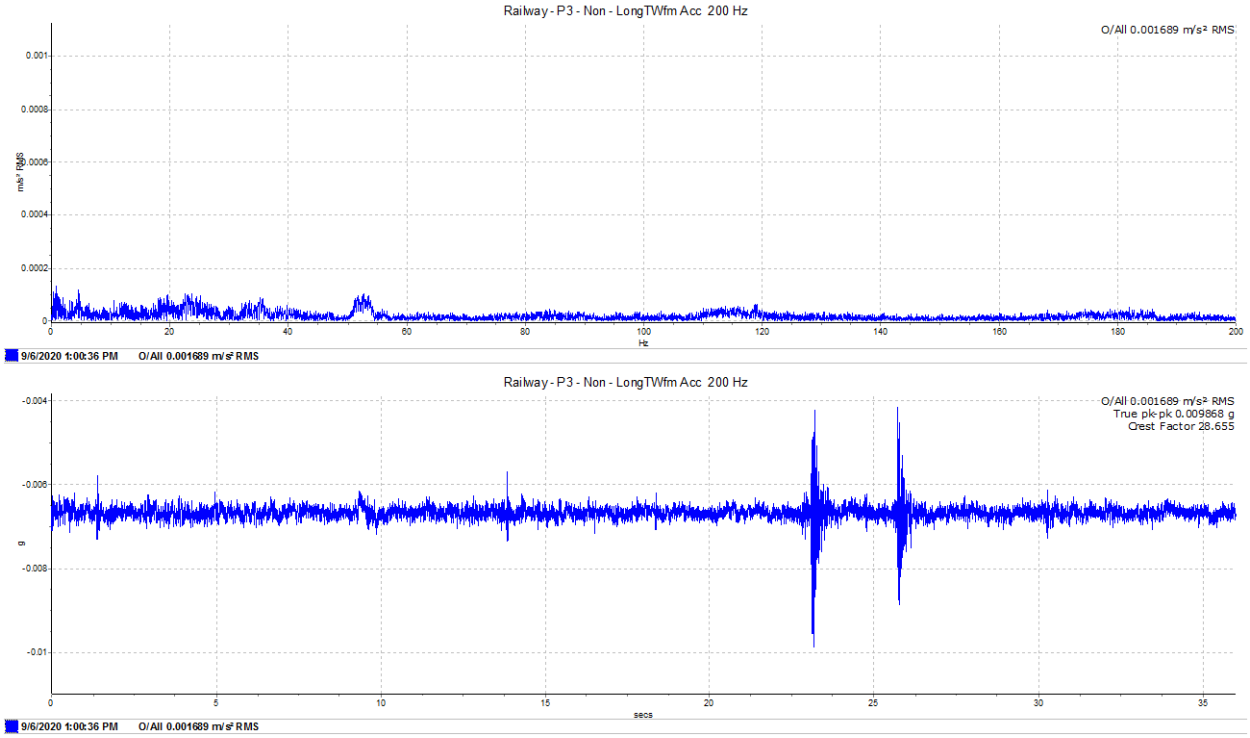
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point2 Mahlet Rawh:



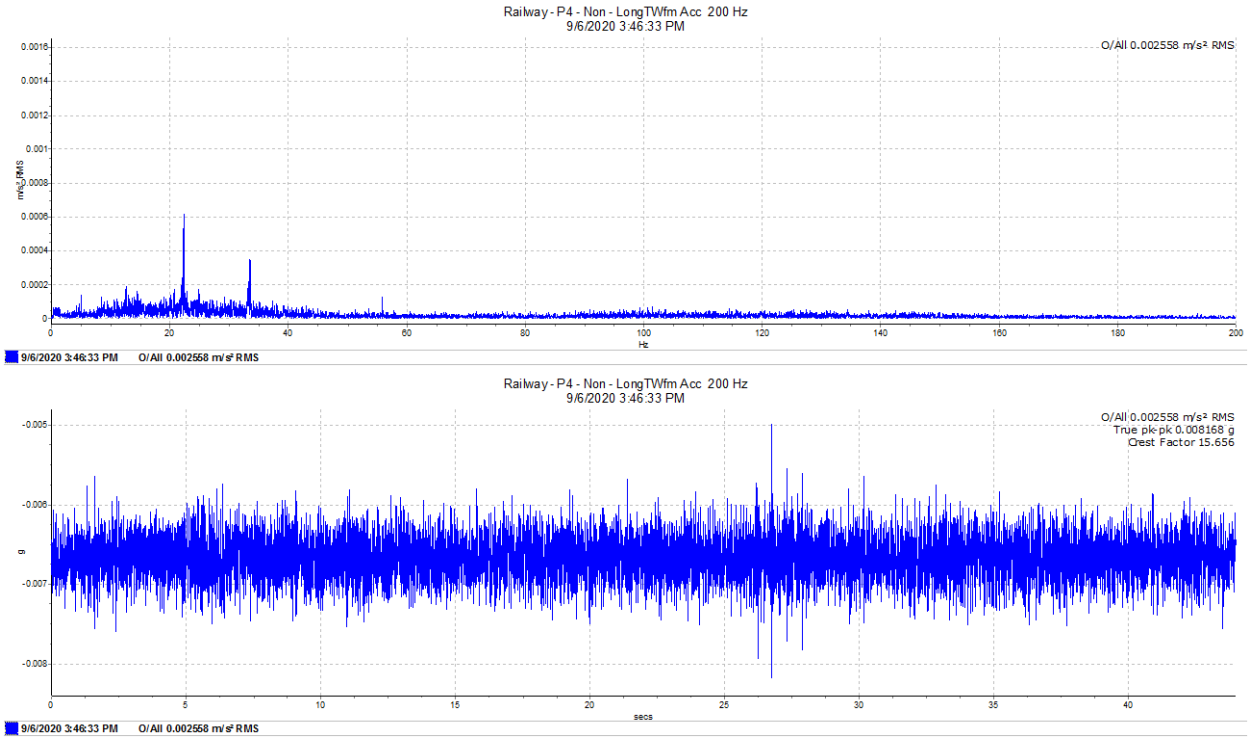
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-3 El Mahala El Kobra:



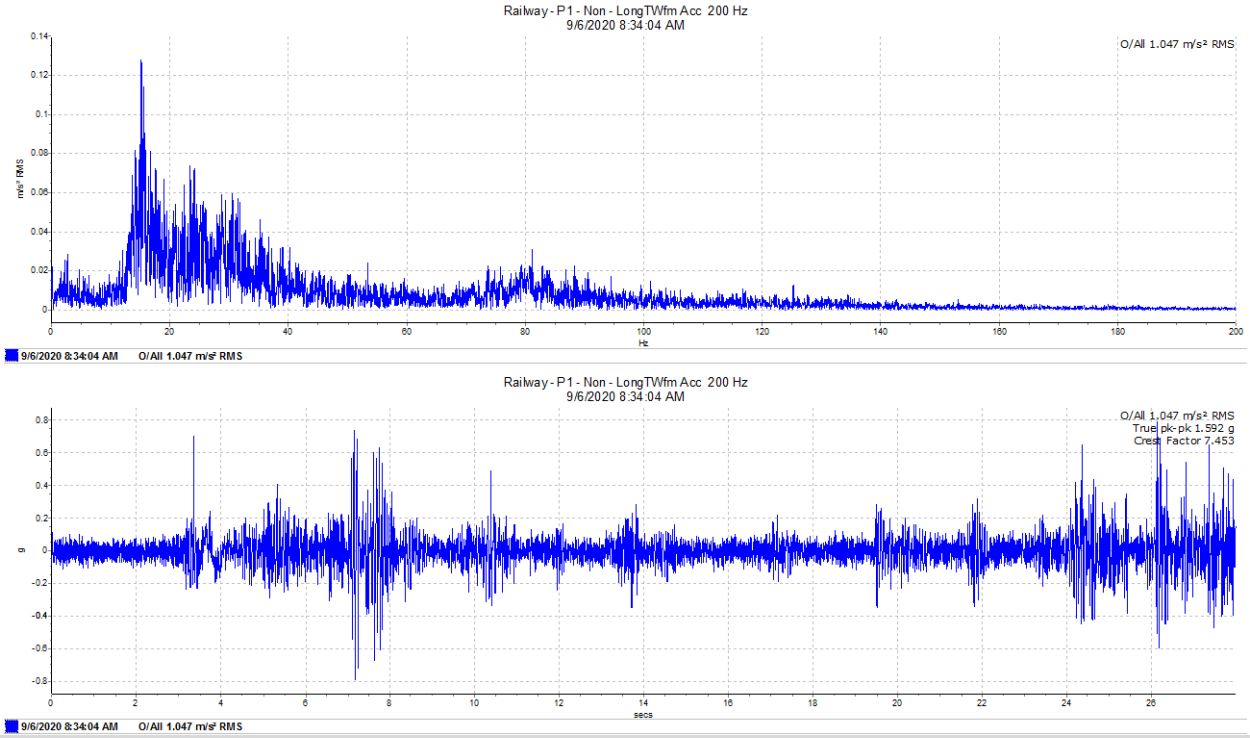
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-4 Samannoud:



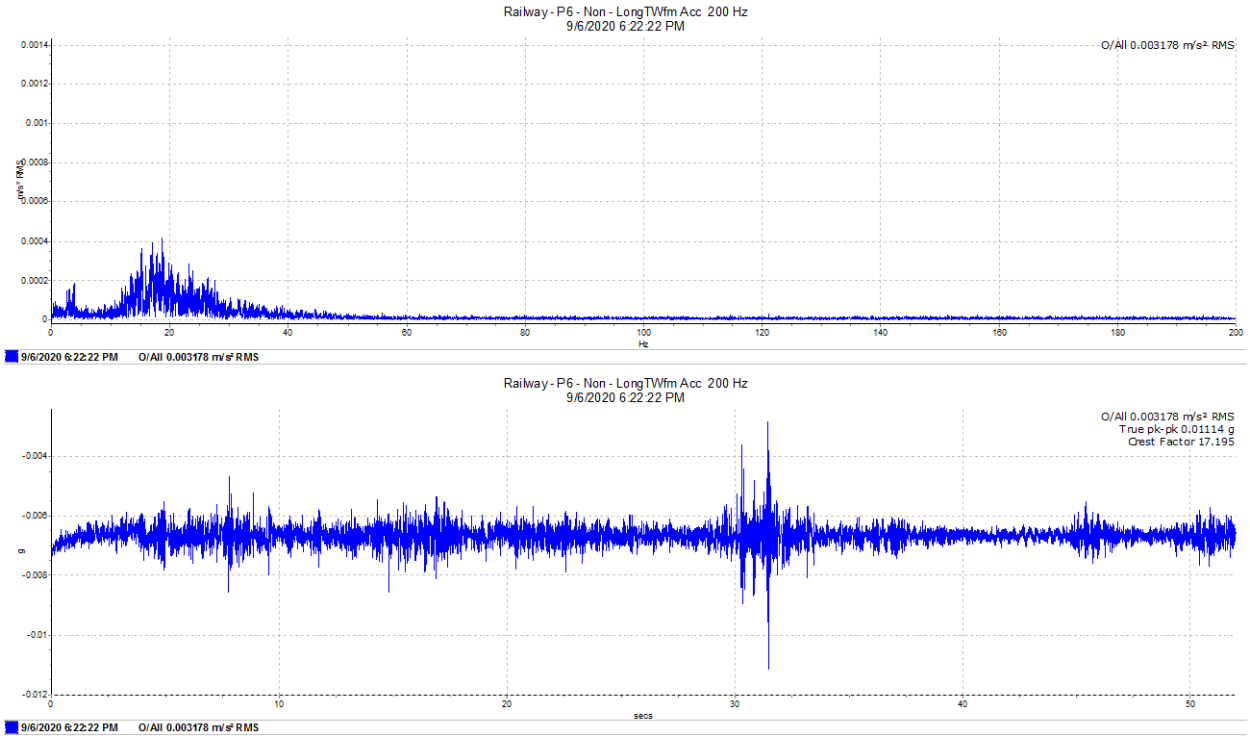
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point -5 El Mansoura:



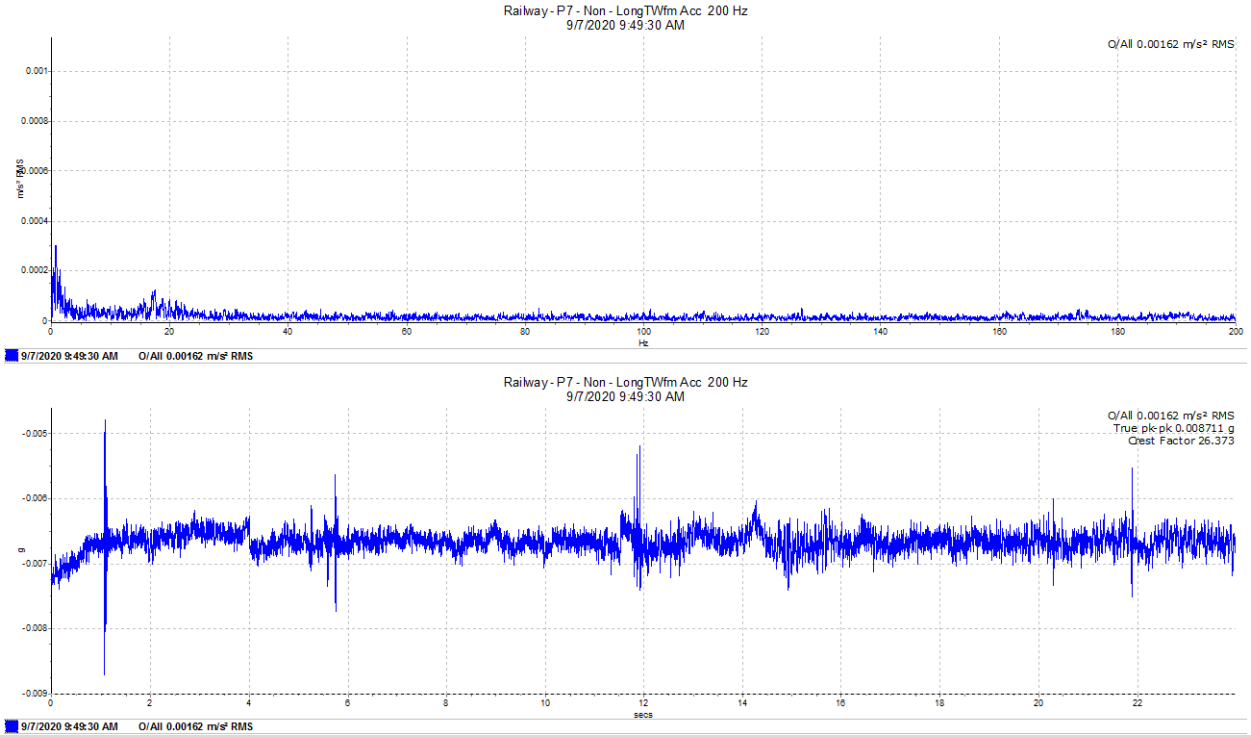
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-6 Battra:



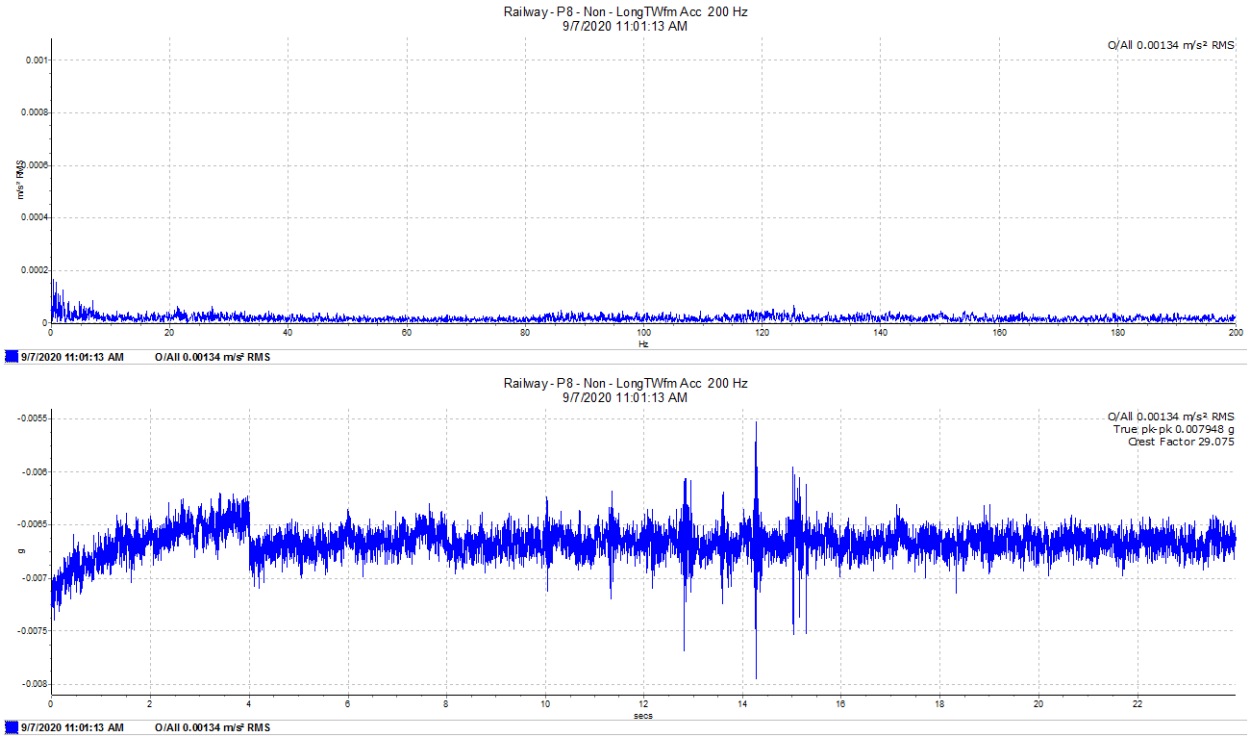
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-7 Sherbine :



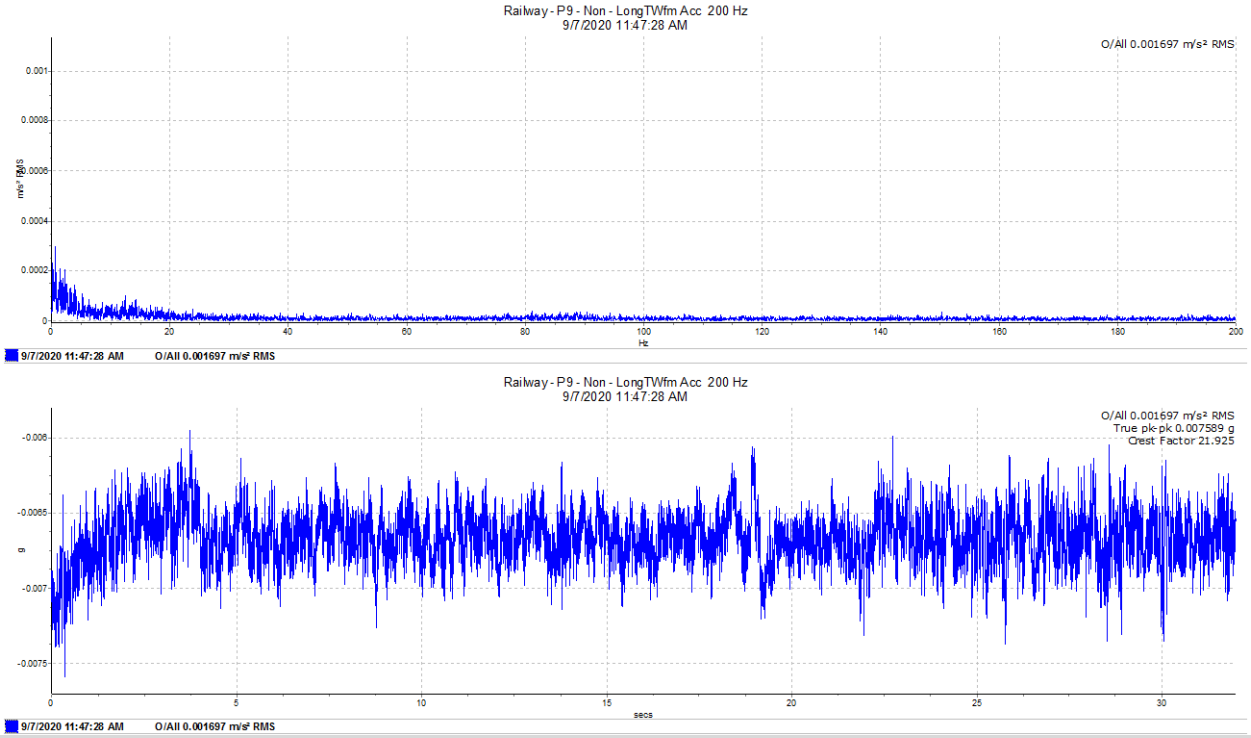
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-8 Ras Al Khaleej:



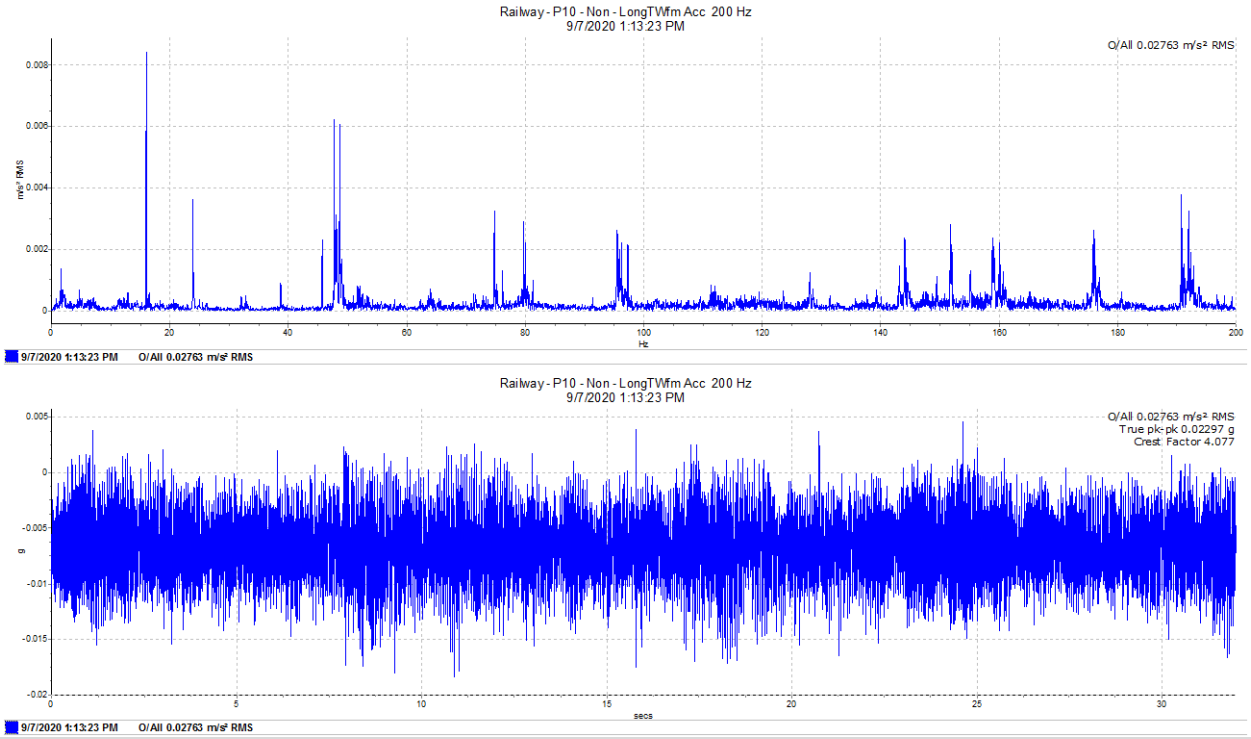
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-9 Taftish Kafr Saad:



The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-10 Damietta:

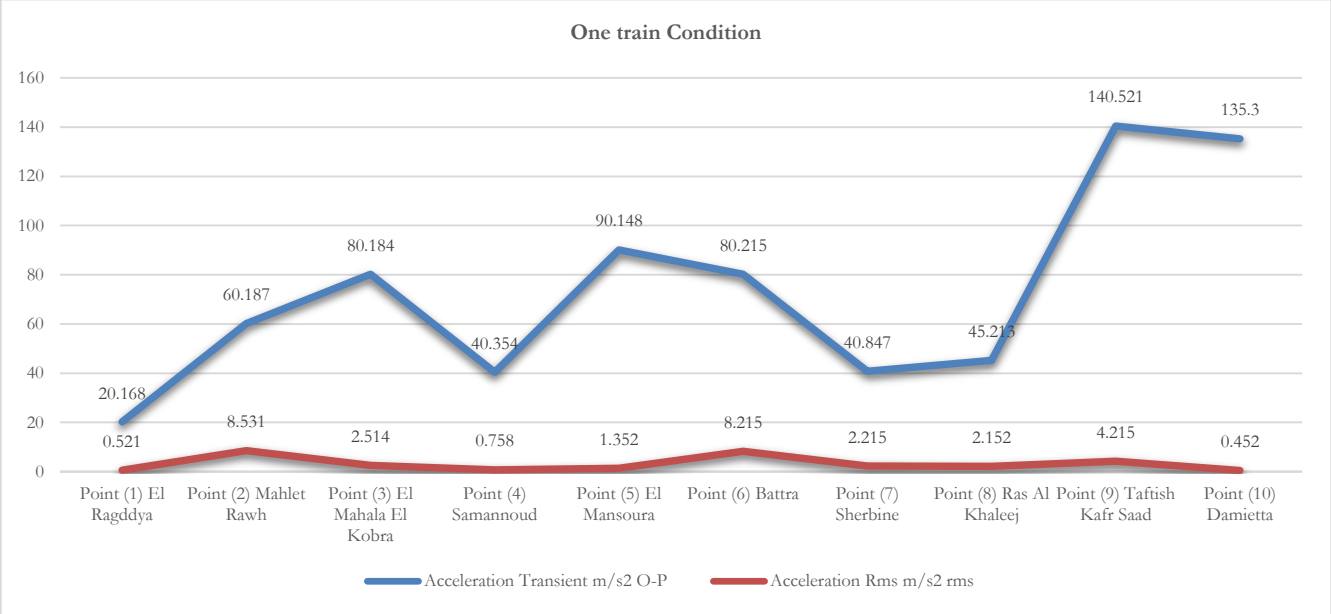


The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

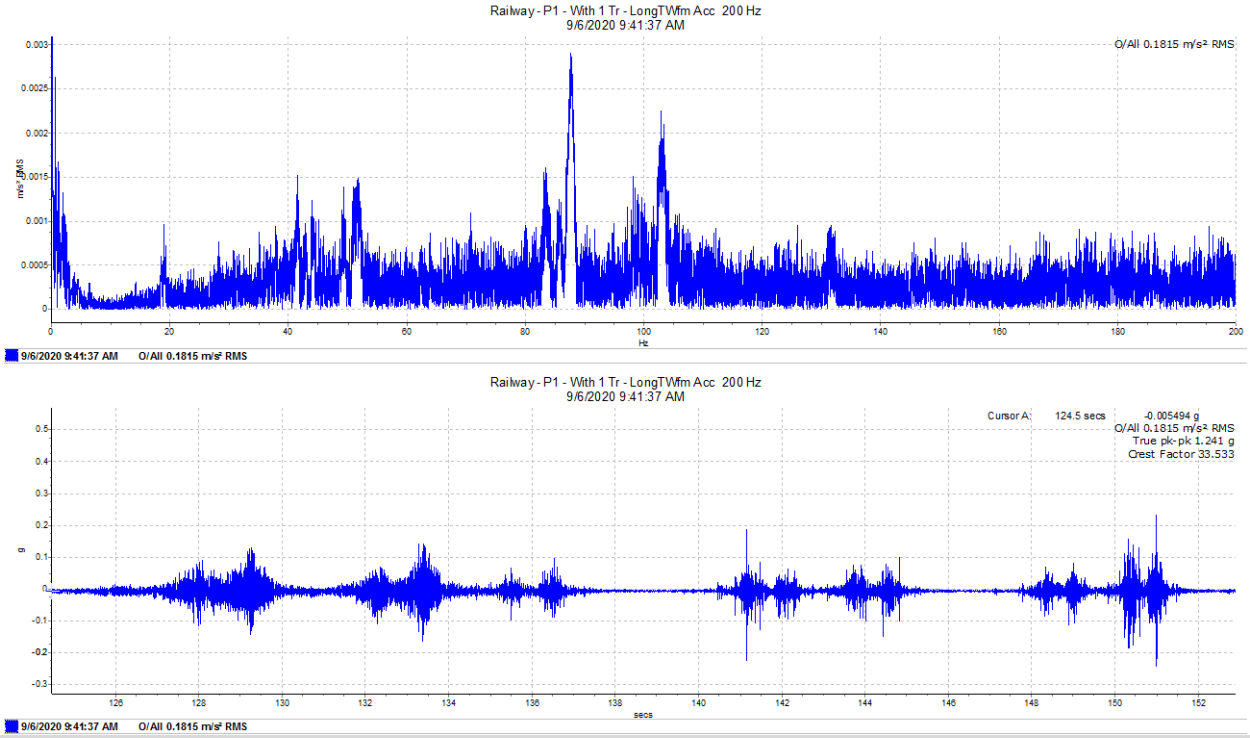
Condition-2 (1 Train):

Table 37: Analysis results for the Vibration Simulation

Location	Acceleration Transient m/s^2 O-P	Acceleration Rms m/s^2 rms
Point (1) El Ragddya	20.168	0.521
Point (2) Mahlet Rawh	60.187	8.531
Point (3) El Mahala El Kobra	80.184	2.514
Point (4) Samannoud	40.354	0.758
Point (5) El Mansoura	90.148	1.352
Point (6) Battra	80.215	8.215
Point (7) Sherbine	40.847	2.215
Point (8) Ras Al Khaleej	45.213	2.152
Point (9) Taftish Kafr Saad	140.521	4.215
Point (10) Damietta	135.3	0.452

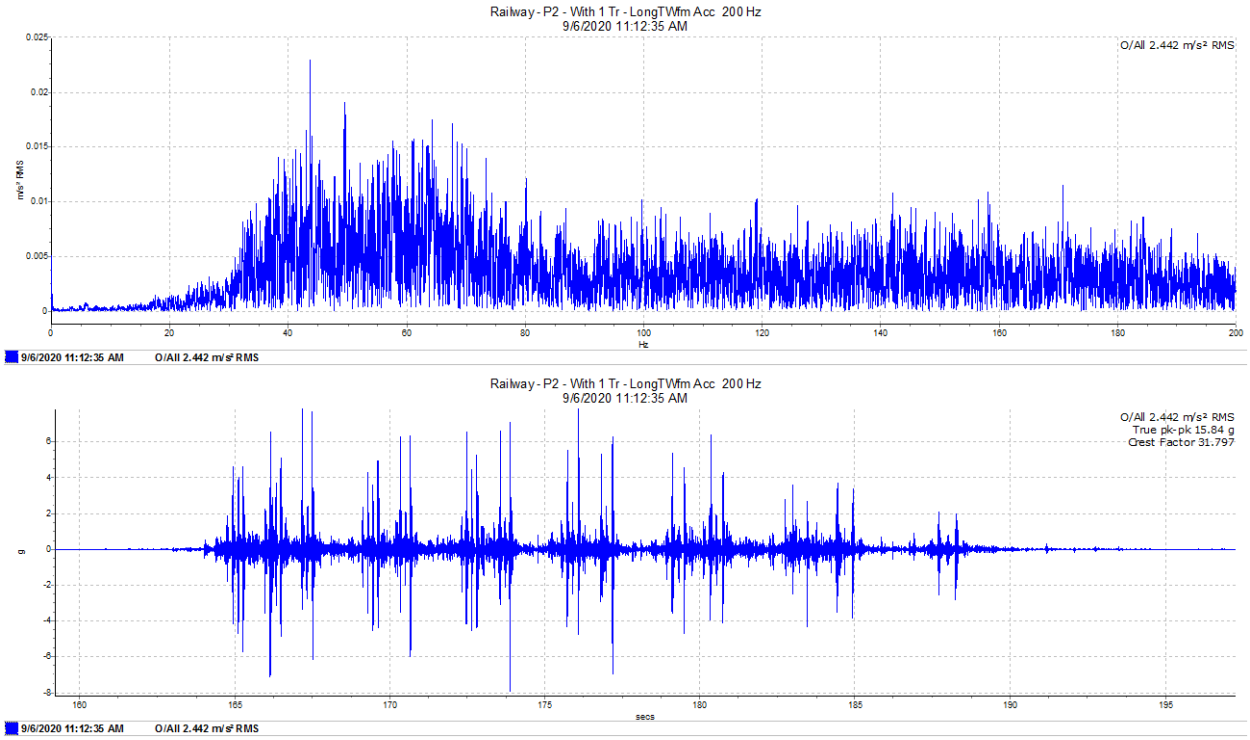


Point 1El Ragddya:



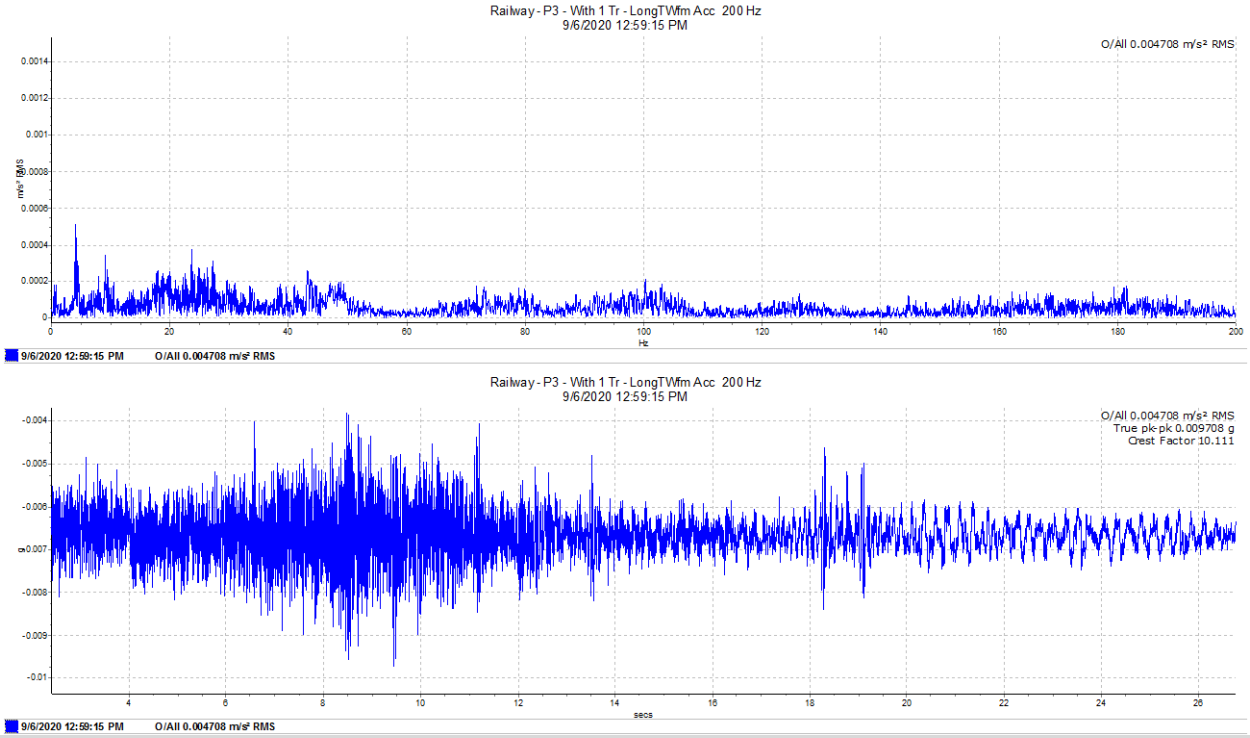
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point 2 Mahlet Rawh:



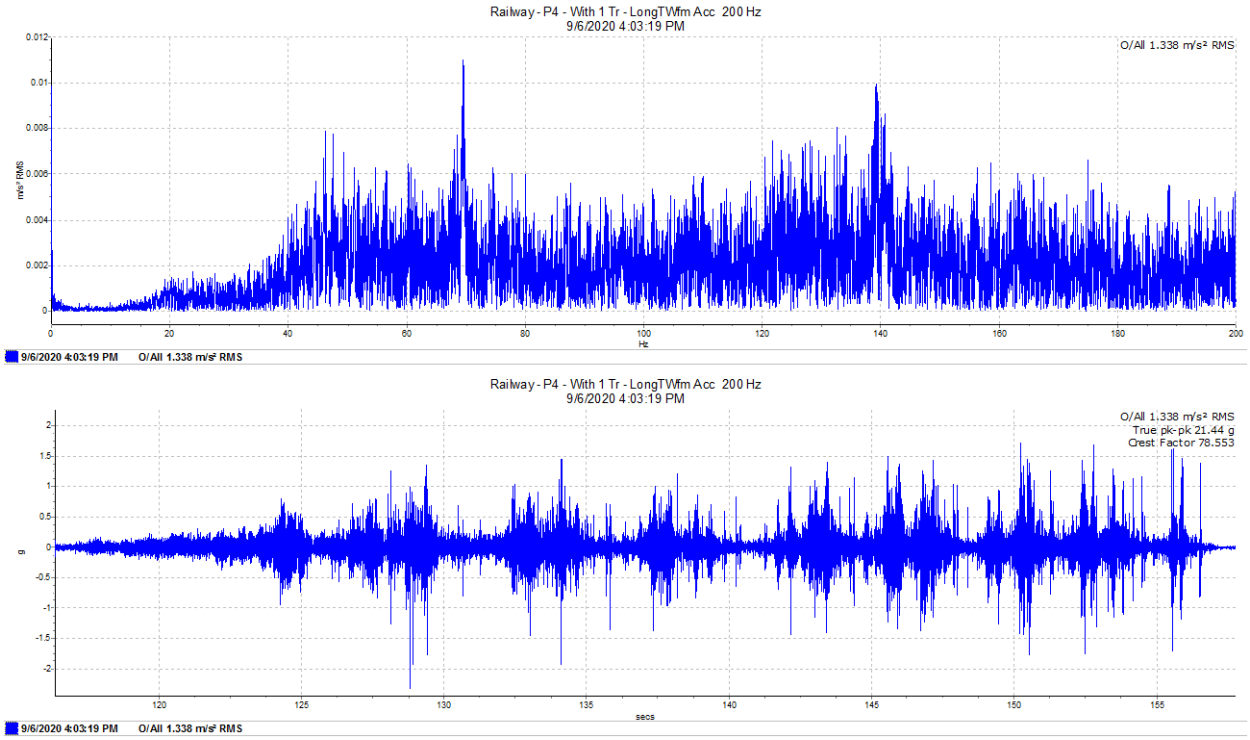
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-3 El Mahala El Kobra:



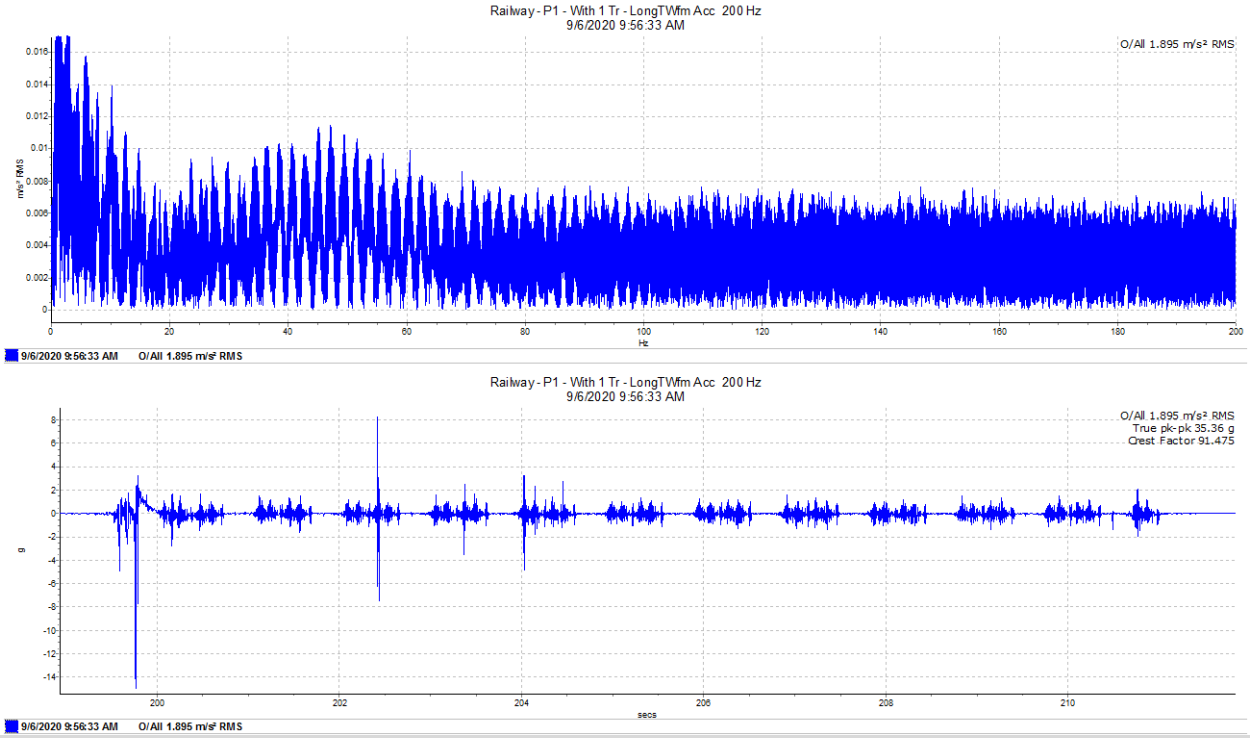
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-4 Samannoud:



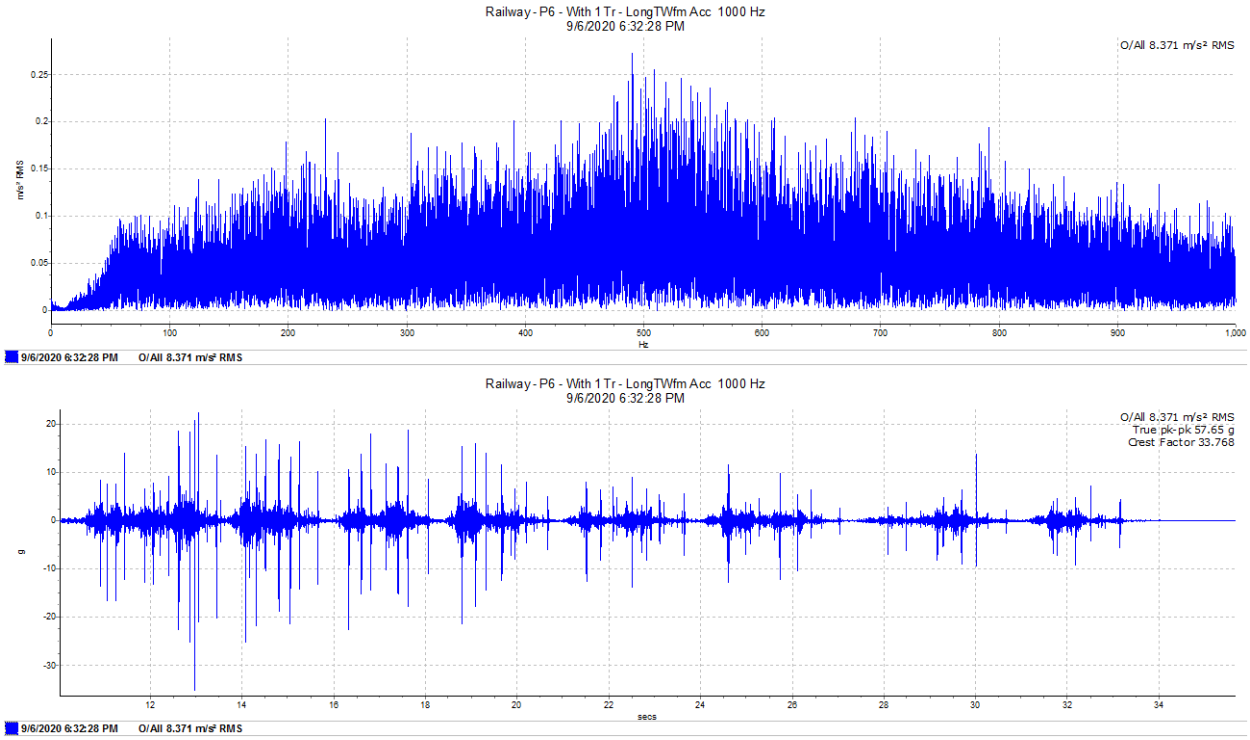
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point -5 El Mansoura:



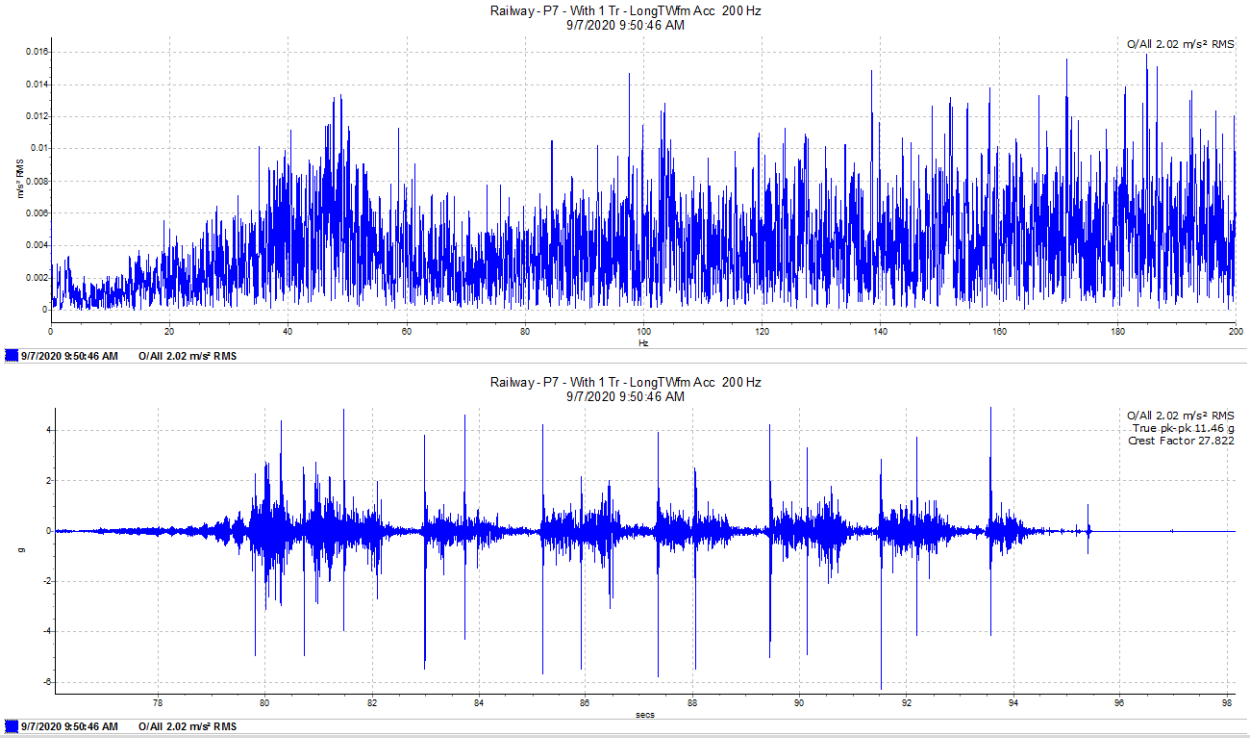
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-6 Battra:



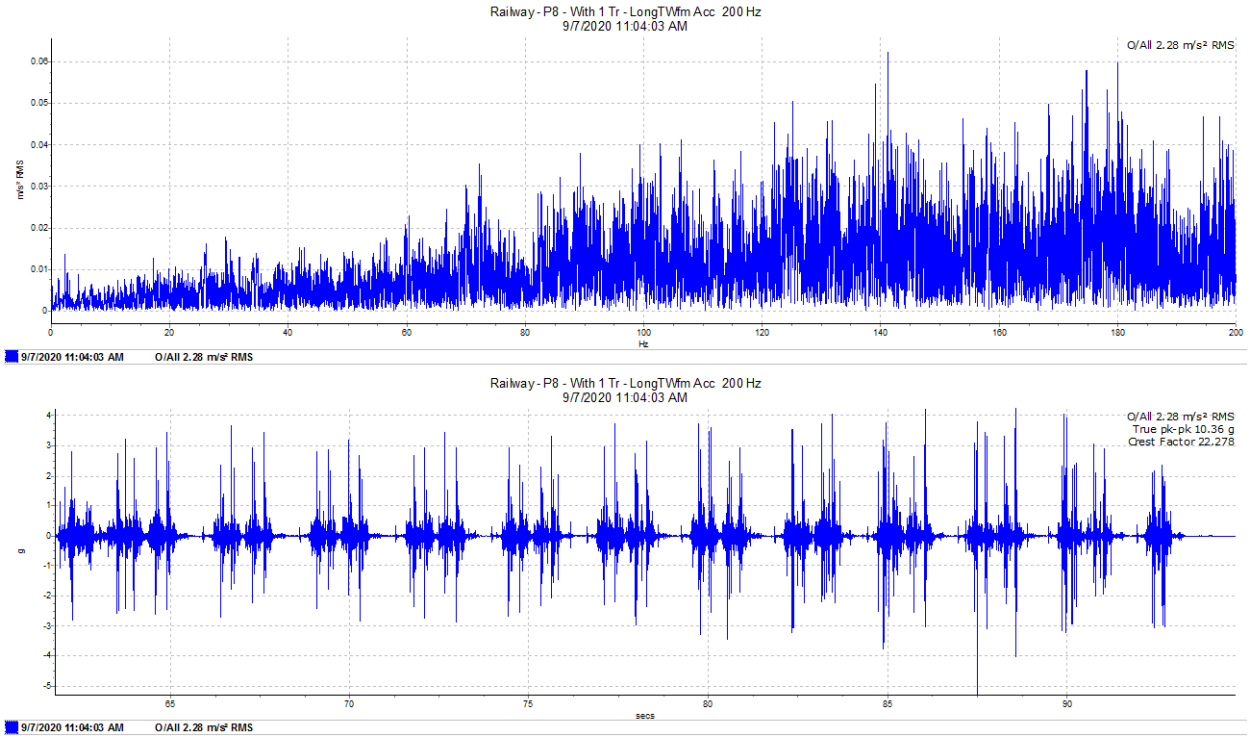
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-7 Sherbine:



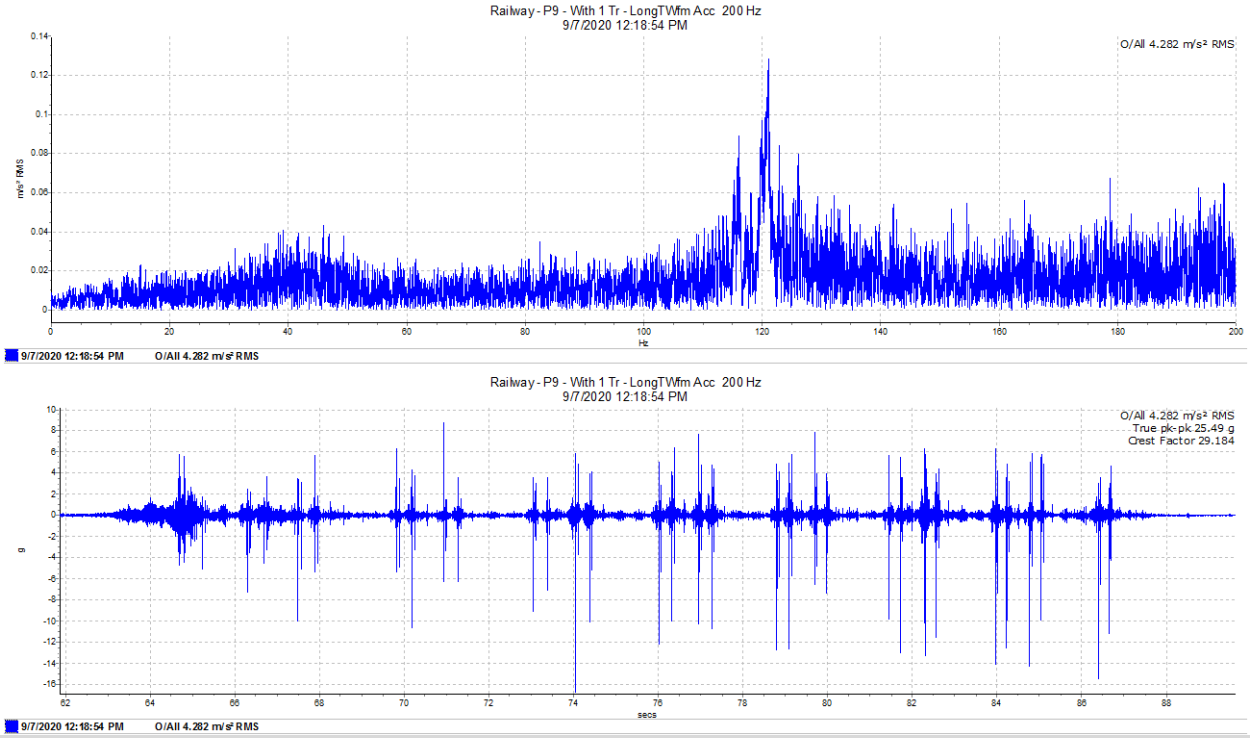
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-8 Ras Al Khaleej:



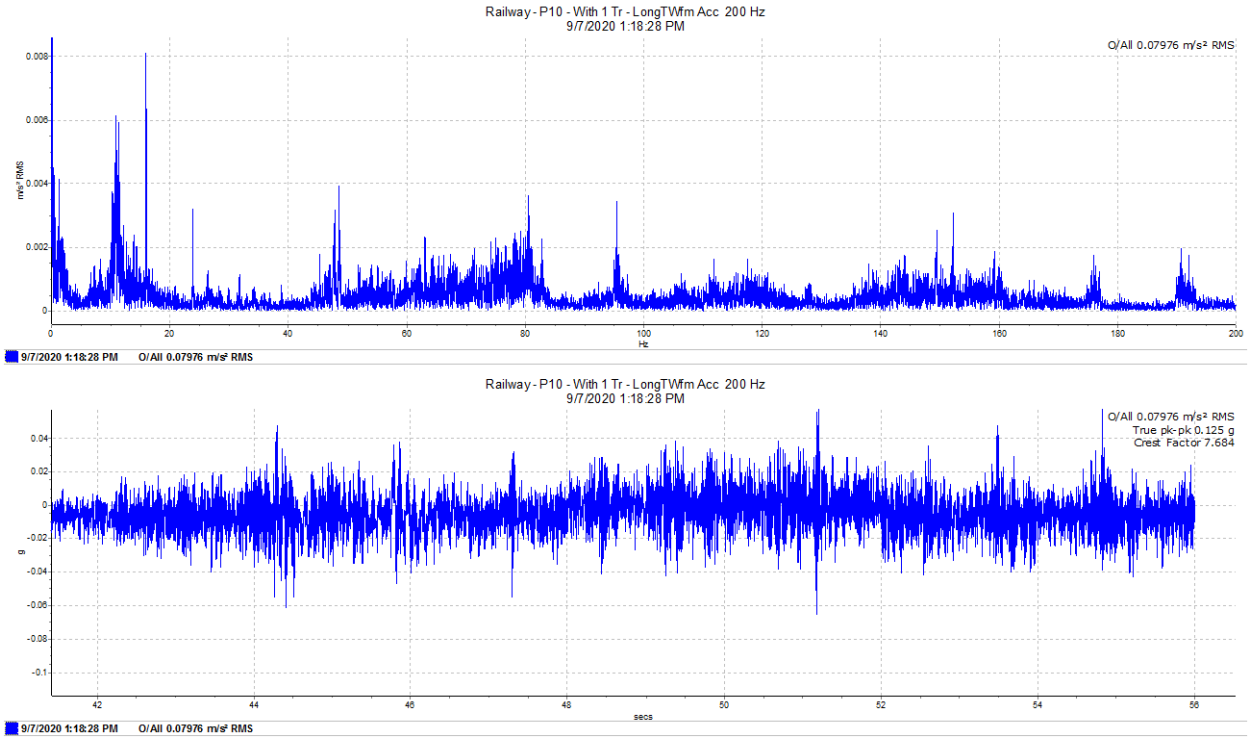
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-9 Taftish Kafr Saad:



The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-10 Damietta:



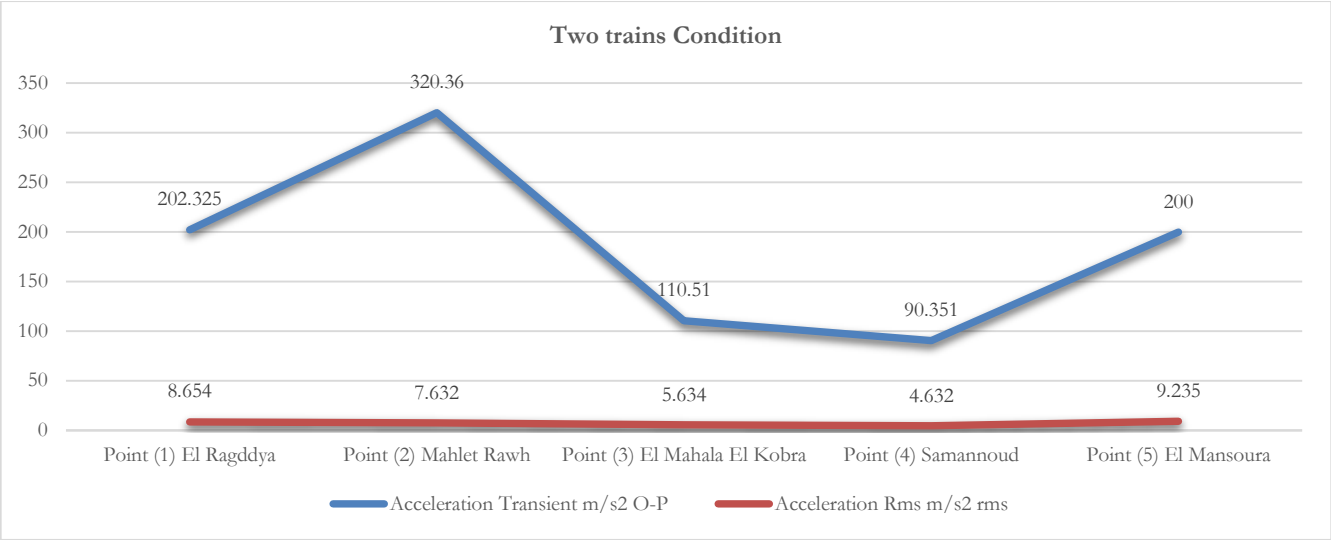
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Condition-3 (2 Trains):

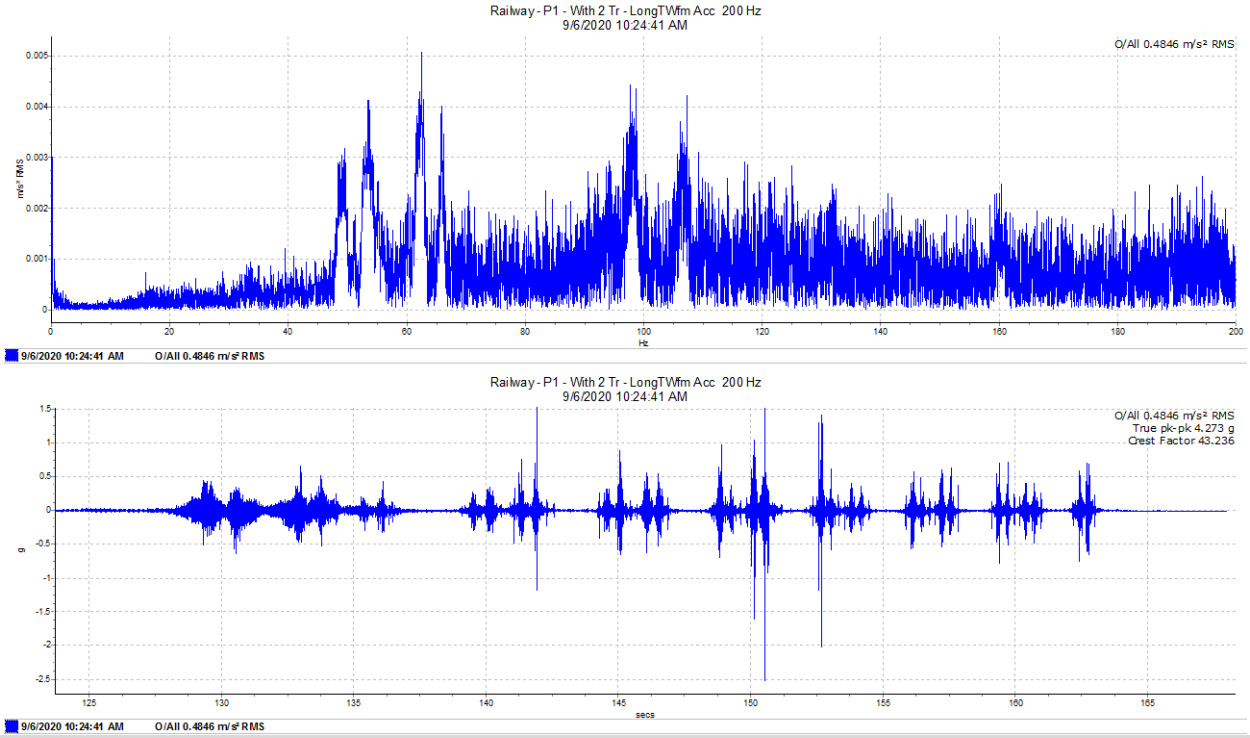
Table 38: Analysis results for the Vibration Simulation

Location	Acceleration Transient m/s^2 O-P	Acceleration Rms m/s^2 rms
Point (1) El Ragddya	202.325	8.654
Point (2) Mahlet Rawh	320.36	7.632
Point (3) El Mahala El Kobra	110.51	5.634
Point (4) Samannoud	90.351	4.632
Point (5) El Mansoura	200	9.235

Some of the points were measured during 2 trains travelling together with normal speed but other points were measured during 2 train travelling but in not same time (time shift by 2.2 sec to 4 sec)

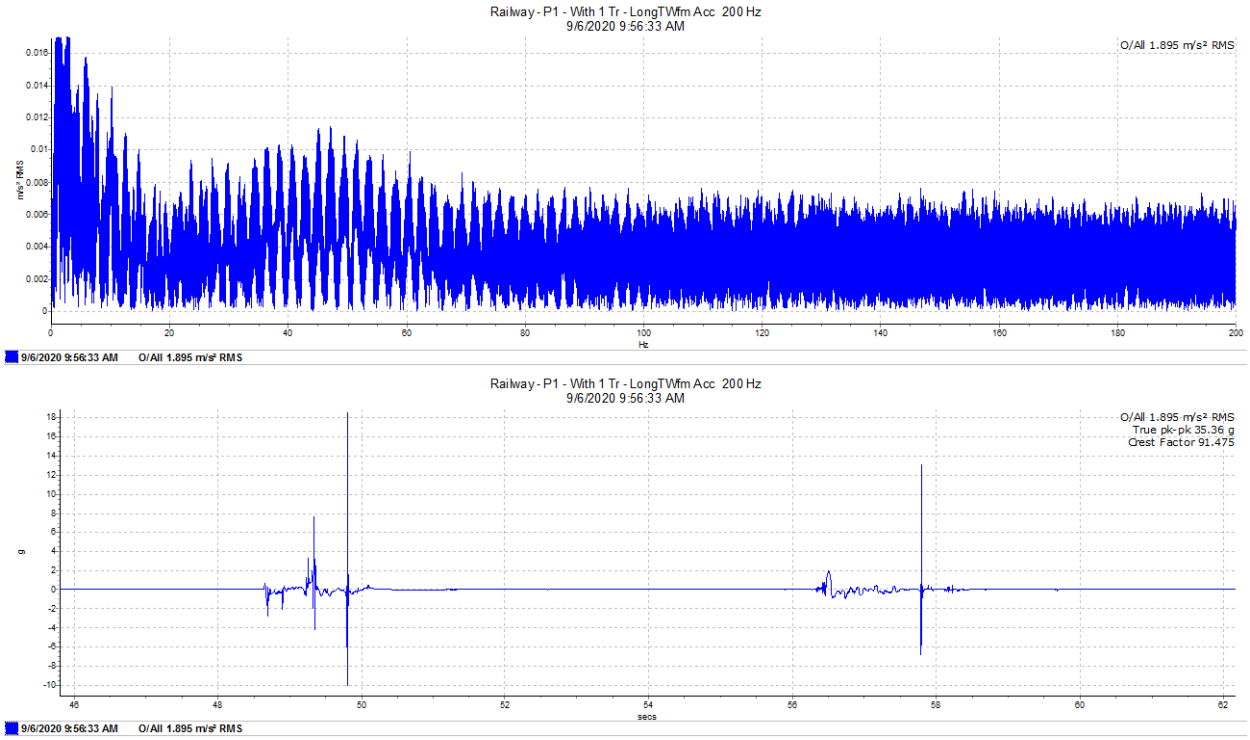


Point 1 El Ragddya:



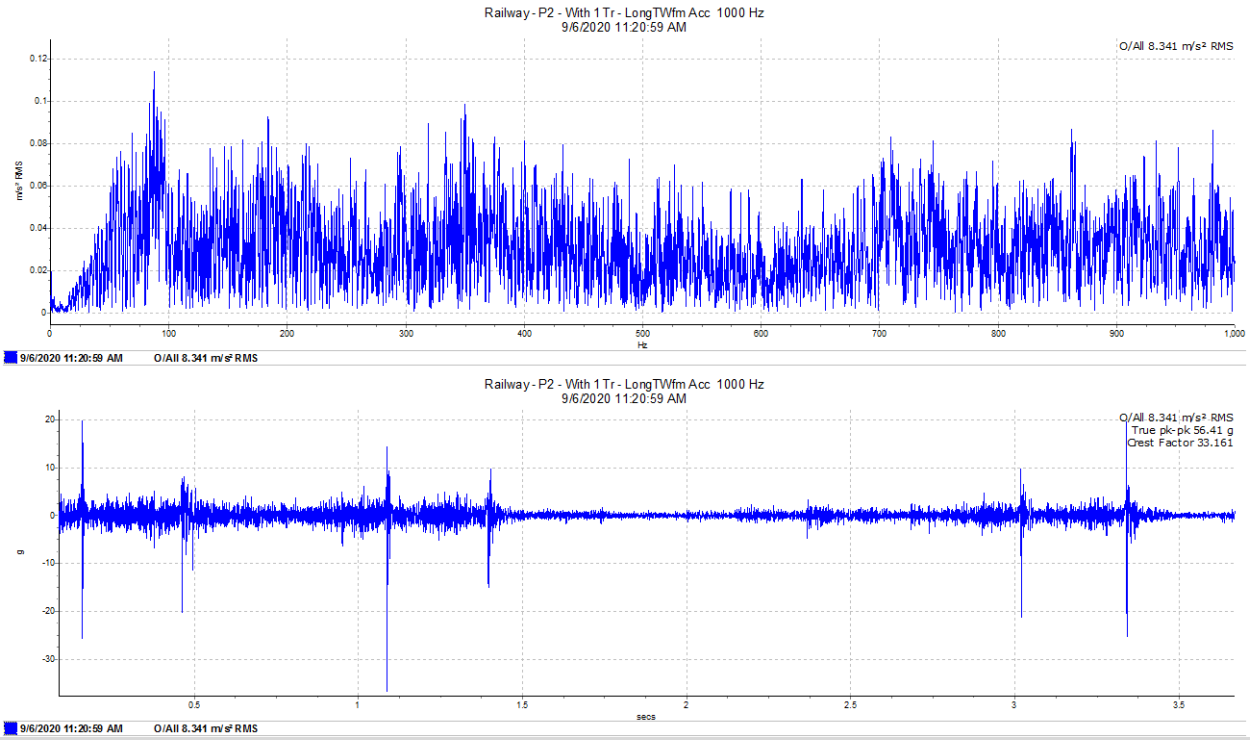
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-2 Mahlet Rawh:



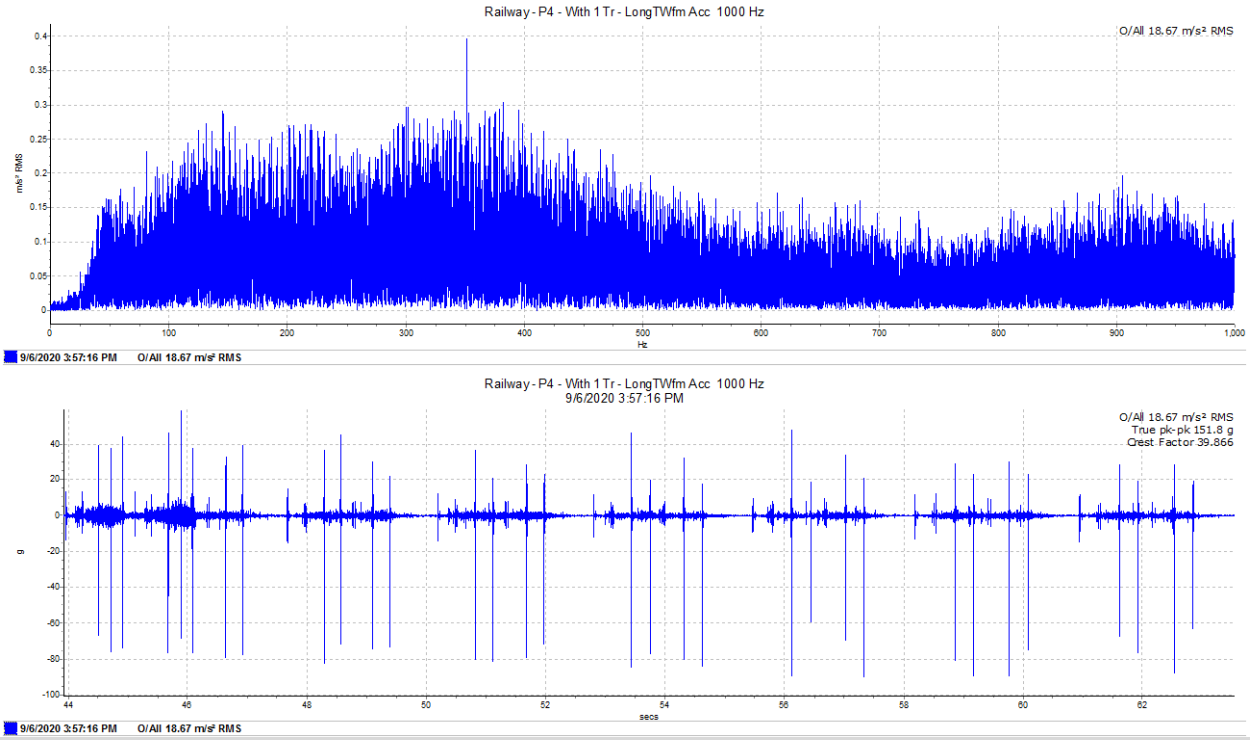
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-3 El Mahala El Kobra:



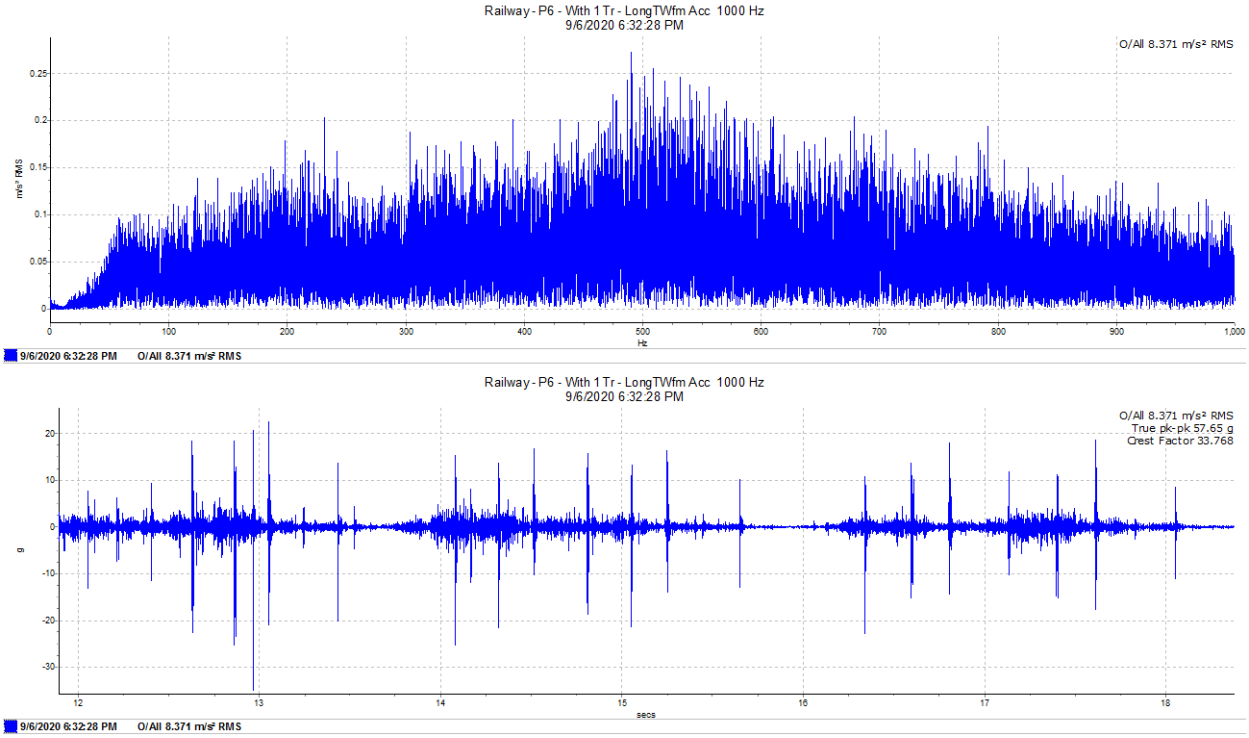
The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-4 Samannoud:



The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

Point-5 El Mansoura:



The First graph (the cross bar represents tricones in hertz frequencies - the longitudinal bar represents the value of vibrations in meters per second squared). Second graph (cross bar represents the temporal representation of an event in seconds - the longitudinal bar represents Acceleration (g or m/s2) overall value for the 0.2kHz & 1kHz band is measured at each point.

8. ANNEXES

8.1 Annex (1): Photo Documentation for Air Quality Measurements

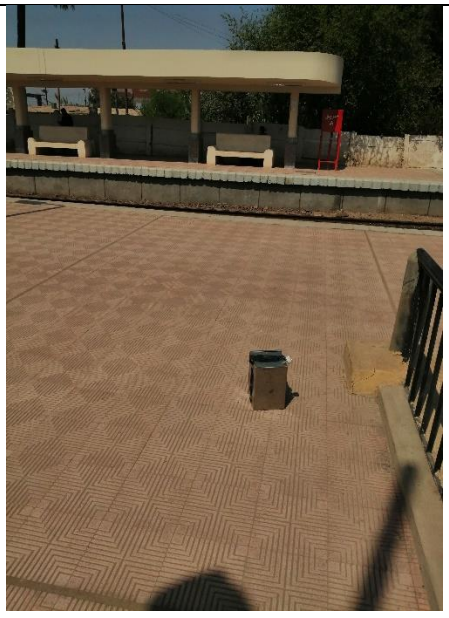
Photo Gallery for Air Quality Measurements	
Point (1) El Ragddya Station	
	
Point (2) Mahlet Rawh Station	
	
Point (3) El Mahala El Kobra Station	
	

Photo Gallery for Air Quality Measurements
Point (4) Samannoud Station

Point (5) El Mansoura Station
 
Point (6) Battra Station
 

Photo Gallery for Air Quality Measurements	
Point (7) Sherbine Station	
	
Point (8) Ras Al Khaleej Station	
	
Point (9) Taftish Kafr Saad Station	
	

Photo Gallery for Air Quality Measurements	
Point (10) Damietta Station	
	
	

8.2 Annex (2): Photo Documentation for Ambient Noise Levels

Photo Gallery for Ambient Noise Levels	
Point (1) El Ragddya Station	
Point (2) Mahlet Rawh Station	
	

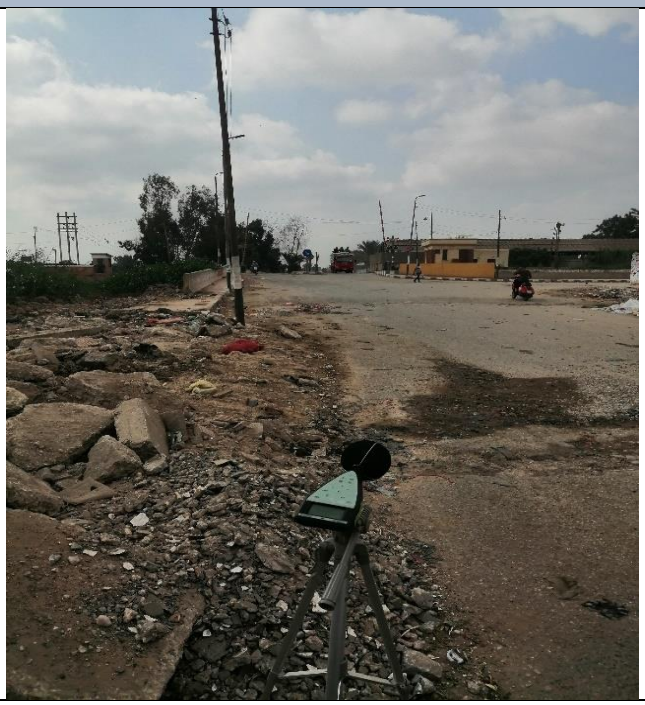
Photo Gallery for Ambient Noise Levels	
Point (3) El Mahala El Kobra Station	
Point (4) Samannoud Station	
	

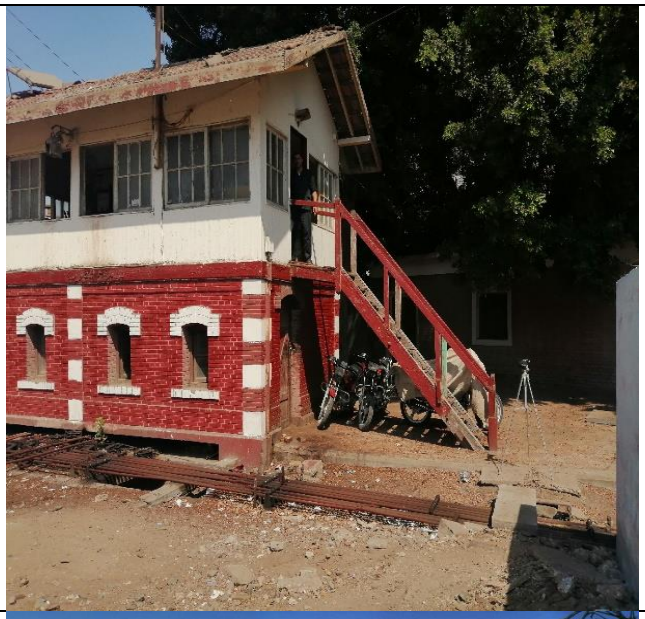
Photo Gallery for Ambient Noise Levels	
Point (5) El Mansoura Station	
	
Point (6) Battra Station	
Point (7) Sherbine Station	

Photo Gallery for Ambient Noise Levels	
Point (8) Ras Al Khaleej Station	
Point (9) Taftish Kafr Saad Station	
Point (10) Damietta Station	

8.3 Annex (3): Photo Documentation for Spot Vibration measurements

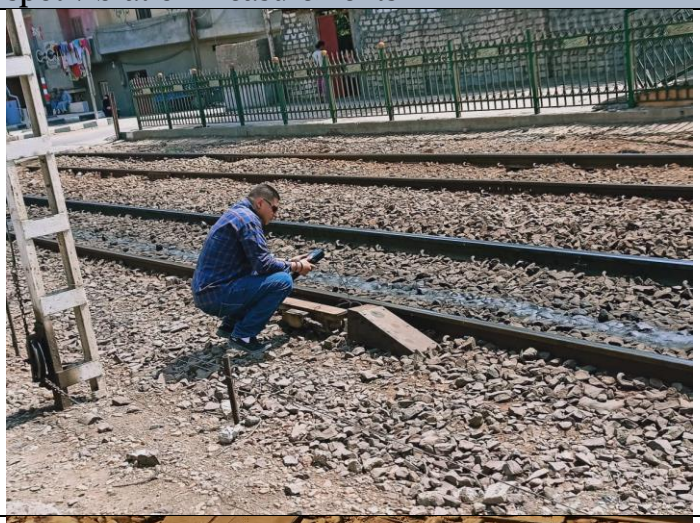
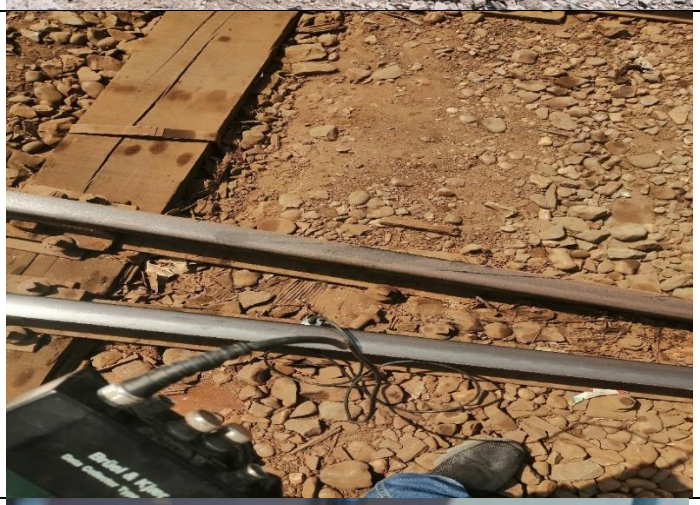
Photo Gallery for the spot vibration measurements	
Point (1) El Ragddya Station	
Point (2) Mahlet Rawh Station	
Point (3) El Mahala El Kobra Station	

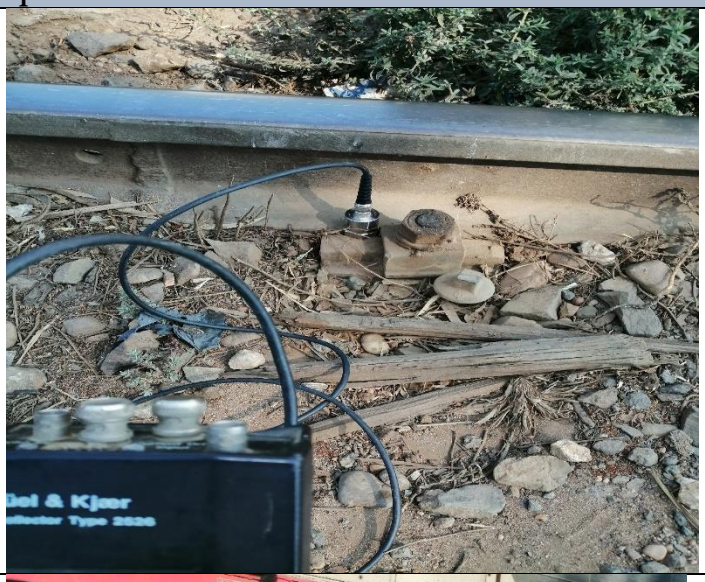
Photo Gallery for the spot vibration measurements	
Point (4) Samannoud Station	
Point (5) El Mansoura Station	
Point (6) Battra Station	
	

Photo Gallery for the spot vibration measurements	
Point (7) Sherbine Station	
Point (8) Ras Al Khaleej Station	
Point (9) Taftish Kafr Saad Station	
Point (10) Damietta Station	

8.4 Annex (4): Equipment Calibration Certificates

8.4.1 Ambient Noise Measurements Device

Instrumentation:

All the instruments are manufactured by 1 Device Bruel & Kjaer (B&K) Modular Precision Sound Analyzer Type 2238, 1 Device Bruel & Kjaer (B&K) Modular Precision Sound Analyzer Type 2245 the world's leading company in noise measurement, located in Denmark.

Two main instruments were used in the measurements:

- Modular Precision Sound Analyzer Type 2238 Serial Number is 2326236
- Modular Precision Sound Analyzer Type 2245 Serial Number is 2245-100416

Modular Precision Sound Analyzer Type 2238 sound level meter

- The instruments are calibrated using B&K Sound Level Calibrator Type 4231, which produces a reference sound of 94 dB the calibration is performed for the microphones and the instruments before and after each group of readings.
- The microphones are mounted on Tripods Type UA0801 at a height of 1.2 meters from the ground surface.

Standards:

The instruments conform to:

- IEC651 (1979) and IEC804 (1985) Type 2;
- ANSI S1.4 (1983) and draft S1.43 (1992) Type 2;
- BS 5969 and BS 6698 Type 1.
- Instrumentations for Vibration measurements
- Data Collector System — 2526 Series
- Data Collector Type 2526 MK2
- Intrinsically Safe Data Collector Type 2526E
- Balancing Program Type 7111
- Field Analysis & Balancing (FAB) Program Type 7112
- The 2250 is equipped with suitable software for RT calculations.

شركة دلتا للالكترونيات
DELTA COMPANY FOR ELECTRONICS

Date: 20-02-2020
Ref: 10/2020

Calibration Certificate

We here by certify that the **Following Sound Level Analyzers**

TYPE	S/N
2238	**2326236**

Were calibrated in our workshop using Multi-Function Acoustic Calibrator Type 4231 according to the supplier's standard procedure for calibration.

Calibration Date: 20/2/2020

Next Calibration 19/02/2021

Director General

Eng. Mohamea Moustafa Omar

٣١ ش الشهيد عبد المنعم حافظ - المنطقة - القاهرة (صندوق بريد: ٢٨٨٢ الحورية - هليوبوليس) تليفون: ٢٤١٩٩٠٥٣ - ٢٤١٨٩٦٠٥ فاكس: ٢٤١٨٠٩٦٤
31 El Shahid Abdel Moneim Hafez St., Almaza - Cairo, Egypt (P.O.Box: 2882 El Horia - Heliopolis) Tel.: 24189665 - 24199053 Fax: 24180964
Mobile: 01068808555 E-mail: dce@dce-eg.com

B&K 2245 Sound Level Meter with Enviro Noise Partner

B&K 2245 Sound Level Meter with Enviro Noise Partner is a complete solution for environmental noise measurements.
Whether you are a complete novice, occasional user or an acoustics specialist – sometimes all you need is a simple sound level meter – one that provides you with reliable, accurate results without all the fuss. That is what B&K 2245 delivers.
This robust, class 1 sound level meter puts functionality, ease of-use and versatility into the palm of your hand together with the reliability and confidence that is ensured with the Brüel & Kjær brand.

Features

- Single measurement range: 16 – 141 dB(A) from noise floor to maximum level
- Frequency rang e: 6 Hz – 20 kHz
- 1/1- or 1/3-octave band frequency analysis
- Logging of all stored parameters for intervals down to 1 second
- 24-bit compressed MP3 audio recording
- 16 GB internal storage
- Markers to isolate sounds (for example, removing a barking dog or picking out the moment when a sound source is operating)
- Checklists to ensure each step is completed to regulatory requirements
- Automatic measurement transfer to network storage for backup and analysis
- Robust design for both indoor and outdoor measurements
- Wireless connectivity for remote control of measurements

Hassle-free Licencing

Each B &K 2245 licence is installed in the instrument, enabling measurement functions on the instrument and administering connections to licenced mobile apps and post-processing in the PC apps.
This means there are no licence files to install on the PC, and no dongles. Mobile and desktop apps can be freely downloaded and installed on any iPhone and PC, and measurements made with embedded licences can be edited by the desktop app on any PC, forever.

Brüel & Kjær

B&K 2245 FIRMWARE CERTIFICATE

INSTRUMENT IDENTIFICATION

Serial Number: 2245-100416

TYPE APPROVAL

Your B&K 2245 Sound Level Meter is pre-installed with 2245 sound level meter general type-approved firmware.

VARIANT AND VERSION

Your instrument is installed with the following firmware variant and version:

Variant: FW-2245–000-

Version: 1.1.2.386

REPAIR AND SERVICE

All repair and service of your instrument must be performed at a certified Brüel & Kjær Service Centre.

BR 0013–11

Brüel & Kjær

MANUFACTURER'S CERTIFICATE OF CONFORMANCE

We certify that Brüel & Kjær **-2245---** Serial No. **2245-100416** has been tested and passed all production tests, confirming compliance with the manufacturer's published specification at the date of the test.

The final test has been performed using calibrated equipment, traceable to national or international standards or by ratio measurements.

Brüel & Kjær is certified under ISO 9001 assuring that all test data is retained on file and is available for inspection upon request.

Nærum 25-feb-2020

Torben Bjørn
Vice President, Operations

Please note that this document is not a calibration certificate.
For information on our calibration services please go to www.bksv.com/service.

8.4.2 Ambient Air Quality Measurements Device

TSP, PM_{10}, SO_2, NO_2 and CO Brand:

(1) Sensidyne Gilian Abatement Air Sampling Pump Starter Kit
(2) MSA Personal Pump

Model number: BDX-II Picture:

Calibration:

Assessment of sulfur dioxide TSP, SO2, NO2, PM10 and CO and its analysis by locally and internationally approved chemical methods.

Step-by-Step Calibration Instructions:

1. Slide front cover upwards, to stop, by applying thumb pressure to cover and pushing upwards.
2. Insert 9v. battery, observing correct terminal orientation.
3. Slide front cover downward to stop, revealing control panel, with “Flow” and "On” markings.
4. Unscrew charcoal tube holder and insert absorber tube. Make sure the right length of holder is used for the specific tube used. Screw tube holder down to stop, to avoid leaking.
5. Connect nipple on end of holder to bubble flow device.
6. Turn on pump with on/off switch.
7. Follow instructions provided with bubble flow meter to generate bubble. 8. Set required flow with screwdriver provided. Turning the potentiometer
9. clockwise increases flow.
10. Turn off the pump.
11. Disconnect hose to bubble flow meter.
12. Remove nipple on end of charcoal tube holder before sampling.

Calibration Tools:

Specter can provide the following instrument for setting pump (BFM – 10 Pocket Bubble Flow Meter)

Certificate of Factor Service

Customer: TECHNO MASTER

Certificate #: 6638462
RMA #:

Instrument:

Manufacturer:	**RAE Systems**
Model Number:	**PGM7320**
Serial Number:	**592-903428**
Last Service:	14/6/2019
Next Service:	14/6/2020

Please read TN-148 regarding calibration intervals
TN-148 is located at
www.raesystems.com

Calibration Results:

		Concentration	Unit	Zero Reading	Span Reading	Gas Ref.
VOC	Isobutylene	100	ppm	0	100	709927-24
LEL	Methane	Choose an item	% LEL			
Oxygen	N/A	N/A	%			
Toxic 1	N/A	N/A	ppm			
Toxic 2	N/A	N/A	ppm			
Toxic 3	N/A	N/A	ppm			
Toxic 4	N/A	N/A	ppm			

Pump flow rate at calibration: **350 cc/min**

Calibration Equipment list:

Instrument number:

Fluke Multi-meter Choose an item.

Power Supply Choose an item.

المركز الوطني للخدمات البيئية NCESOH

REA SYSTEMS EUROPE APS JLT Branch
OFFICE NO. 409, THE PALLADIUM,
JUMEIRAH LAKES TOWERS. DUBAI
Tel: +97144405949 Fax: +97444405949

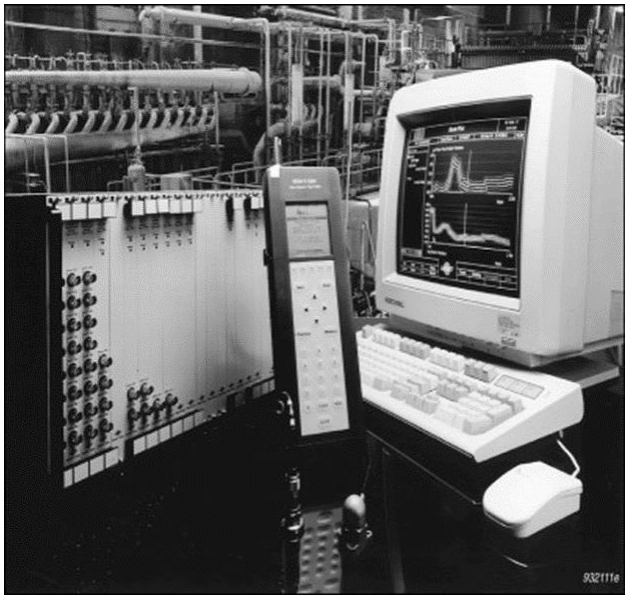
RAE Systems certifies that the instrument specified herein has passed calibration using calibration gases and procedures which are traceable to NIST standards.

8.4.3 Vibration Spot Measurements Device

COMPASS Monitoring System – Type 3540

Computerized **P**rediction, **A**nalysis & **S**afety **S**ystem Version 6.x and higher

Brüel & Kjær Vibro



USES:

- Fully automatic and integrated system for the protective, predictive, and performance monitoring of rotating machinery
- Piston rod-drop monitoring of reciprocating machinery
- Complements existing monitoring systems with the addition of predictive/performance monitoring, high speed communications, centralised data storage, access and display at multiple locations
- Detailed, diagnostic analysis of machine faults

FEATURES:

- Powerful, comprehensive monitoring system for continuous (on-line) and intermittent (on-line and off-line) measurements with identical processing, analysis and display from a common database
- Modular system with flexibility to optimally meet individual applications, and which is easily expandable to meet growing requirements
- Adaptive Monitoring Strategy (AMS) maximises sensitivity by automatically adapting the monitoring system to different operating conditions
- Innovative data compression provides rapid access to significant values with 0.1s resolution within measurements spanning 30 years
- Digital Signal Processing (DSP) provides effective, detailed monitoring necessary for the earliest recognition of small changes, and allows rapid variations in monitoring strategy for specific operating modes, e.g. run-up, running, coast down
- Based on the most progressive industry standards for easy upgrading, flexibility, and all of the benefits of a multi--user, multi-tasking environment

- Total plant wide system integration with flexible interfacing solutions that include RS232, LAN, Modbus, and relay outputs
- Dial-up capability for remote monitoring
- Automatic self-testing gives high system reliability
- Versatile automatic monitoring functions, and user-friendly interface give high performance at low operational costs

شركة دلتا للإلكترونيات
DCE DELTA COMPANY FOR ELECTRONICS

التاريخ:- 20/8/2020

شهادة معايرة

تشهد شركة دلتا للإلكترونيات وكلاء شركة BRUEL & KJAER بأنها قامت بمعايرة جهاز قياس الاهتزازات طراز 2526 مسلسل 1740695 كاملا بمشتملاته. وقد تمت المعايرة طبقا للشروط الموضوعه من قبل موكلينا وذلك كما يلى:-

١. معايرة الجهاز بالكامل شامل المجس والكابل باستخدام وحدة المعايرة 4294.

Mode	Standard reading	Actual reading
Acceleration	10 m/s² ±3%	10 m/s²
Velocity	10 mm/s ±3%	10 mm/s

٢. معايرة الجهاز الكترونيا باستخدام الوحدة توليد الاشارة WB 1292

Mode	Input Signal	Standard reading	Actual reading
Acceleration	100 mV at 500 Hz	160 db	160.5 db
Acceleration	10 mV at 500 Hz	140 db	140.5 db
Acceleration	1 mV at 500 Hz	120 db	120.5 db
Velocity	100 mV at 500 Hz	150 db	150 db
Velocity	100 mV at 2 KHz	138 db	138 db

من القراءات السابقة تعتبر درجة الثقة 99%.

وهذة شهادة منا بذلك علما بأن المعايرة سارية لمدة عام اعتبارا من اليوم.

مدير عام الشركة
مهندس/محمد عمر

٣١ ش الشهيد عبد المنعم حافظ - الماظة - القاهرة (ص.ب : ٢٨٨٢ الحرية - هليوبوليس) تليفون : ٢٤١٩٩٠٥٣ - ٢٤١٨٩٦٠٥ فاكس : ٢٤١٨٠٩٦٤
31 El Shahid Abdel Moneim Hafez St., Almaza - Cairo, Egypt (P.O.Box: 2882 El Horia - Heliopolis) Tel.: 24189605 - 24199053 Fax: 24180964
Mobile: 0168808555 E-mail: dce@dce-eg.com

8.4.4 Vibration Simulation Measurements Device

The complete four-channel vibration analysis package

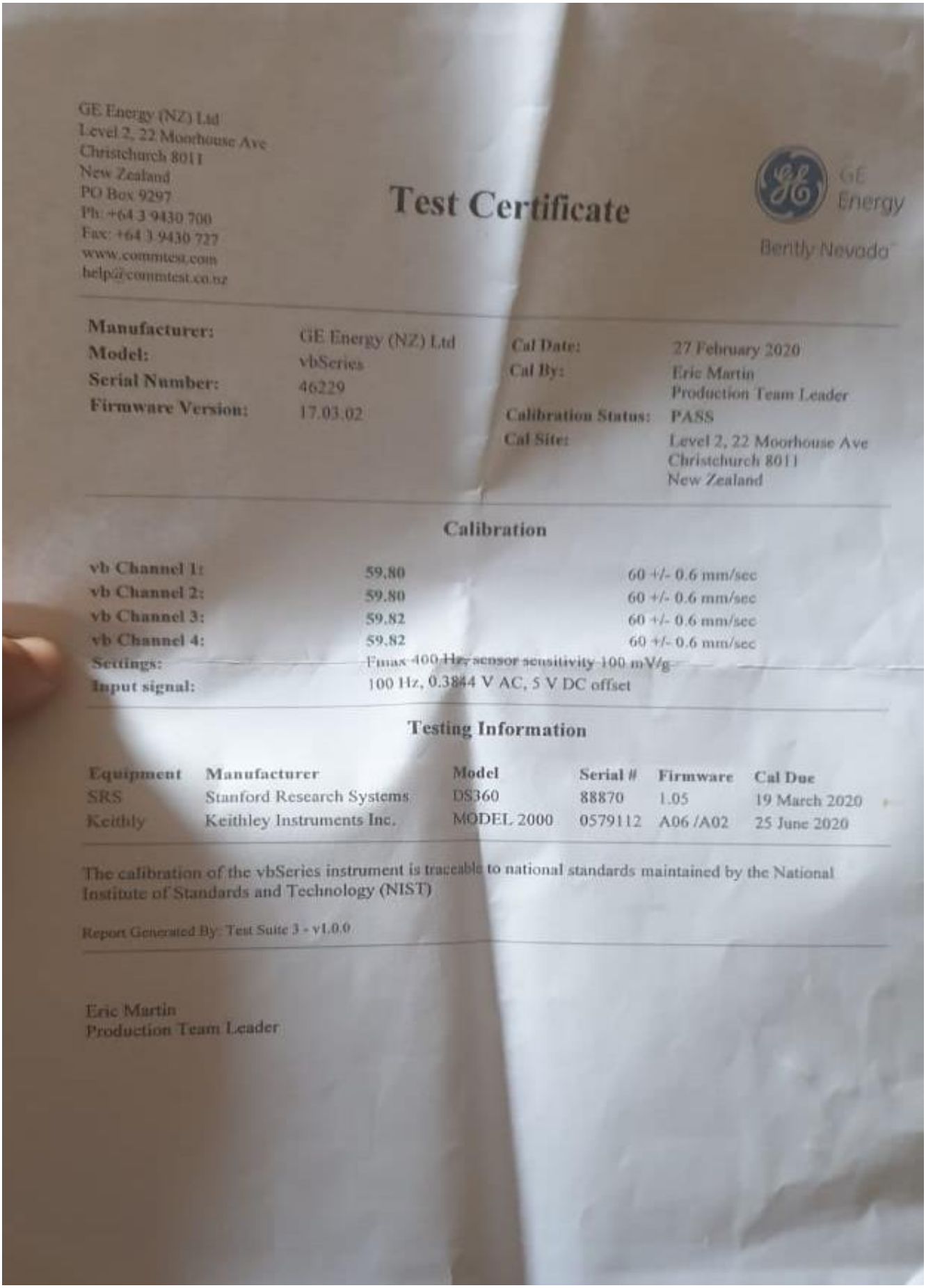
The vb8® analyzer is a uniquely sophisticated and feature-packed instrument that remains intuitive in operation and flexible enough to suit every level of vibration analysis, from novice through to expert.
The Ascent® software included contains the collective experience of over 25 years of expert in-depth machine fault analysis.

1. Users with no prior experience or without a previously recorded vibration history can now establish a measurement program utilizing proven baseline values from ISO standards and The Proven Method from Technical Associates.
2. Experienced users can now generate meaningful spectral alarm bands automatically rather than just relying on basic overall alarms or spectral band guesswork.
3. Veteran analysts can now objectively evaluate and compare their findings against a time-tested and proven historical foundation.

Key features

Ascent® Level 2 software:

- Fully automated measurement parameter and alarm setups based on The Proven Method from Technical Associates
- ISO 2372 and 10816 standards Enhanced instrument functionality:
- 4 channel simultaneous recordings
- Triax-enabled
- 12 800 lines FFT resolution
- 80 kHz Fmax
- 1GB memory – Virtually unlimited spectra storage
- Modal Impact Testing & Cross Channel Spectrum (ODS)
- Ability to export data in Universal File Format
- (UFF) for additional analysis in ODS software such as Vibrant Technology ME'scope
- Support for acceleration, velocity, displacement, DC-coupled, current and voltage output sensors
- Simultaneous acquisition – 2 plane balancing with up to 4 sensors
- Unique Commtest 6Pack™ recording system
- Numeric parameter input via keypad with Ascent® trend and alarm capability
- Option to add Flex features like Remote Comms & Wi-Fi
- Cable Test mode
- Upgradable Proflash system and free firmware updates for 5 years



GE Energy (NZ) Ltd
Level 2, 22 Moorhouse Ave
Christchurch 8011
New Zealand
PO Box 9297
Ph: +64 3 9430 700
Fax: +64 3 9430 727
www.commtest.com
help@commtest.co.nz

Test Certificate

GE Energy
Bently Nevada

Manufacturer:	GE Energy (NZ) Ltd	**Cal Date:**	27 February 2020
Model:	vbSeries	**Cal By:**	Eric Martin Production Team Leader
Serial Number:	46229		
Firmware Version:	17.03.02	**Calibration Status:**	PASS
		Cal Site:	Level 2, 22 Moorhouse Ave Christchurch 8011 New Zealand

Calibration

vb Channel 1:	59.80	60 +/- 0.6 mm/sec
vb Channel 2:	59.80	60 +/- 0.6 mm/sec
vb Channel 3:	59.82	60 +/- 0.6 mm/sec
vb Channel 4:	59.82	60 +/- 0.6 mm/sec
Settings:	Fmax 400 Hz, sensor sensitivity 100 mV/g	
Input signal:	100 Hz, 0.3884 V AC, 5 V DC offset	

Testing Information

Equipment	Manufacturer	Model	Serial #	Firmware	Cal Due
SRS	Stanford Research Systems	DS360	88870	1.05	19 March 2020
Keithly	Keithley Instruments Inc.	MODEL 2000	0579112	A06 /A02	25 June 2020

The calibration of the vbSeries instrument is traceable to national standards maintained by the National Institute of Standards and Technology (NIST)

Report Generated By: Test Suite 3 - v1.0.0

Eric Martin
Production Team Leader