Appendix C

Defiance DPM Noise and Vibration Measurement Report

Detroit Transportation Corporation

Detroit People Mover Noise and Vibration Measurement

Defiance Testing & Engineering
Report No. 106145-000

Prepared for:

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Detroit Transportation Corporation

Detroit People Mover Noise and Vibration Measurement

Defiance Testing & Engineering
Report No. 106145-000

1.0 OBJECTIVE

The objective of this project was to instrument a people mover car and perform noise and vibration measurement.

2.0 INSTRUMENTATION and TEST PROCEDURES

Defiance instrumented a people mover car and performed noise and vibration measurement from August 27 to 28, 2011 at Detroit Transportation Corporation's facility in Detroit, MI. Defiance instrumented a people mover car with total of 32 channels as per Table No.1 Instrumentation Channel List. The front truck of the test car was a new one and the rear truck was an old one. **Appendix A** shows instrumentation photographs. LMS SCADAS Mobile system with Test.Lab software was utilized to collect and process noise and vibration data. Data acquisition sample rates were set to 52 KHz for microphones and 4,096Hz for accelerations and loads.

Data were collected as two laps of clockwise (Run1 and Run3) and two laps of counter-clockwise (Run2 and Run4). The front end of the test car was connected to another car. Test car was in the front during counter-clockwise test runs. All the speakers and fans in the car were turn off during the test. Car was stopped at every station with the doors opened and closed.

3.0 RESULT SUMMARY

Appendix B lists statistic results for the data of the four test runs.
Appendix C Result Plots shows the following plots and results:

- Link load time plots with maximum and minimum loads.
- Microphone sound pressure level time plots with RMS sound pressure levels.
- Microphone loudness time plots with RMS loudness.
- Microphone 1/3rd Octave frequency plots.
- Wheel Mount Acceleration Time Plots with Maximum and Minimum Accelerations.

Equipment items used for this test are listed in **Appendix D: Equipment List**.

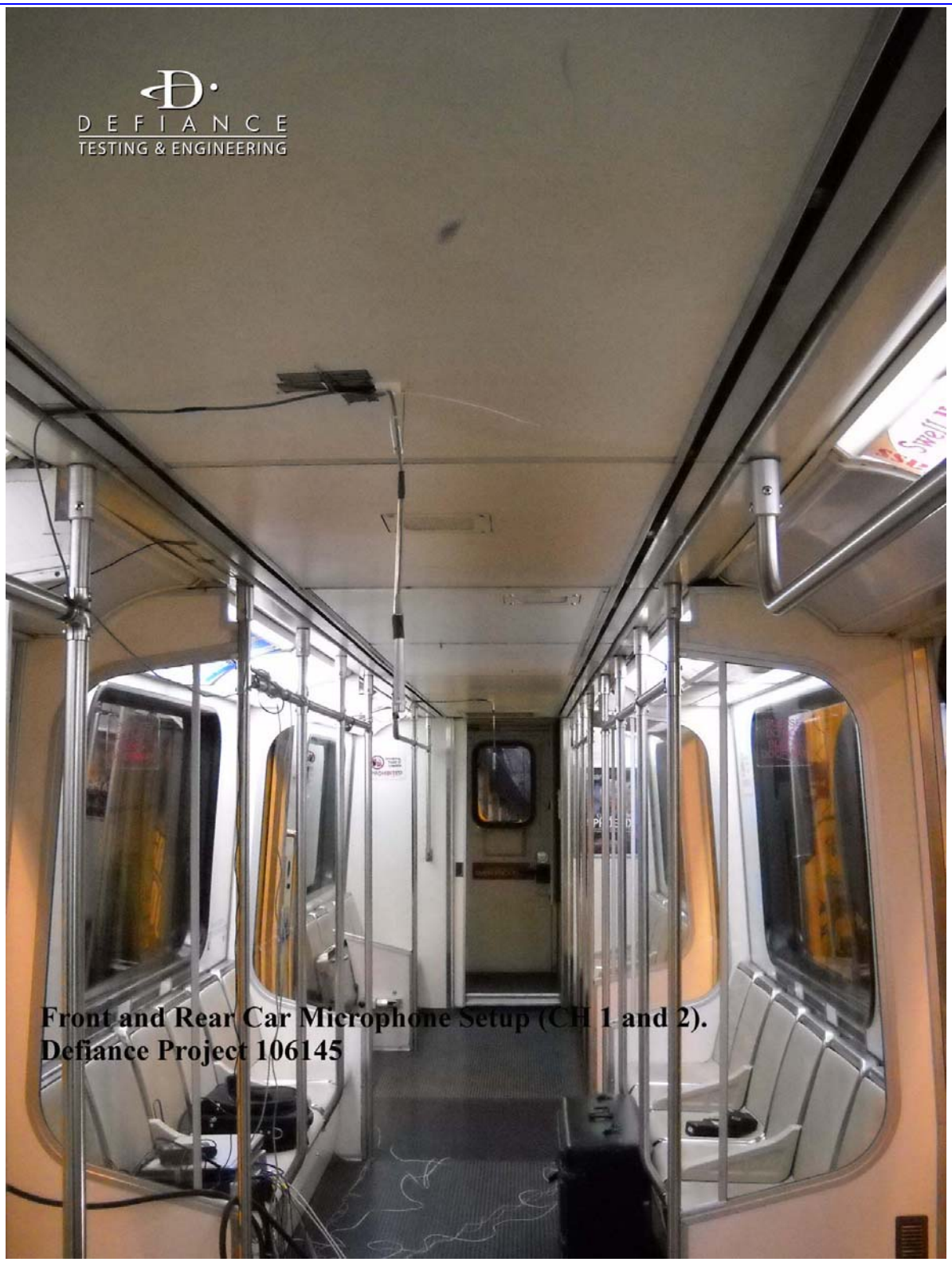
Table No. 1 Instrumentation Channel List

People Mover Instrumentation Channel List

Channel No.	Channel Description	EU	Positive Direction
1	Front Car Microphone	Pa	NA
2	Rear Car Microphone	Pa	NA
3	Front Truck LF Wheel Mnt Accel X	g	FWD
4	Front Truck LF Wheel Mnt Accel Y	g	Right
5	Front Truck LF Wheel Mnt Accel Z	g	Up
6	Front Truck RR Wheel Mnt Accel X	g	FWD
7	Front Truck RR Wheel Mnt Accel Y	g	Right
8	Front Truck RR Wheel Mnt Accel Z	g	Up
9	Front Truck Left Bolster Car Side Accel Z	g	Up
10	Front Truck Left Bolster Truck Side Accel Z	g	Up
11	Front Truck Right Bolster Car Side Accel Z	g	Up
12	Front Truck Right Bolster Truck Side Accel Z	g	Up
13	Front Truck Pivot Car Side Accel X	g	FWD
14	Front Truck Pivot Car Side Accel Y	g	Right
15	Front Truck Pivot Car Side Accel Z	g	Up
16	Rear Truck LF Wheel Mnt Accel X	g	FWD
17	Rear Truck LF Wheel Mnt Accel Y	g	Right
18	Rear Truck LF Wheel Mnt Accel Z	g	Up
19	Rear Truck RR Wheel Mnt Accel X	g	FWD
20	Rear Truck RR Wheel Mnt Accel Y	g	Right
21	Rear Truck RR Wheel Mnt Accel Z	g	Up
22	Rear Truck Left Bolster Car Side Accel Z	g	Up
23	Rear Truck Left Bolster Truck Side Accel Z	g	Up
24	Rear Truck Right Bolster Car Side Accel Z	g	Up
25	Rear Truck Right Bolster Truck Side Accel Z	g	Up
26	Rear Truck Pivot Car Side Accel X	g	FWD
27	Rear Truck Pivot Car Side Accel Y	g	Right
28	Rear Truck Pivot Car Side Accel Z	g	Up
29	Front Truck Long Link Load	lbs	Tension
30	Front Truck Short Link Load	lbs	Tension
31	Rear Truck Long Link Load	lbs	Tension
32	Rear Truck Short Link Load	lbs	Tension

Appendix A

Instrumentation Setup Photographs



Front and Rear Car Microphone Setup (CH 1 and 2).
Defiance Project 106145

Front Car Microphone Setup (CH 1).
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Rear Car Microphone Setup (CH 2)
Defiance Project 106145

Front Truck LH Wheel Mnt Accel Setup (CH 3 to 5).
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Front Truck RR Wheel Mnt Accel Setup (CH 6 to 8).
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Bolster Accelerometer Setup at Truck and Car Sides.
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Front Truck LH Car Side Pivot Accel Setup (CH 13 to 15).
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Rear Truck RH Car Side Pivot Accel Setup (CH 26 to 28).
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Front Truck Long Link Load Sensor Setup (CH 29).
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Front Truck Short Link Load Sensor Setup (CH 30).
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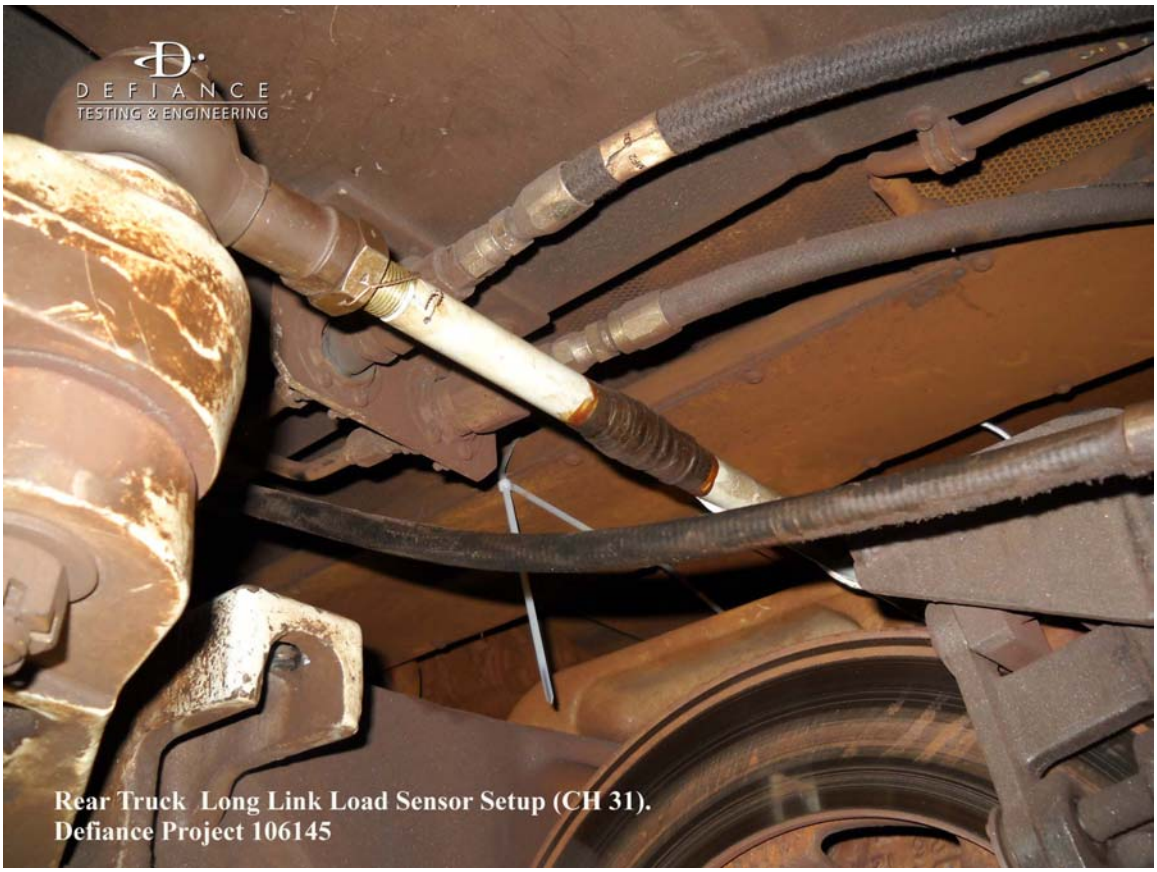

Rear Truck Long Link Load Sensor Setup (CH 31).
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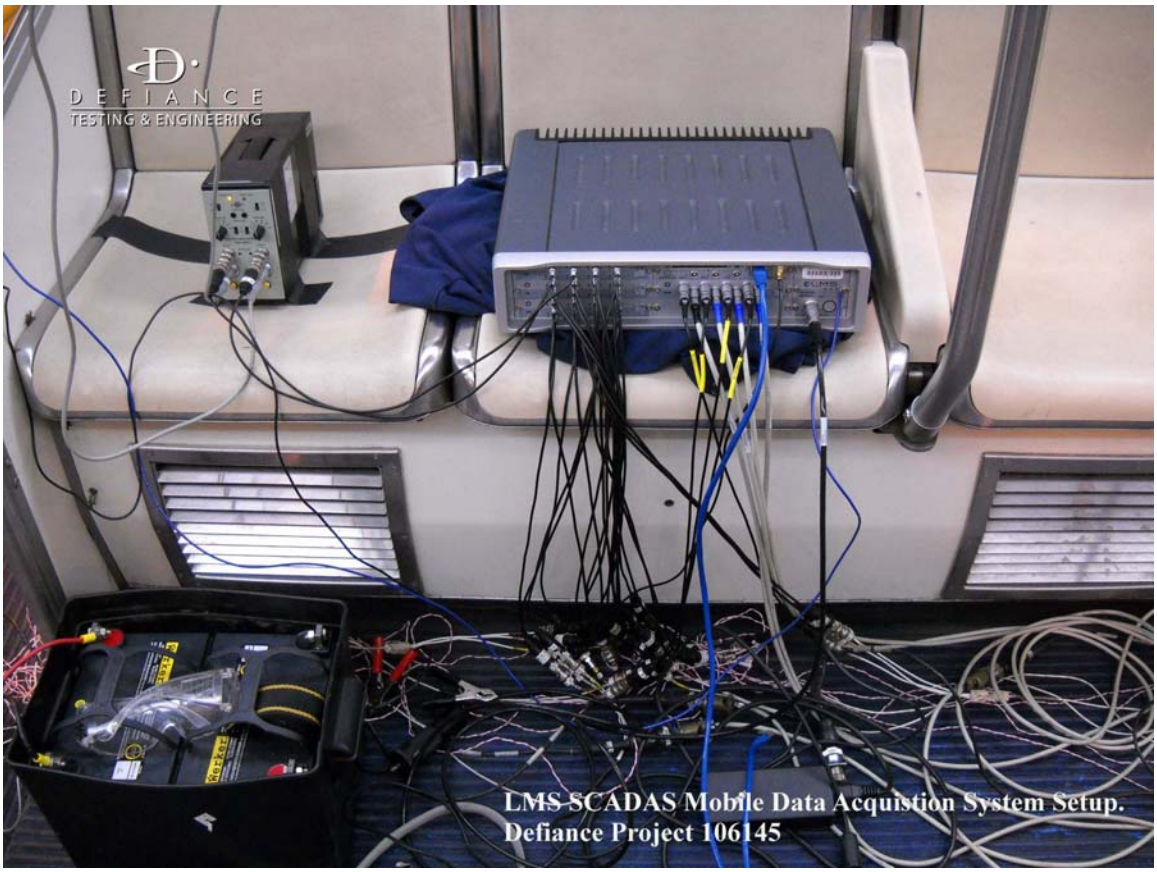
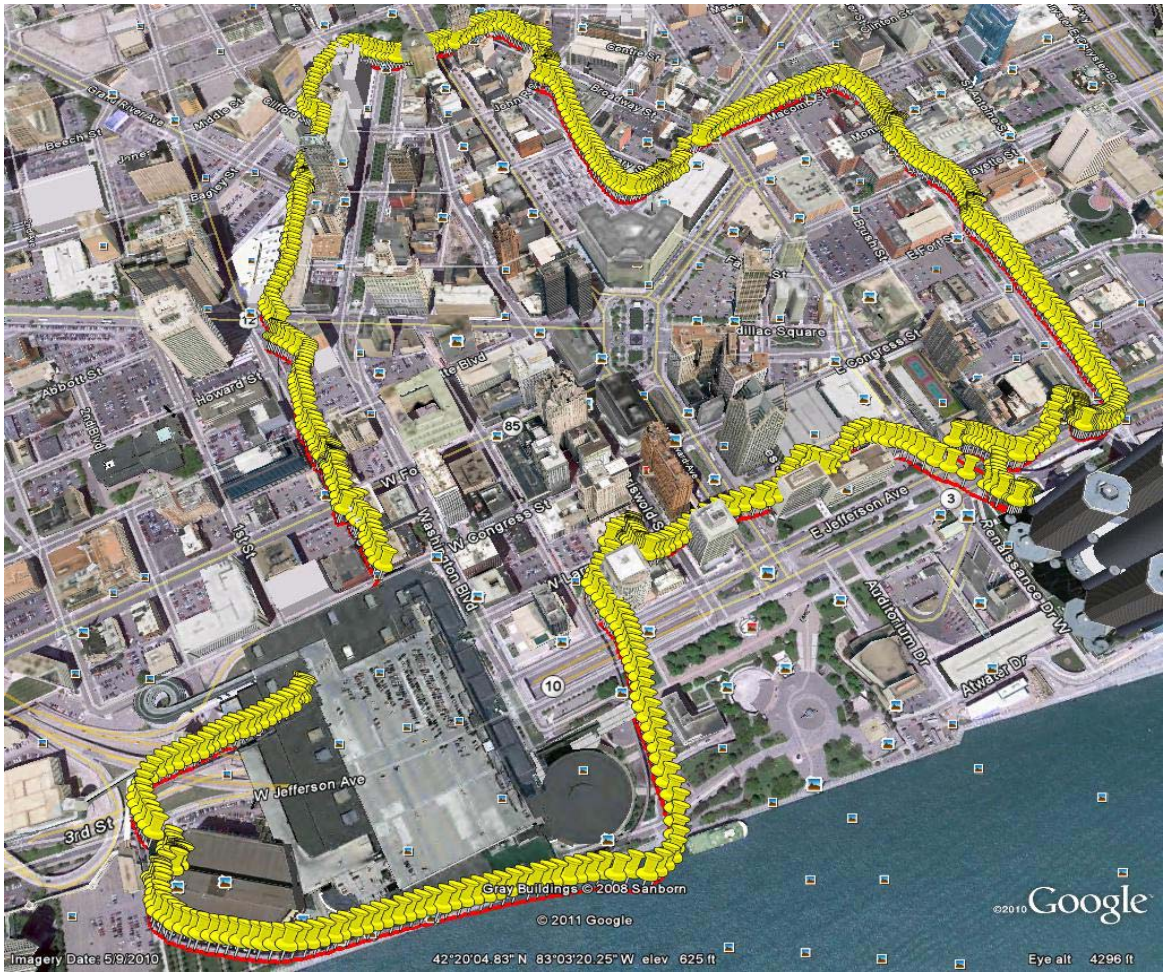
Rear Truck Short Load Sensor Setup (CH 32).
Defiance Project 106145


DEFIANCE
TESTING & ENGINEERING
LMS SCADAS Mobile Data Acquistion System Setup.
Defiance Project 106145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Beech St
Middle St
Bagley St
Abbott St
Howard St
2nd Blvd
1st St
W Fo
W Congress St
Washington Blvd
W Jefferson Ave
3rd St
Centre St
Broadway St
Macomb St
Brush St
E Fort St
E Congress St
E Jefferson Ave
Renaissance Dr W
Auditorium Dr
Atwater Dr
Gray Buildings © 2008 Sanborn
© 2011 Google
©2010 Google
Imagery Date: 5/9/2010
42°20'04.83" N 83°03'20.25" W elev 625 ft
Eye alt 4296 ft

Appendix B

Statistic Results

Statistics for Run1 Data

Channels	RMS	Max	Min	Range	Average	EU
5:Front Truck LF Wheel Mnt Accel X:+X	1.09	32.18	-33.46	65.64	-2.42E-07	g
6:Front Truck LF Wheel Mnt Accel Y:+Y	1.87	79.25	-75.04	154.29	7.51E-07	g
7:Front Truck LF Wheel Mnt Accel Z:+Z	0.89	41.57	-31.12	72.69	-1.64E-06	g
8:Front Truck RR Wheel Mnt Accel X:+X	0.86	26.6	-39.5	66.1	9.36E-07	g
9:Front Truck RR Wheel Mnt Accel Y:+Y	1.68	68.19	-51.09	119.28	-1.81E-06	g
10:Front Truck RR Wheel Mnt Accel Z:+Z	0.85	34.04	-29.17	63.21	5.54E-07	g
11:Front Truck Left Bolser Car Side Accel Z:+Z	0.06	1.49	-1.43	2.92	-2.32E-06	g
12:Front Truck Left Bolster Truck Side Accel Z:+Z	0.42	8.74	-9.93	18.67	1.81E-06	g
13:Front Truck Right Bolser Car Side Accel Z:+Z	0.07	1.36	-1.54	2.9	1.74E-07	g
14:Front Truck Right Bolster Truck Side Accel Z:+Z	0.41	13.79	-9.78	23.57	1.40E-06	g
15:Front Truck Pivot Car Side Accel X:+X	0.24	5.28	-6.55	11.83	5.04E-07	g
16:Front Truck Pivot Car Side Accel Y:+Y	0.33	9.1	-6.9	16	2.96E-06	g
17:Front Truck Pivot Car Side Accel Z:+Z	0.09	2.52	-2.21	4.73	-2.78E-06	g
18:Rear Truck LF Wheel Mnt Accel X:+X	0.92	43.8	-44.94	88.74	1.55E-07	g
19:Rear Truck LF Wheel Mnt Accel Y:+Y	1.71	77.07	-73.22	150.29	2.86E-06	g
20:Rear Truck LF Wheel Mnt Accel Z:+Z	0.71	35.7	-30.08	65.78	-2.38E-07	g
21:Rear Truck RR Wheel Mnt Accel X:+X	1	35.75	-33.67	69.42	8.97E-07	g
22:Rear Truck RR Wheel Mnt Accel Y:+Y	1.72	79.45	-76.93	156.38	-1.16E-06	g
23:Rear Truck RR Wheel Mnt Accel Z:+Z	0.84	45.68	-32.34	78.02	-4.13E-06	g
24:Rear Truck Left Bolser Car Side Accel Z:+Z	0.06	2.17	-1.72	3.89	-6.38E-06	g
25:Rear Truck Left Bolster Truck Side Accel Z:+Z	0.41	11.24	-8.98	20.22	1.92E-06	g
26:Rear Truck Right Bolster Car Side Accel Z:+Z	0.06	3.79	-1.51	5.3	5.01E-06	g
27:Rear Truck Right Bolster Truck Side Accel Z:+Z	0.41	15.4	-11.94	27.34	7.57E-06	g
28:Rear Truck Pivot Car Side Accel X:+X	0.21	5.86	-7.08	12.94	1.37E-06	g
29:Rear Truck Pivot Car Side Accel Y:+Y	0.48	16.19	-16.42	32.61	-1.67E-07	g
30:Rear Truck Pivot Car Side Accel Z:+Z	0.09	2.26	-1.86	4.12	-1.65E-06	g
31:Front Truck Long Link Load	88.59	508.94	-508.94	1017.88	65.74	lbf
32:Front Truck Short Link Load	1021.76	4479.38	-2974.81	7454.19	883.71	lbf
33:Rear Truck Long Link Load	735.13	1232.91	89.84	1143.07	712.09	lbf
34:Rear Truck Short Link Load	500.76	3631.59	-3284.53	6916.12	357.61	lbf

Statistics for Run2 Data

Channel	RMS	Max	Min	Range	Average	EU
5:Front Truck LF Wheel Mnt Accel X:+X	1.11	70.1	-55.72	125.82	-3.51E-06	g
6:Front Truck LF Wheel Mnt Accel Y:+Y	2.2	102.65	-67.88	170.53	-2.24E-05	g
7:Front Truck LF Wheel Mnt Accel Z:+Z	0.96	47.77	-31.9	79.67	-2.64E-07	g
8:Front Truck RR Wheel Mnt Accel X:+X	0.92	30	-30.94	60.94	3.48E-07	g
9:Front Truck RR Wheel Mnt Accel Y:+Y	1.74	65.78	-50.72	116.5	-6.25E-07	g
10:Front Truck RR Wheel Mnt Accel Z:+Z	0.86	30.14	-25.36	55.5	-5.60E-08	g
11:Front Truck Left Bolser Car Side Accel Z:+Z	0.06	1.4	-1.38	2.78	-5.43E-07	g
12:Front Truck Left Bolster Truck Side Accel Z:+Z	0.43	7.59	-8.05	15.64	2.32E-06	g
13:Front Truck Right Bolser Car Side Accel Z:+Z	0.07	1.27	-1.25	2.52	3.64E-07	g
14:Front Truck Right Bolster Truck Side Accel Z:+Z	0.41	12.23	-9.64	21.87	-9.74E-07	g
15:Front Truck Pivot Car Side Accel X:+X	0.24	7.03	-5.87	12.9	-4.13E-07	g
16:Front Truck Pivot Car Side Accel Y:+Y	0.34	7.12	-7.45	14.57	1.05E-06	g
17:Front Truck Pivot Car Side Accel Z:+Z	0.09	2.04	-2.1	4.14	-6.15E-07	g
18:Rear Truck LF Wheel Mnt Accel X:+X	0.93	41.13	-34.72	75.85	-1.25E-06	g
19:Rear Truck LF Wheel Mnt Accel Y:+Y	1.71	96.47	-73.49	169.96	1.70E-06	g
20:Rear Truck LF Wheel Mnt Accel Z:+Z	0.7	36.92	-29.36	66.28	-2.40E-06	g
21:Rear Truck RR Wheel Mnt Accel X:+X	0.98	38.09	-36.81	74.9	-1.38E-07	g
22:Rear Truck RR Wheel Mnt Accel Y:+Y	1.72	76.27	-75.8	152.07	-1.03E-06	g
23:Rear Truck RR Wheel Mnt Accel Z:+Z	0.85	30.49	-27.63	58.12	-3.19E-06	g
24:Rear Truck Left Bolser Car Side Accel Z:+Z	0.06	1.51	-1.64	3.15	-1.75E-06	g
25:Rear Truck Left Bolster Truck Side Accel Z:+Z	0.4	10.6	-10.84	21.44	7.28E-07	g
26:Rear Truck Right Bolster Car Side Accel Z:+Z	0.06	3.02	-1.5	4.52	-8.38E-07	g
27:Rear Truck Right Bolster Truck Side Accel Z:+Z	0.41	18.67	-13.6	32.27	4.90E-06	g
28:Rear Truck Pivot Car Side Accel X:+X	0.22	7.29	-6.68	13.97	1.28E-06	g
29:Rear Truck Pivot Car Side Accel Y:+Y	0.49	14.98	-14.49	29.47	3.58E-07	g
30:Rear Truck Pivot Car Side Accel Z:+Z	0.08	2.59	-1.98	4.57	-6.21E-07	g
31:Front Truck Long Link Load	145.62	553.92	-553.92	1107.84	117.11	lbf
32:Front Truck Short Link Load	581.35	3817.44	-3817.44	7634.88	434.24	lbf
33:Rear Truck Long Link Load	130.81	829.23	-450.69	1279.92	100.64	lbf
34:Rear Truck Short Link Load	573.15	3792.29	-3790.12	7582.41	380.42	lbf

Statistics for Run3 Data

Channels	RMS	Max	Min	Range	Average	EU
5:Front Truck LF Wheel Mnt Accel X:+X	1.07	32.21	-34.04	66.25	-1.78E-06	g
6:Front Truck LF Wheel Mnt Accel Y:+Y	1.88	81.33	-74.01	155.34	-7.32E-07	g
7:Front Truck LF Wheel Mnt Accel Z:+Z	0.88	42.56	-32.1	74.66	8.68E-07	g
8:Front Truck RR Wheel Mnt Accel X:+X	0.87	26.02	-37.68	63.7	4.43E-07	g
9:Front Truck RR Wheel Mnt Accel Y:+Y	1.71	70.06	-49.69	119.75	1.13E-07	g
10:Front Truck RR Wheel Mnt Accel Z:+Z	0.83	34.88	-29.62	64.5	1.52E-09	g
11:Front Truck Left Bolser Car Side Accel Z:+Z	0.06	2.19	-1.95	4.14	1.87E-06	g
12:Front Truck Left Bolster Truck Side Accel Z:+Z	0.41	8.75	-10.54	19.29	-1.12E-06	g
13:Front Truck Right Bolser Car Side Accel Z:+Z	0.07	1.67	-1.68	3.35	1.55E-06	g
14:Front Truck Right Bolster Truck Side Accel Z:+Z	0.41	15.1	-12.21	27.31	-8.98E-07	g
15:Front Truck Pivot Car Side Accel X:+X	0.24	4.91	-5.98	10.89	-5.85E-07	g
16:Front Truck Pivot Car Side Accel Y:+Y	0.32	9.2	-7.26	16.46	1.88E-07	g
17:Front Truck Pivot Car Side Accel Z:+Z	0.09	2.63	-2.34	4.97	4.87E-07	g
18:Rear Truck LF Wheel Mnt Accel X:+X	0.91	41.17	-44.5	85.67	-8.80E-07	g
19:Rear Truck LF Wheel Mnt Accel Y:+Y	1.68	74.38	-72.59	146.97	3.45E-06	g
20:Rear Truck LF Wheel Mnt Accel Z:+Z	0.69	31.22	-43.37	74.59	-1.12E-06	g
21:Rear Truck RR Wheel Mnt Accel X:+X	0.99	36	-33.5	69.5	-8.48E-09	g
22:Rear Truck RR Wheel Mnt Accel Y:+Y	1.7	79.48	-75.68	155.16	-1.77E-06	g
23:Rear Truck RR Wheel Mnt Accel Z:+Z	0.83	44.95	-39.5	84.45	-1.52E-06	g
24:Rear Truck Left Bolser Car Side Accel Z:+Z	0.06	2.12	-1.5	3.62	-2.76E-06	g
25:Rear Truck Left Bolster Truck Side Accel Z:+Z	0.4	13.9	-10.66	24.56	1.76E-06	g
26:Rear Truck Right Bolster Car Side Accel Z:+Z	0.06	4.5	-1.31	5.81	1.01E-05	g
27:Rear Truck Right Bolster Truck Side Accel Z:+Z	0.4	12.14	-11.62	23.76	7.64E-06	g
28:Rear Truck Pivot Car Side Accel X:+X	0.21	6.15	-6.76	12.91	1.37E-06	g
29:Rear Truck Pivot Car Side Accel Y:+Y	0.48	12.59	-13.4	25.99	1.81E-06	g
30:Rear Truck Pivot Car Side Accel Z:+Z	0.08	2.4	-2.02	4.42	-1.31E-06	g
31:Front Truck Long Link Load	98.45	647.63	-445.92	1093.55	71.42	lbf
32:Front Truck Short Link Load	649.04	4004.28	-4004.28	8008.56	443.13	lbf
33:Rear Truck Long Link Load	213.27	625.82	-513.72	1139.54	178.94	lbf
34:Rear Truck Short Link Load	524.39	3720.04	-3574.18	7294.22	389.59	lbf

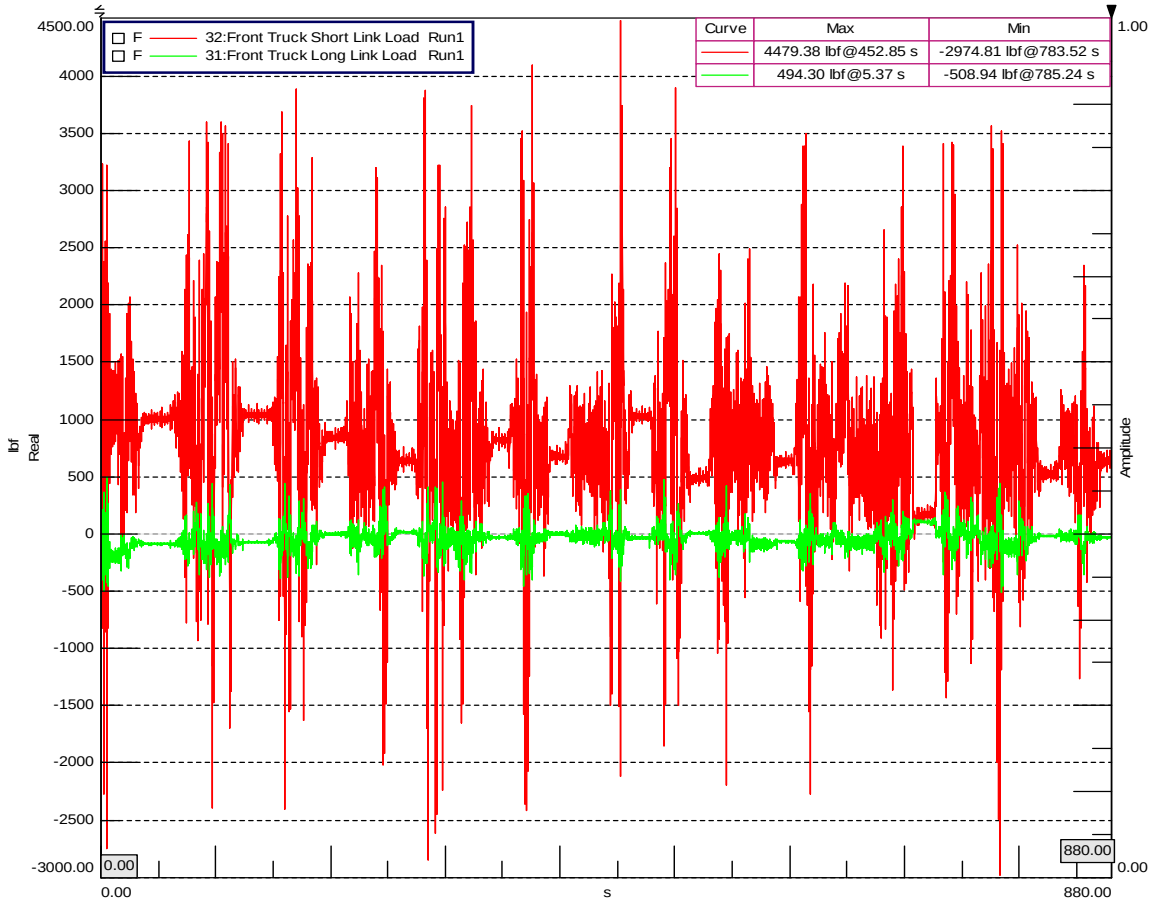
Statistics for Run4 Data

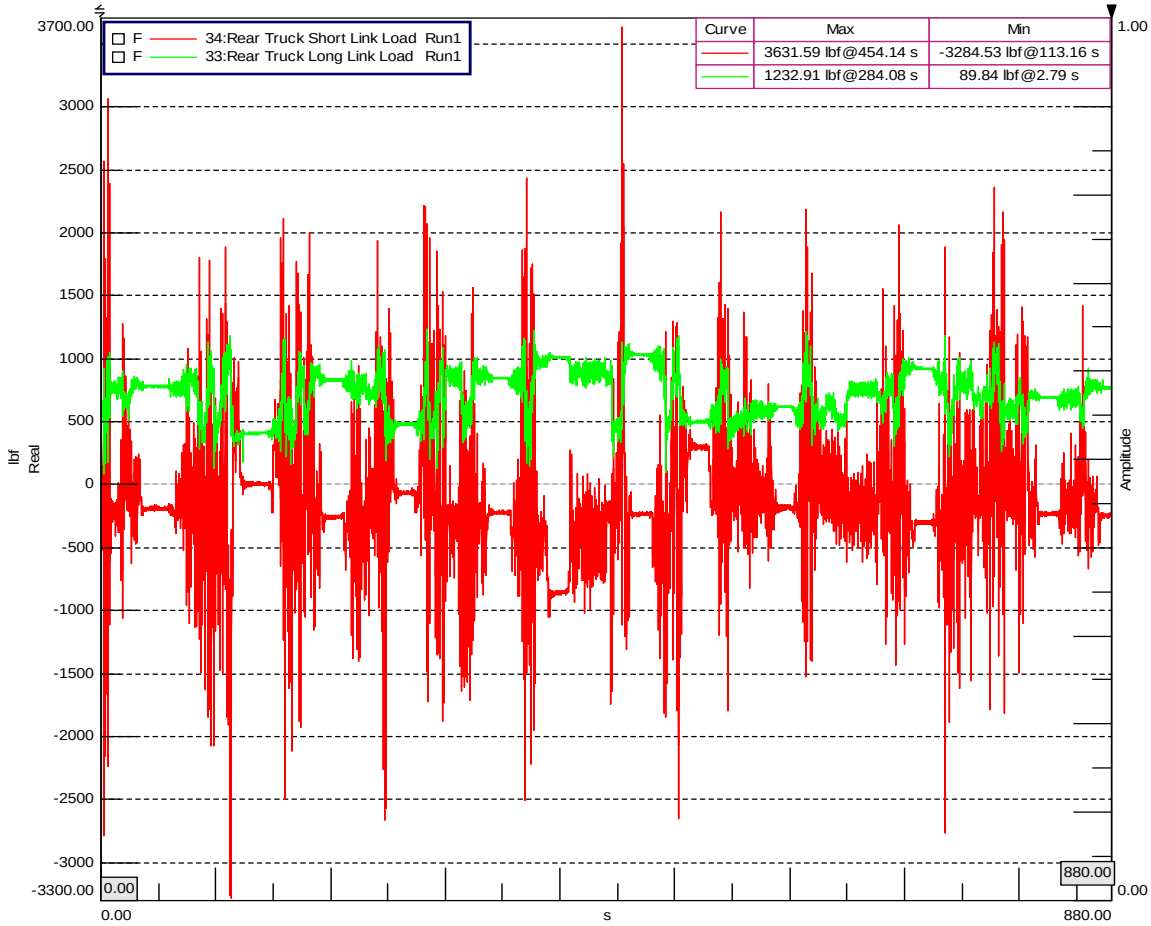
Channels	RMS	Max	Min	Range	Average	EU
5:Front Truck LF Wheel Mnt Accel X:+X	1.12	71.5	-57.99	129.49	-2.56E-06	g
6:Front Truck LF Wheel Mnt Accel Y:+Y	2.23	102.65	-66.74	169.39	-2.38E-05	g
7:Front Truck LF Wheel Mnt Accel Z:+Z	0.96	52.74	-32.19	84.93	-4.94E-07	g
8:Front Truck RR Wheel Mnt Accel X:+X	0.91	28.58	-31.66	60.24	1.10E-06	g
9:Front Truck RR Wheel Mnt Accel Y:+Y	1.75	64.62	-50.61	115.23	-1.75E-07	g
10:Front Truck RR Wheel Mnt Accel Z:+Z	0.85	31.55	-21.51	53.06	1.57E-07	g
11:Front Truck Left Bolser Car Side Accel Z:+Z	0.06	1.46	-1.49	2.95	1.95E-06	g
12:Front Truck Left Bolster Truck Side Accel Z:+Z	0.43	7.13	-7.76	14.89	-2.37E-06	g
13:Front Truck Right Bolser Car Side Accel Z:+Z	0.07	1.42	-1.22	2.64	1.44E-06	g
14:Front Truck Right Bolster Truck Side Accel Z:+Z	0.4	11.14	-9.28	20.42	-1.24E-06	g
15:Front Truck Pivot Car Side Accel X:+X	0.24	7.3	-5.79	13.09	-1.96E-06	g
16:Front Truck Pivot Car Side Accel Y:+Y	0.33	7.19	-6.75	13.94	-1.86E-06	g
17:Front Truck Pivot Car Side Accel Z:+Z	0.09	2.19	-1.95	4.14	1.81E-06	g
18:Rear Truck LF Wheel Mnt Accel X:+X	0.92	40.93	-35.27	76.2	-1.36E-06	g
19:Rear Truck LF Wheel Mnt Accel Y:+Y	1.71	92.15	-72.96	165.11	2.37E-06	g
20:Rear Truck LF Wheel Mnt Accel Z:+Z	0.7	34.64	-22.1	56.74	-2.91E-06	g
21:Rear Truck RR Wheel Mnt Accel X:+X	0.98	37.15	-36.33	73.48	1.71E-06	g
22:Rear Truck RR Wheel Mnt Accel Y:+Y	1.72	77.5	-73.41	150.91	-6.28E-07	g
23:Rear Truck RR Wheel Mnt Accel Z:+Z	0.85	30.06	-22.35	52.41	-3.72E-06	g
24:Rear Truck Left Bolser Car Side Accel Z:+Z	0.06	1.7	-1.84	3.54	1.13E-06	g
25:Rear Truck Left Bolster Truck Side Accel Z:+Z	0.4	10.4	-10.2	20.6	-4.98E-07	g
26:Rear Truck Right Bolster Car Side Accel Z:+Z	0.06	2.98	-1.47	4.45	5.42E-06	g
27:Rear Truck Right Bolster Truck Side Accel Z:+Z	0.4	20.21	-10.87	31.08	4.93E-06	g
28:Rear Truck Pivot Car Side Accel X:+X	0.22	8.23	-7.03	15.26	1.05E-08	g
29:Rear Truck Pivot Car Side Accel Y:+Y	0.49	14.93	-14.26	29.19	-1.72E-07	g
30:Rear Truck Pivot Car Side Accel Z:+Z	0.08	3.13	-2.26	5.39	3.69E-07	g
31:Front Truck Long Link Load	177.82	602.25	-602.25	1204.5	148.02	lbf
32:Front Truck Short Link Load	638.79	3877.65	-3877.65	7755.3	504.34	lbf
33:Rear Truck Long Link Load	135.14	850.09	-445.26	1295.35	105.07	lbf
34:Rear Truck Short Link Load	576.17	3912.38	-3795.06	7707.44	384.04	lbf

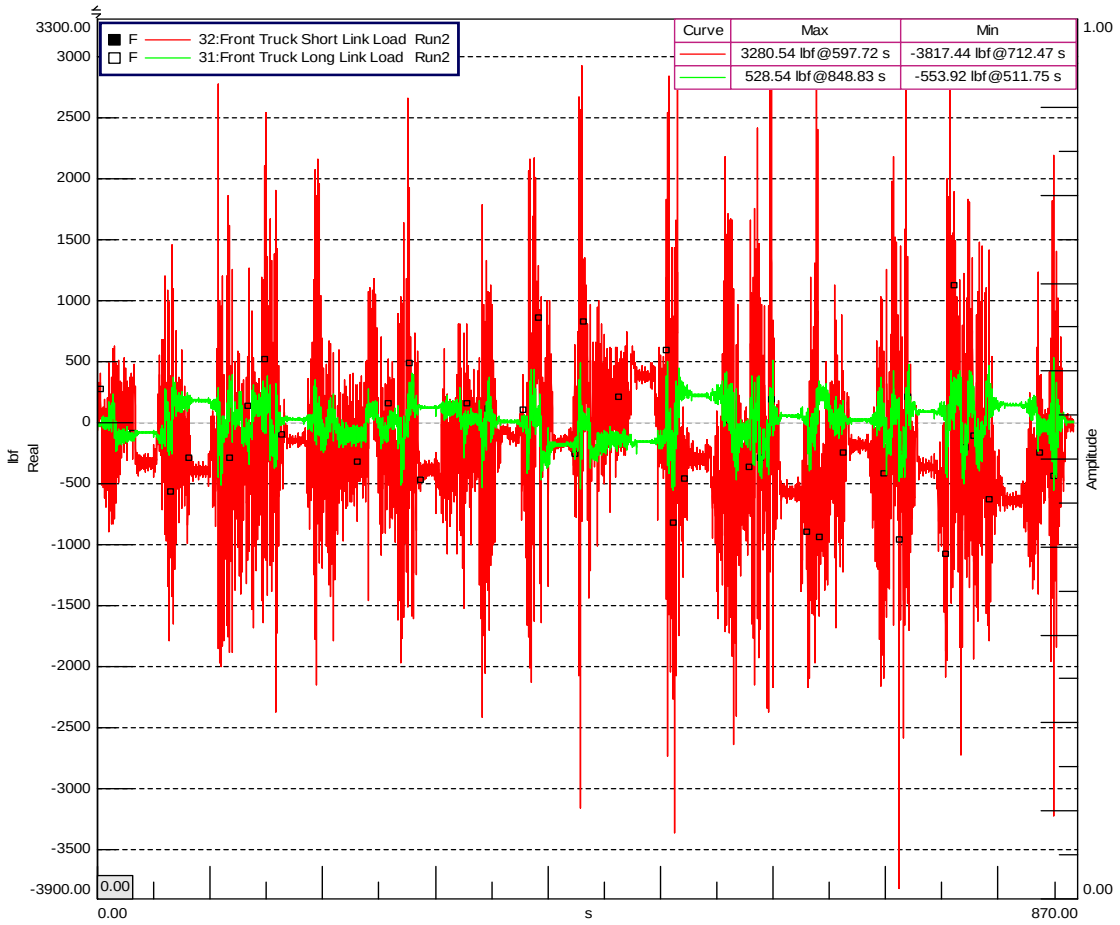
Appendix C

Result Plots

Link Load Time Plots with Max and Min Loads






F 32:Front Truck Short Link Load Run2
F 31:Front Truck Long Link Load Run2
Curve | Max | Min
3280.54 lbf@597.72 s | -3817.44 lbf@712.47 s
528.54 lbf@848.83 s | -553.92 lbf@511.75 s
3300.00
3000
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
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lbf
Real
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1.00
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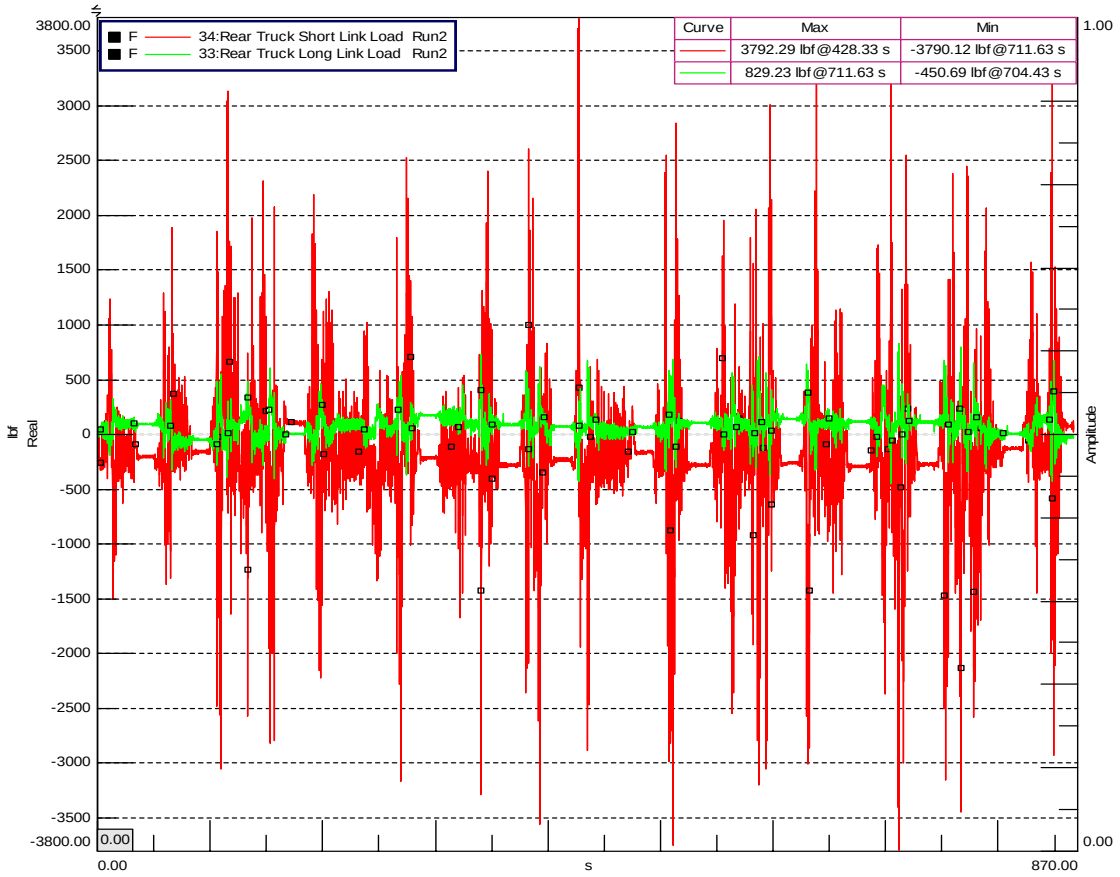
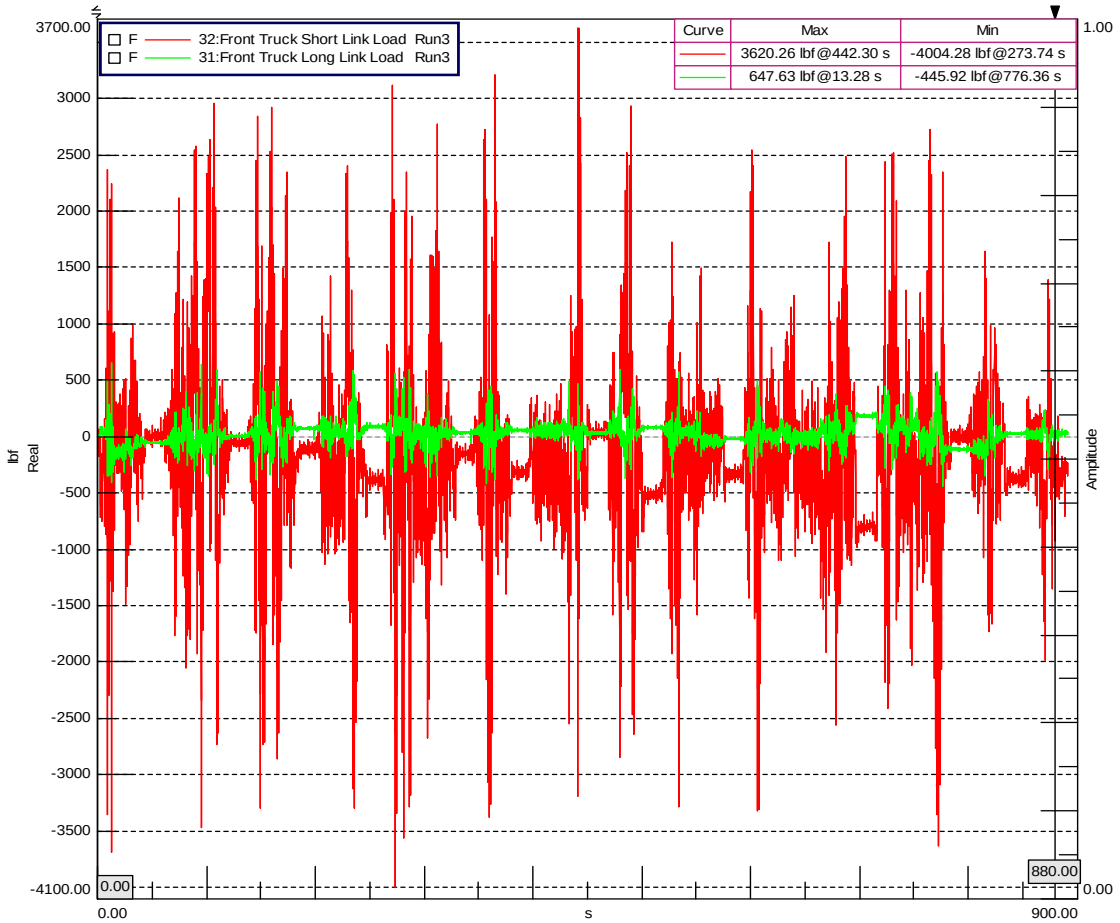
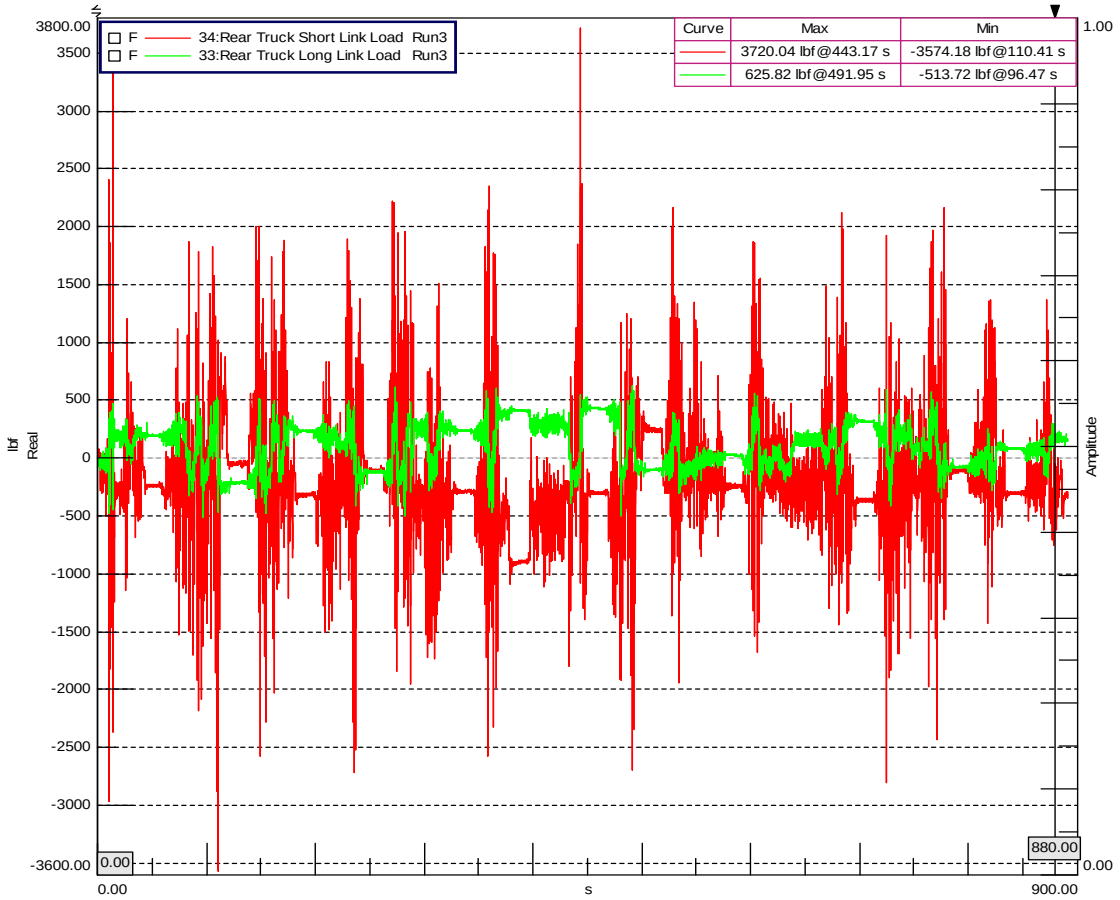
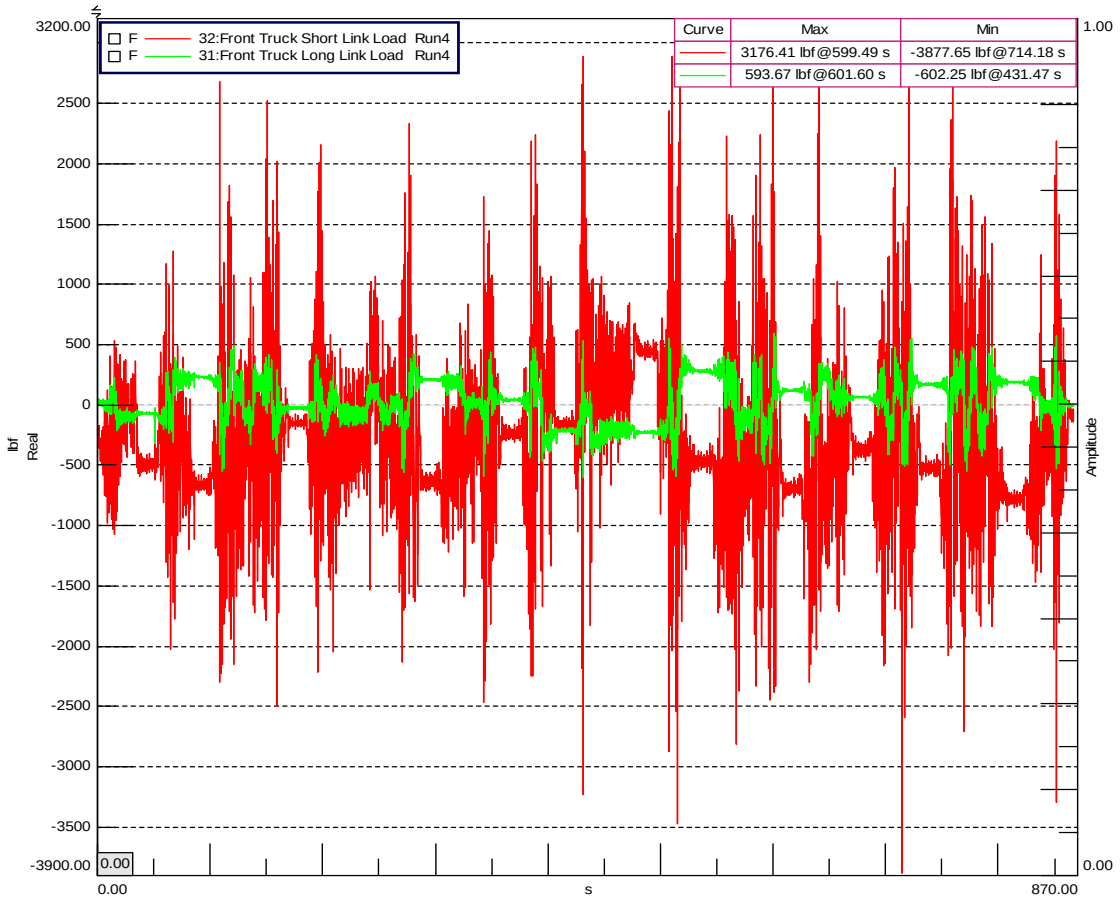
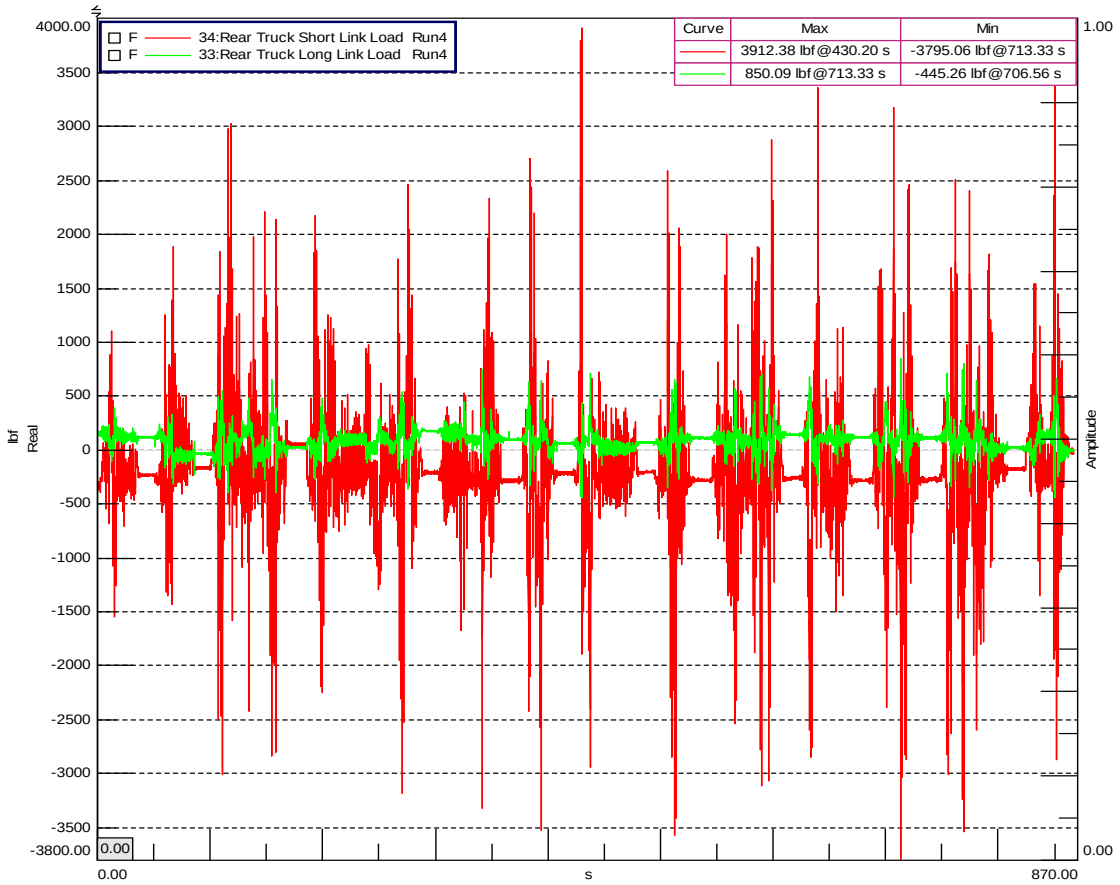

F 34:Rear Truck Short Link Load Run2
F 33:Rear Truck Long Link Load Run2
Curve | Max | Min
3792.29 lbf@428.33 s | -3790.12 lbf@711.63 s
829.23 lbf@711.63 s | -450.69 lbf@704.43 s
3800.00
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-3800.00
lbf
Real
Amplitude
1.00
0.00
0.00
s
870.00

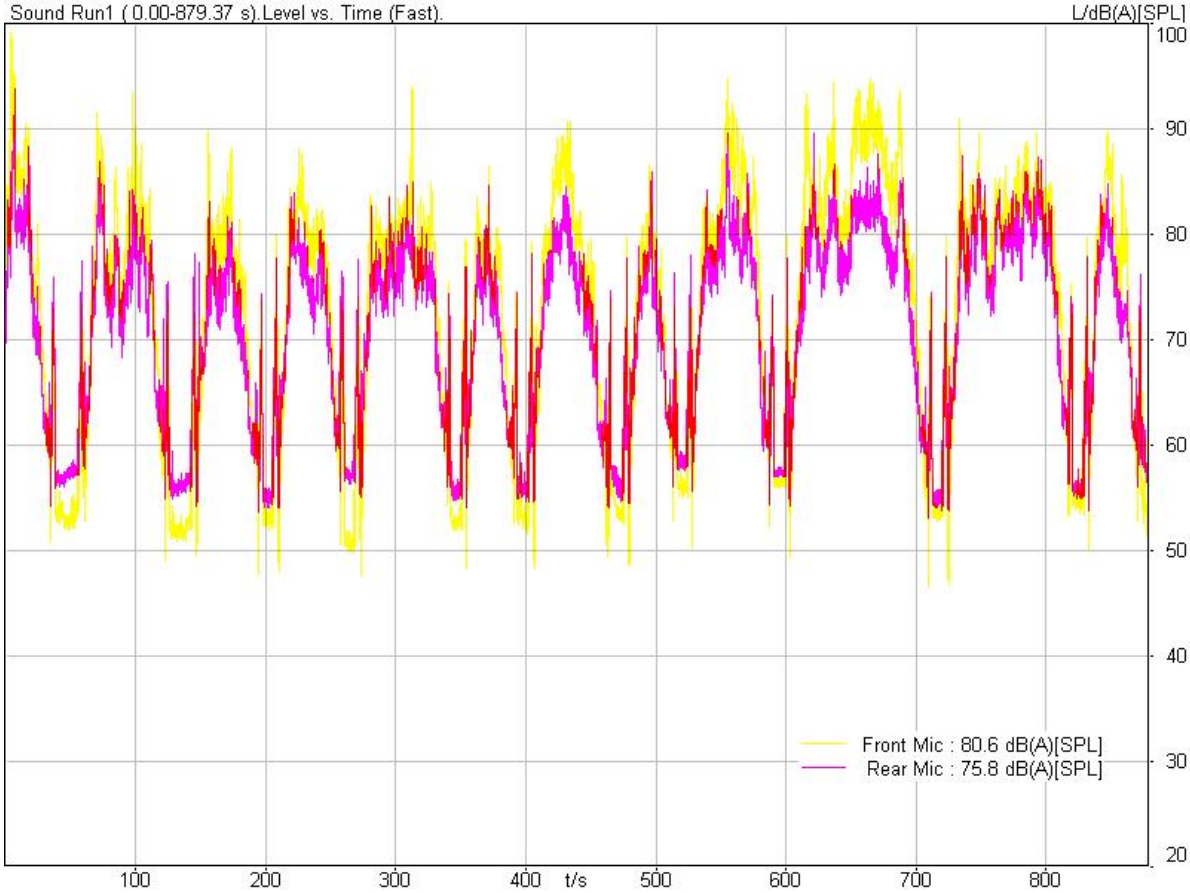

F 32:Front Truck Short Link Load Run3
F 31:Front Truck Long Link Load Run3
Curve | Max | Min
3620.26 lbf@442.30 s | -4004.28 lbf@273.74 s
647.63 lbf@13.28 s | -445.92 lbf@776.36 s
3700.00
3000
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4100.00
lbf
Real
Amplitude
1.00
0.00
0.00
880.00
0.00
s
900.00

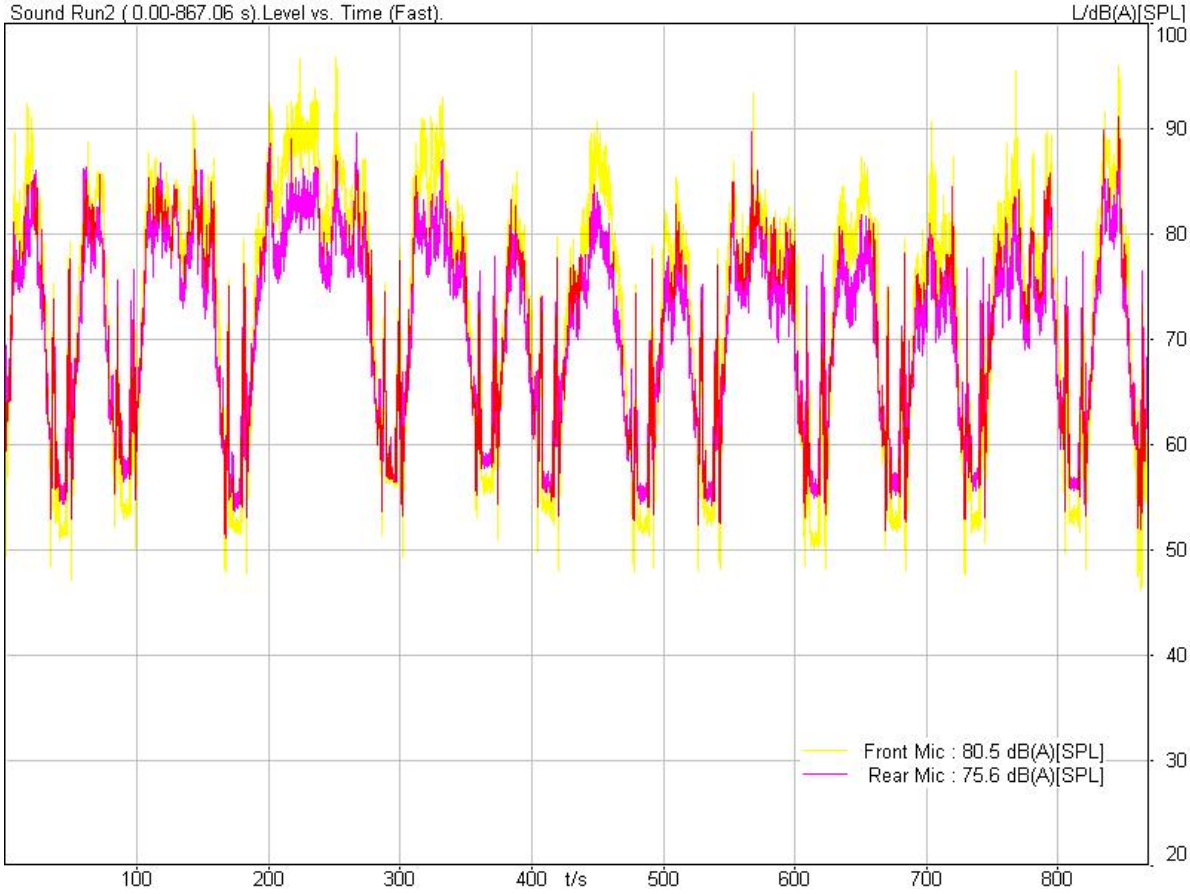

F 34:Rear Truck Short Link Load Run3
F 33:Rear Truck Long Link Load Run3
Curve | Max | Min
3720.04 lbf@443.17 s | -3574.18 lbf@110.41 s
625.82 lbf@491.95 s | -513.72 lbf@96.47 s
3800.00
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
-3000
-3600.00
lbf
Real
Amplitude
1.00
0.00
0.00
880.00
0.00
s
900.00

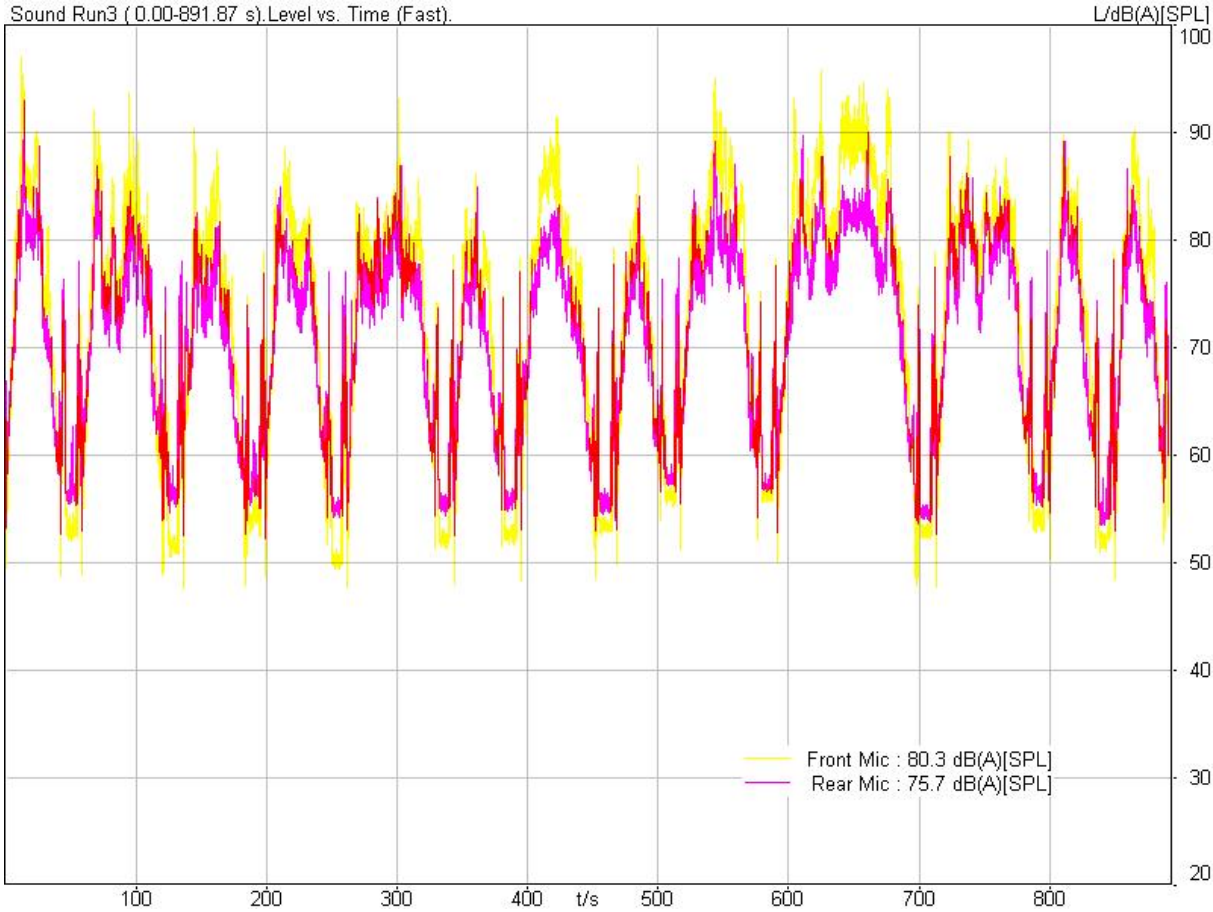

F 32:Front Truck Short Link Load Run4
F 31:Front Truck Long Link Load Run4
Curve
Max
Min
3176.41 lbf@599.49 s
-3877.65 lbf@714.18 s
593.67 lbf@601.60 s
-602.25 lbf@431.47 s
3200.00
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-3900.00
lbf
Real
1.00
0.00
Amplitude
0.00
s
870.00

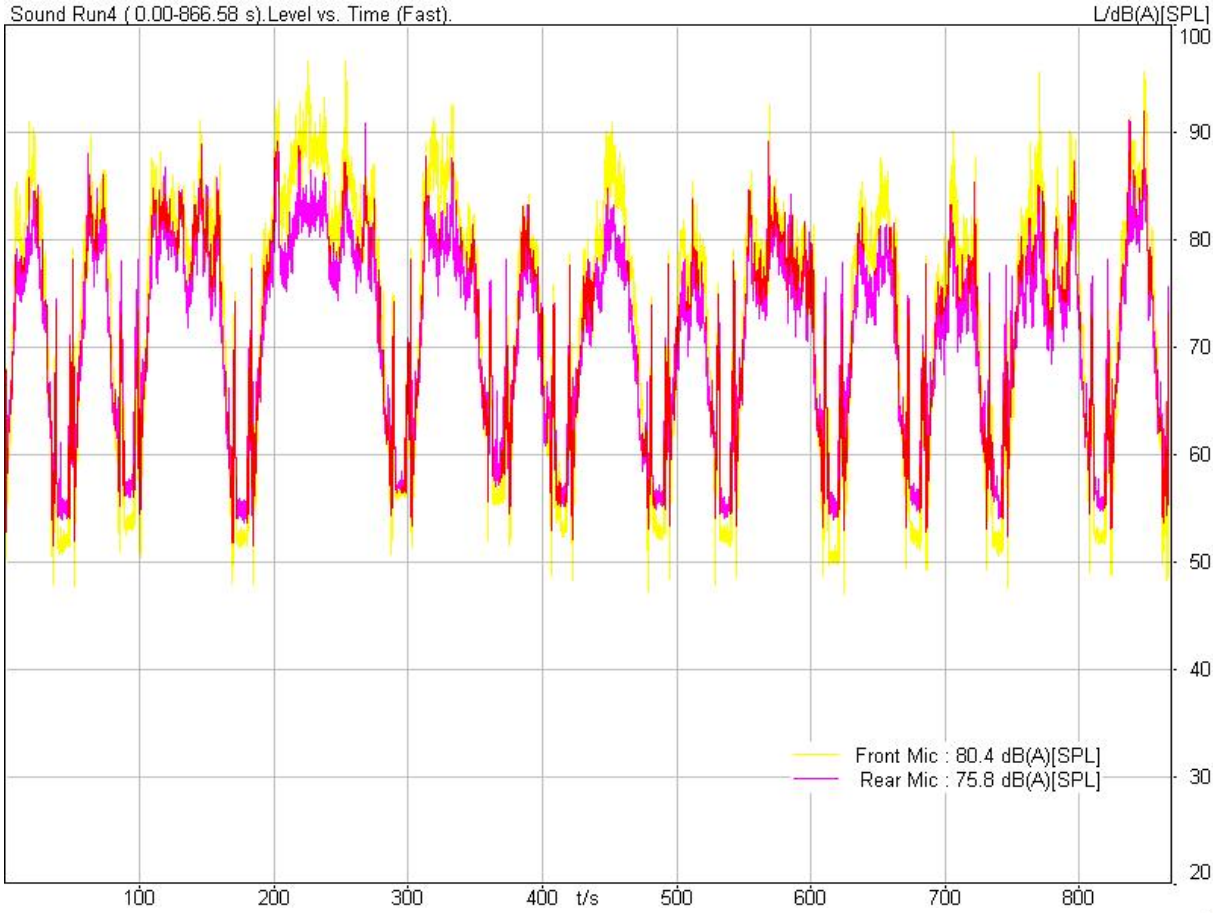

F 34:Rear Truck Short Link Load Run4
F 33:Rear Truck Long Link Load Run4
Curve
Max
Min
3912.38 lbf@430.20 s
-3795.06 lbf@713.33 s
850.09 lbf@713.33 s
-445.26 lbf@706.56 s
4000.00
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-3800.00
lbf
Real
1.00
0.00
Amplitude
0.00
s
870.00

Microphone Sound Pressure Levels Time Plots and RMS Sound Pressure Levels

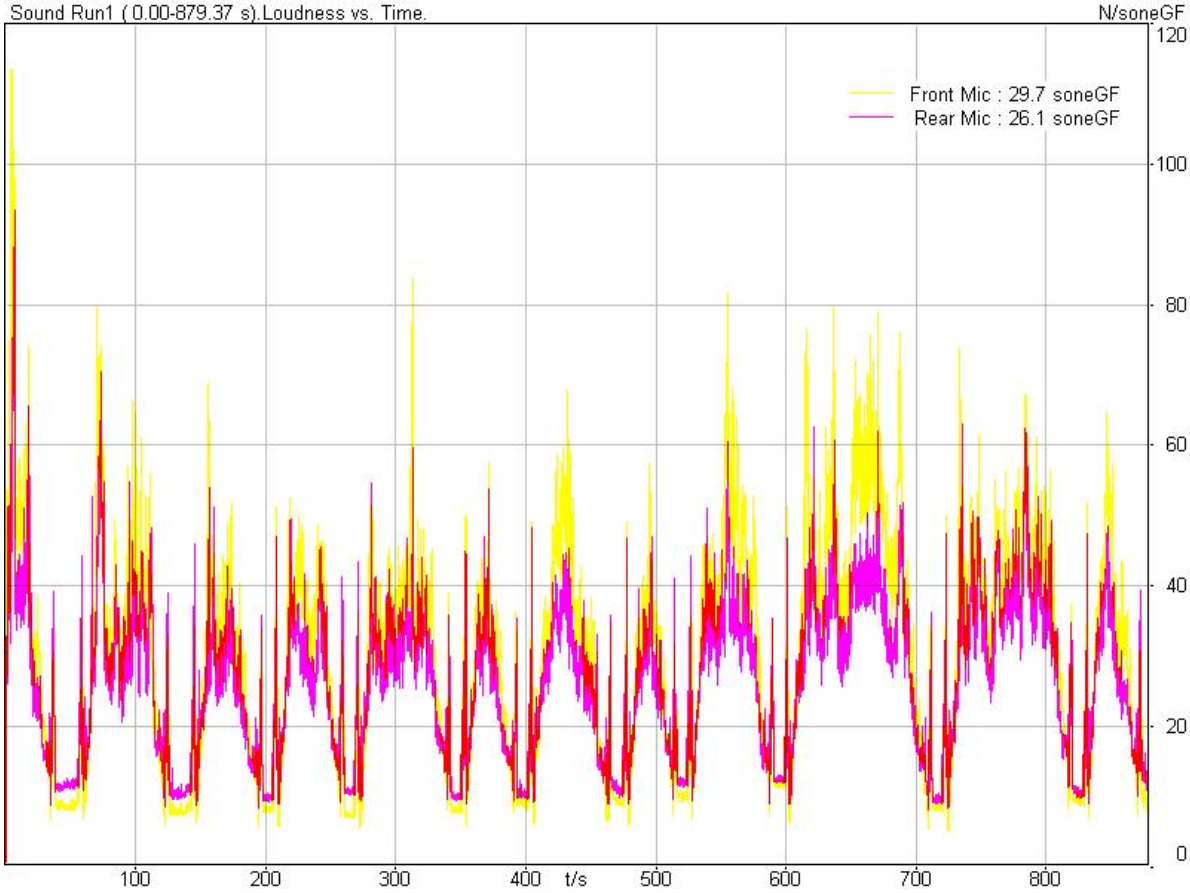


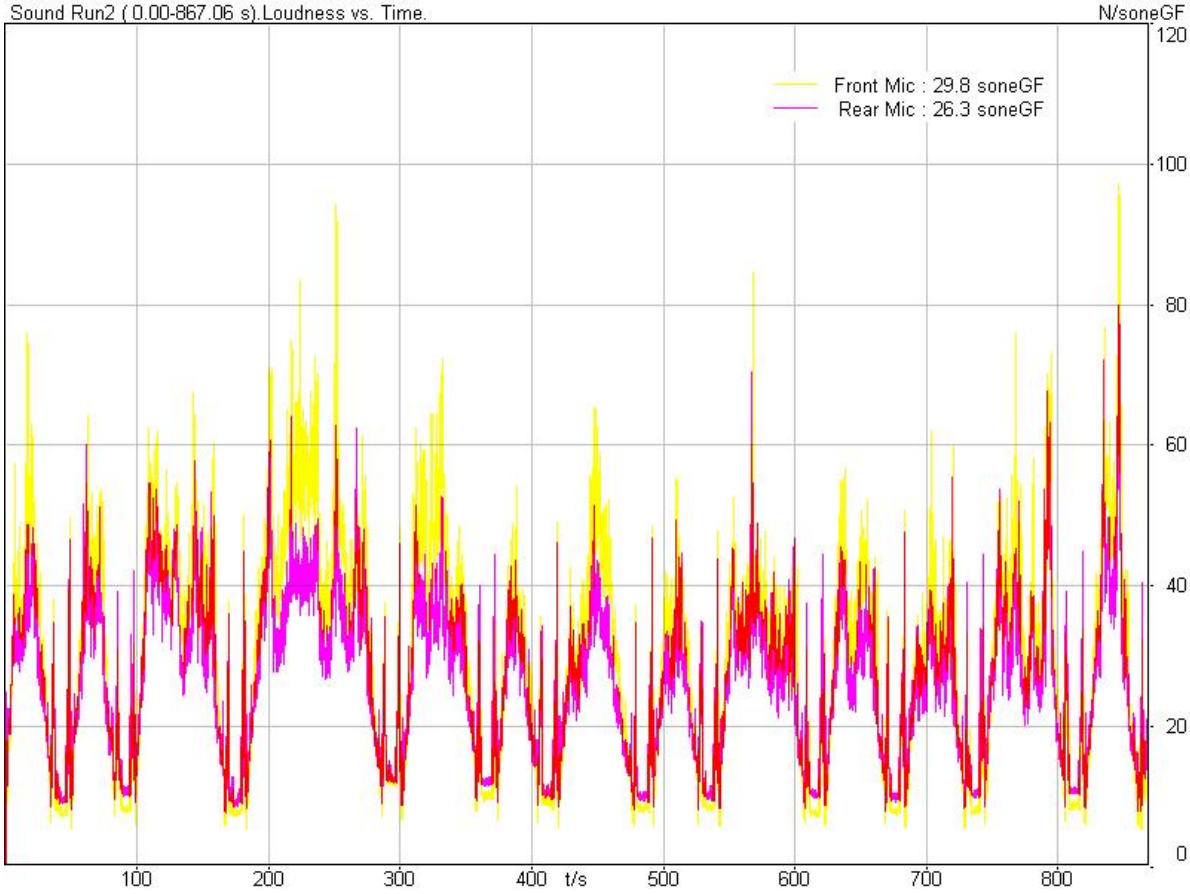


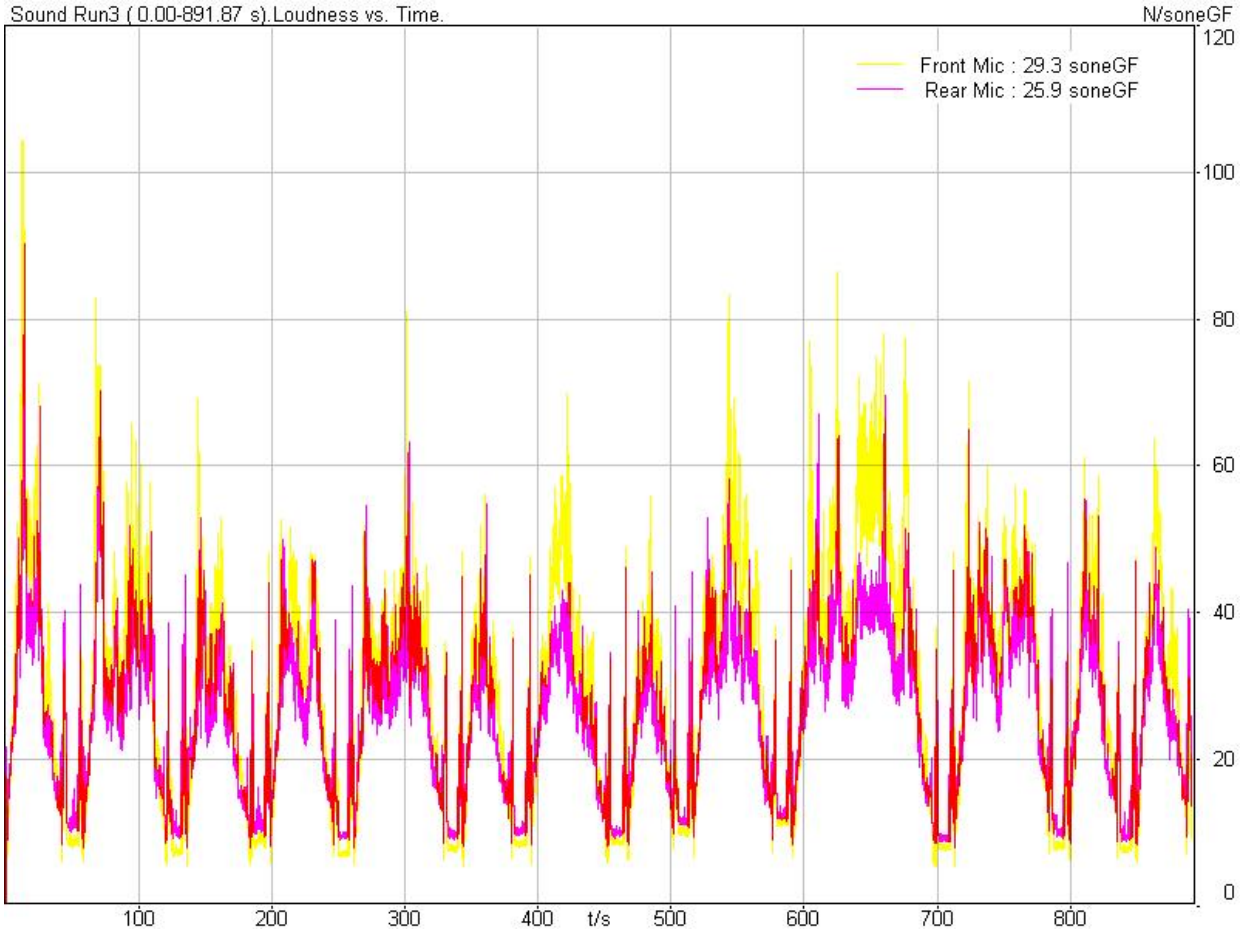

Sound Run3 (0.00-891.87 s).Level vs. Time (Fast).
L/dB(A)[SPL]
100
90
80
70
60
50
40
30
20
100
200
300
400
t/s
500
600
700
800
Front Mic : 80.3 dB(A)[SPL]
Rear Mic : 75.7 dB(A)[SPL]

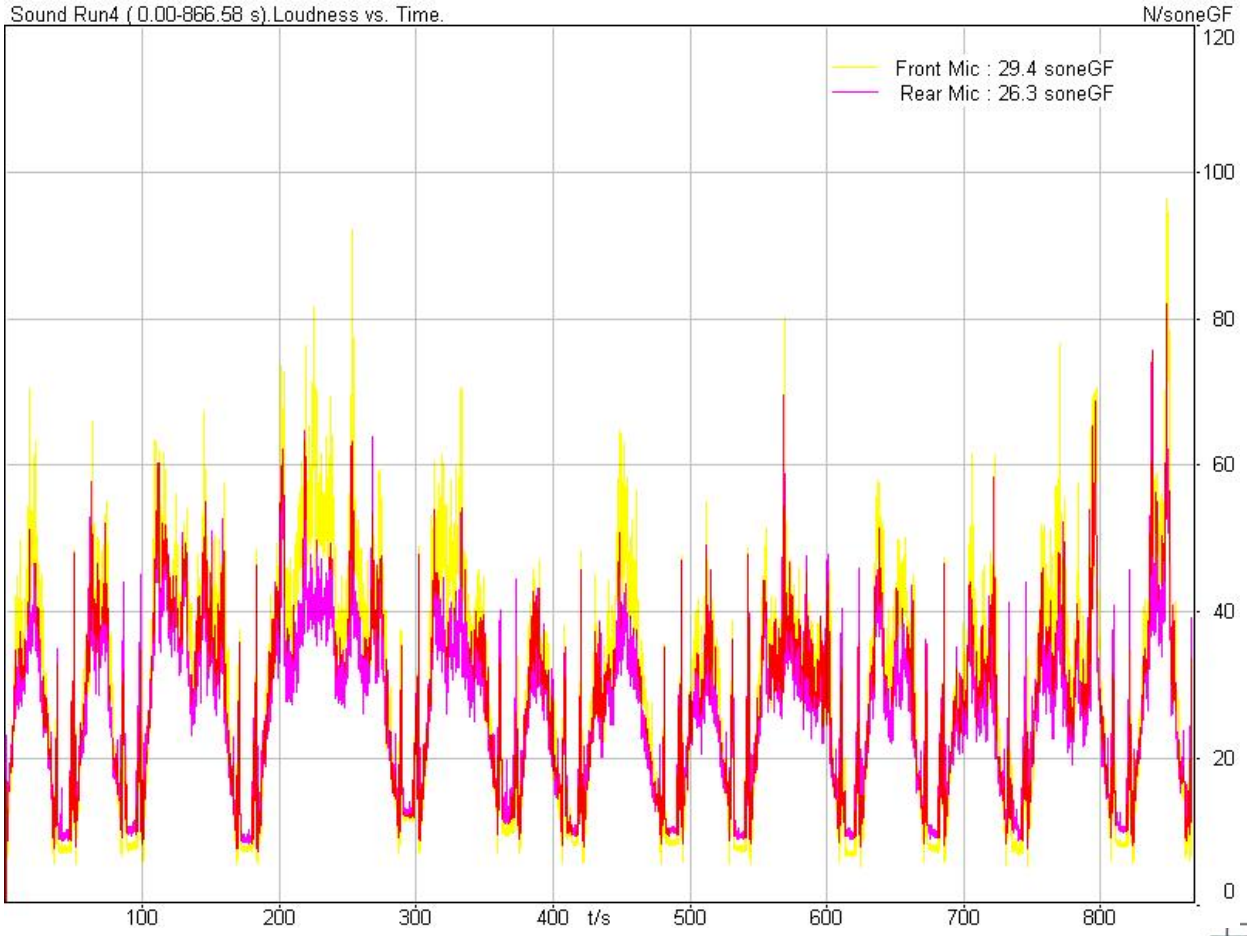

Sound Run4 (0.00-866.58 s).Level vs. Time (Fast).
L/dB(A)[SPL]
100
90
80
70
60
50
40
30
20
100
200
300
400
t/s
500
600
700
800
Front Mic : 80.4 dB(A)[SPL]
Rear Mic : 75.8 dB(A)[SPL]

Microphone Loudness Time Plots and RMS Loudness

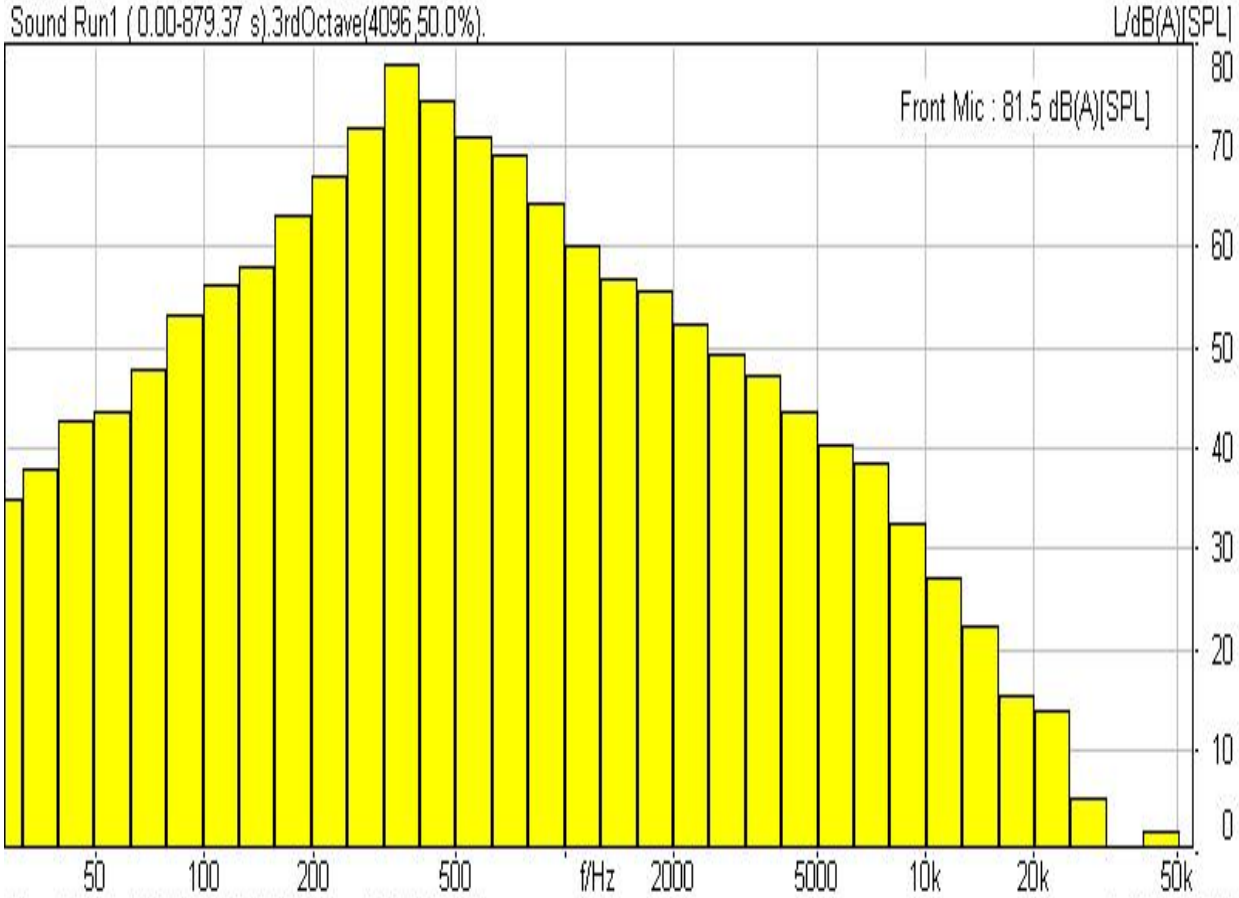


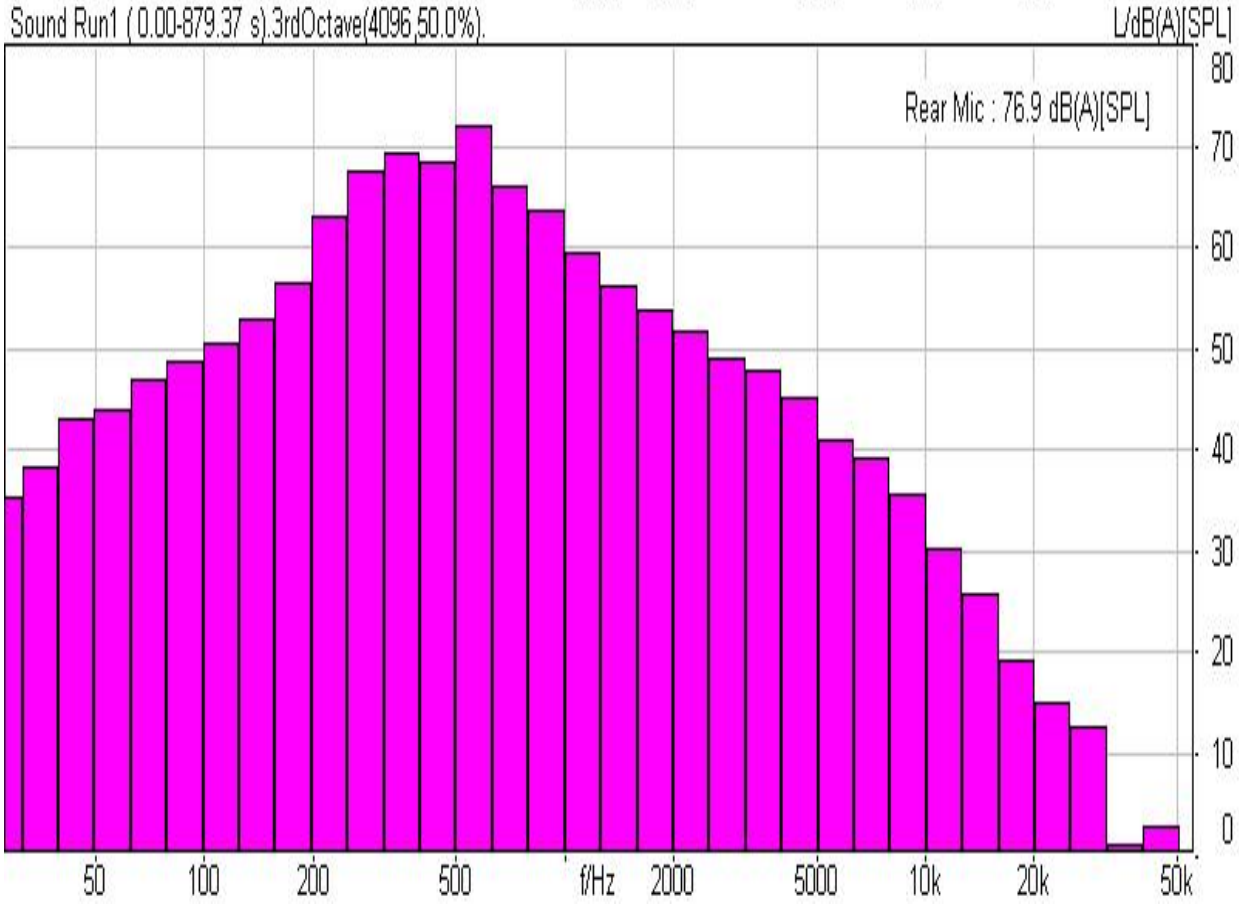


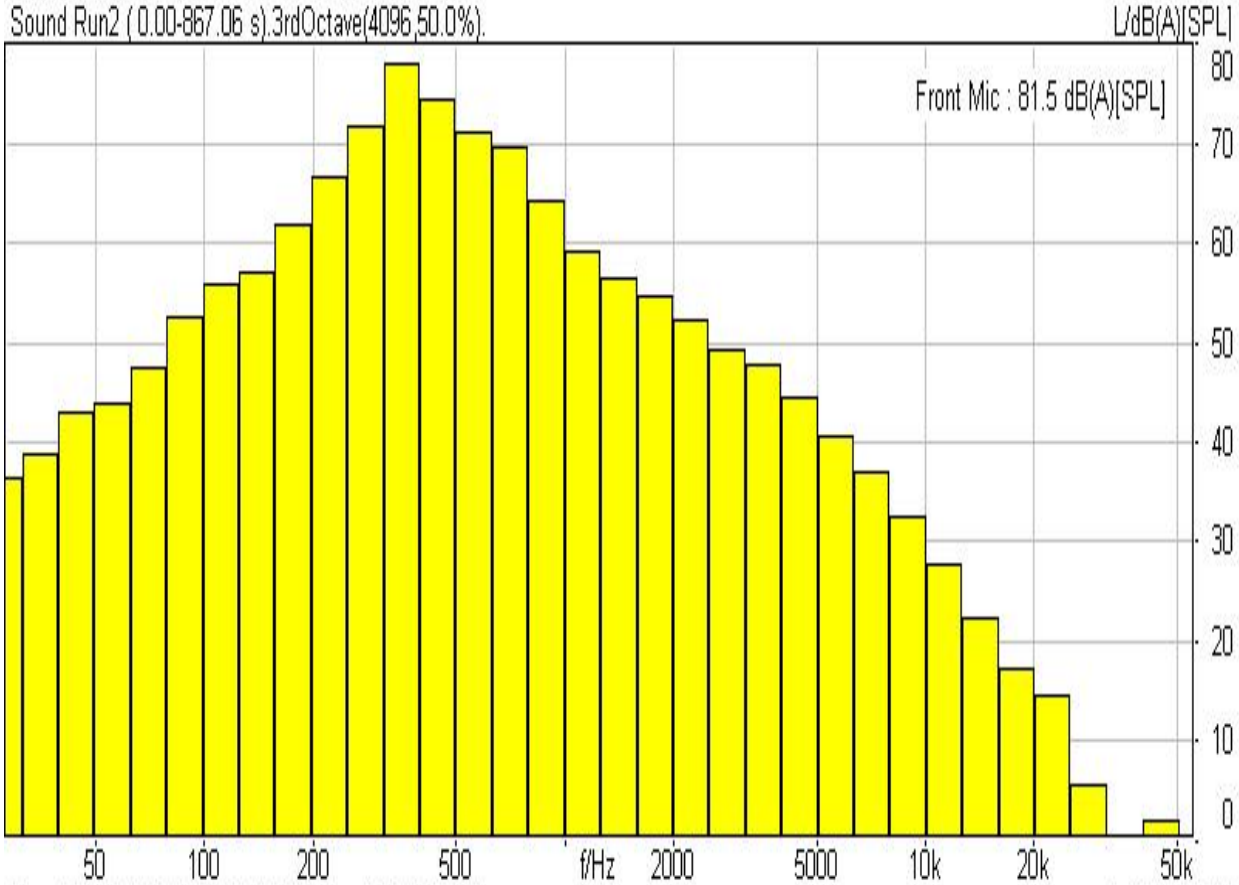

Sound Run3 (0.00-891.87 s).Loudness vs. Time.
N/soneGF
Front Mic : 29.3 soneGF
Rear Mic : 25.9 soneGF
120
100
80
60
40
20
0
100
200
300
400
t/s
500
600
700
800

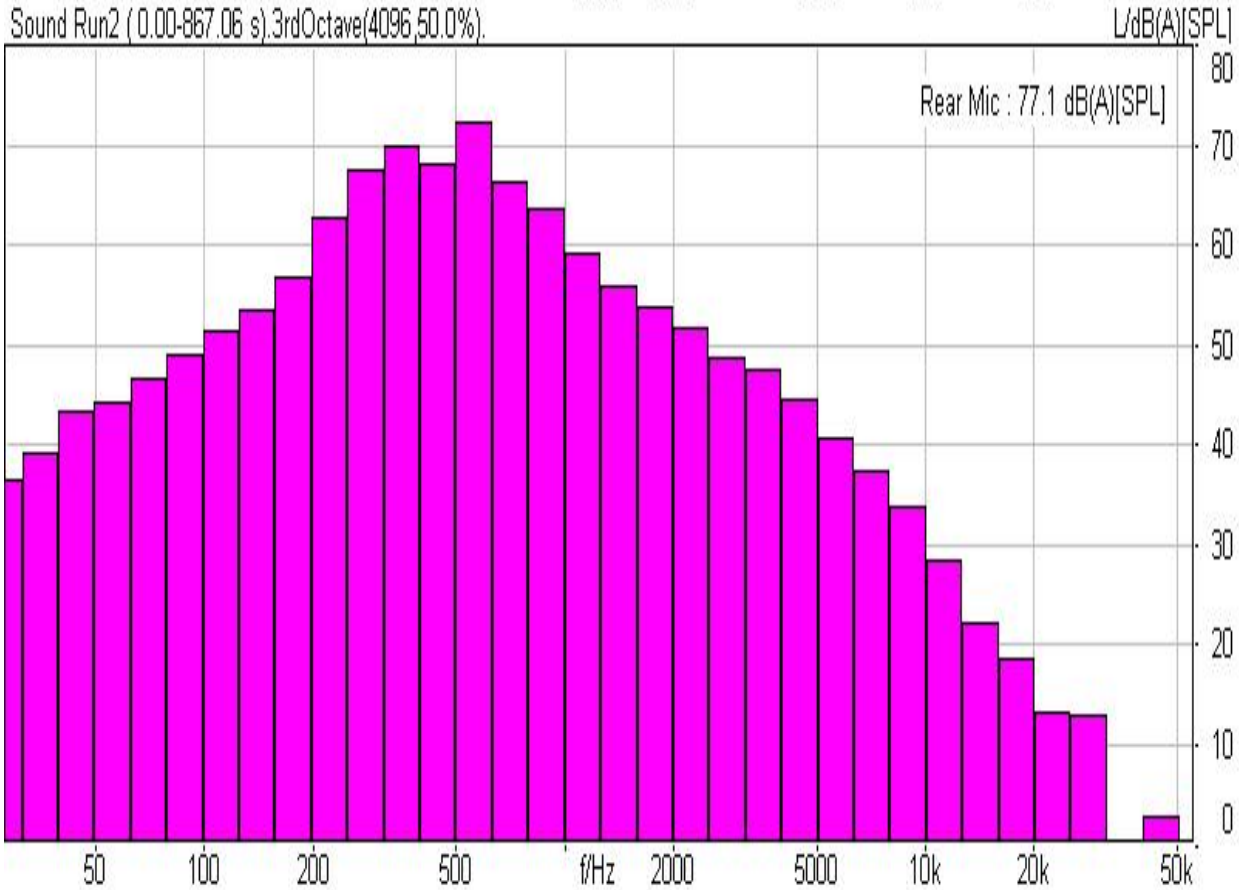

Sound Run4 (0.00-866.58 s).Loudness vs. Time.
N/soneGF
Front Mic : 29.4 soneGF
Rear Mic : 26.3 soneGF
120
100
80
60
40
20
0
100
200
300
400
t/s
500
600
700
800

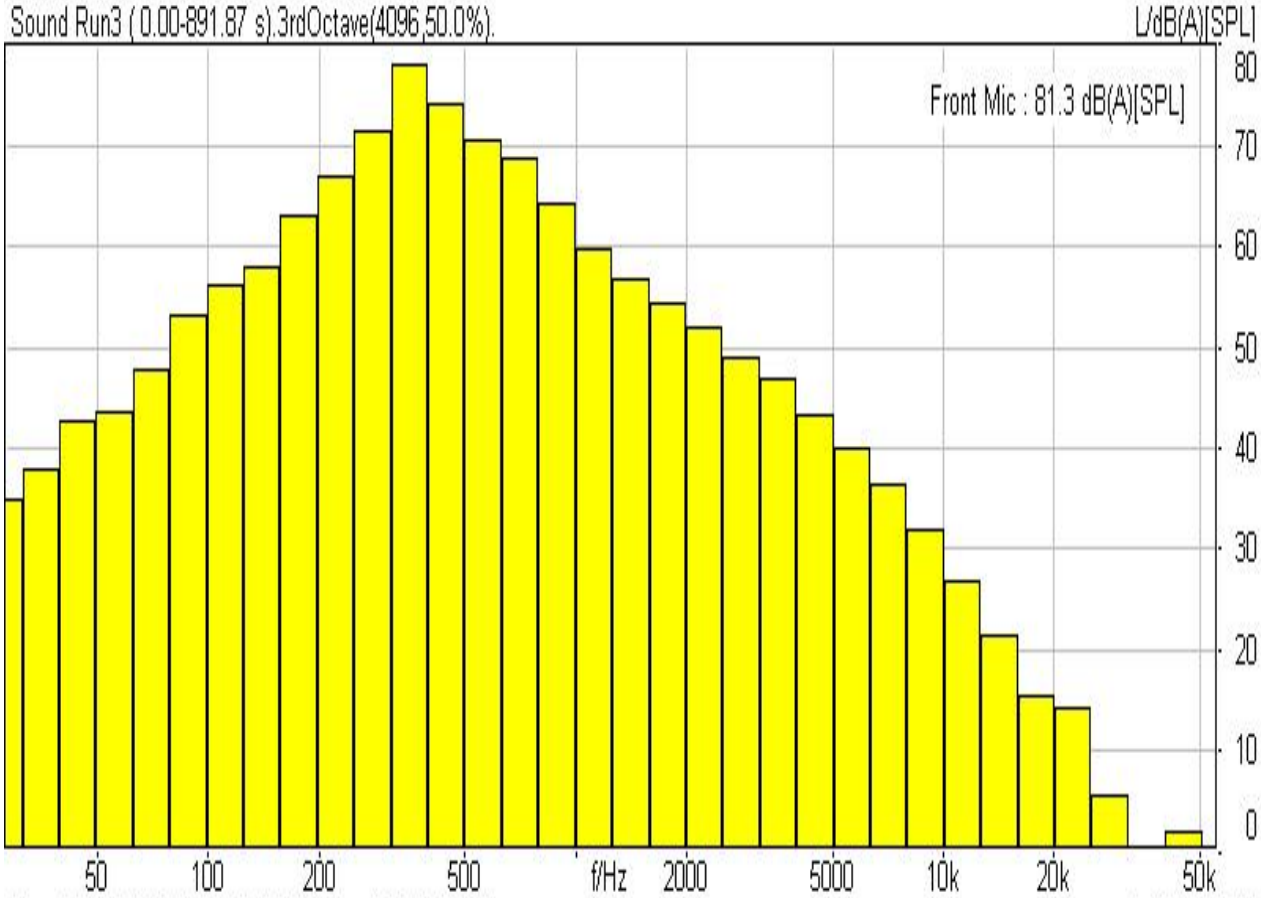
Microphone Sound Pressure Level 1/3rd Octave Plots

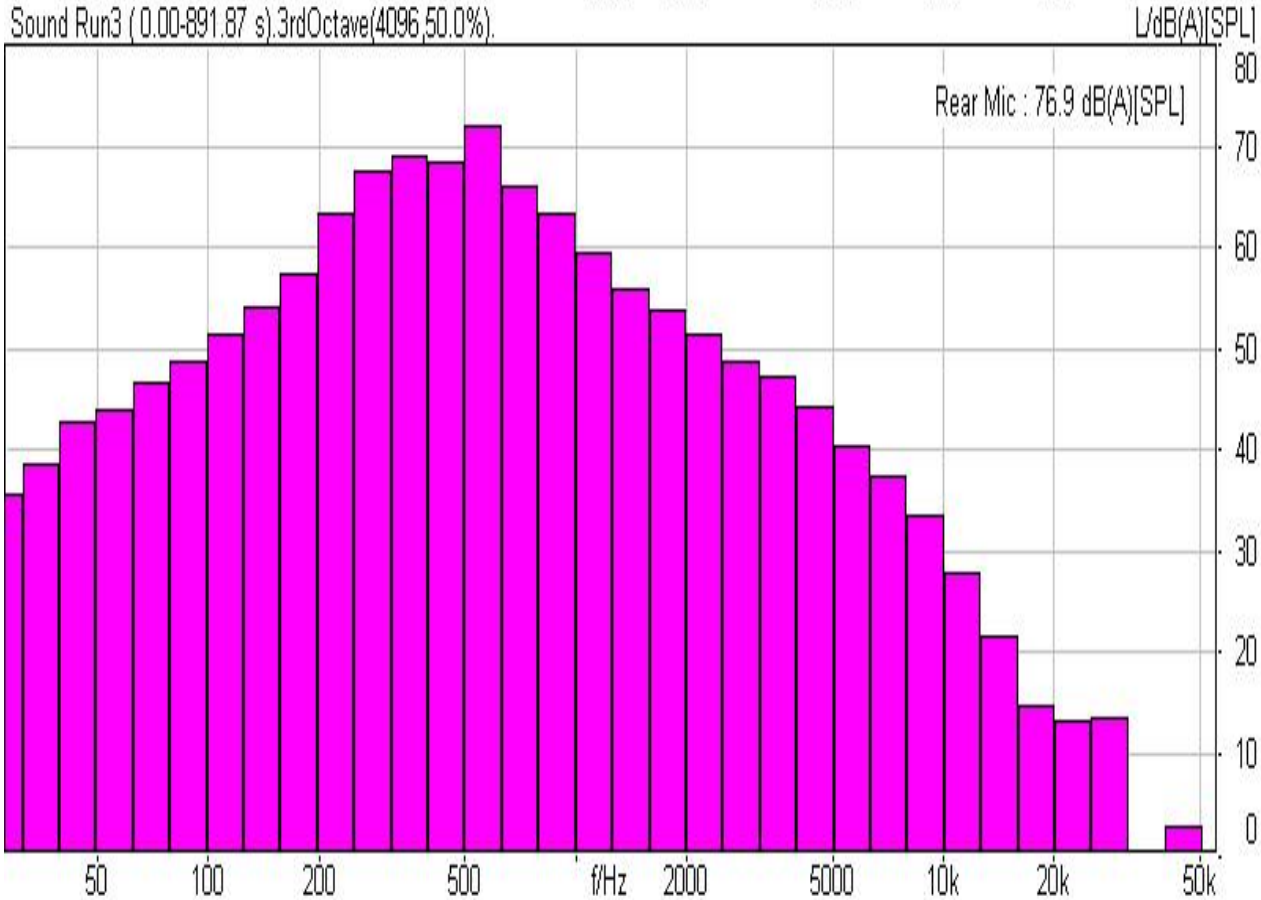


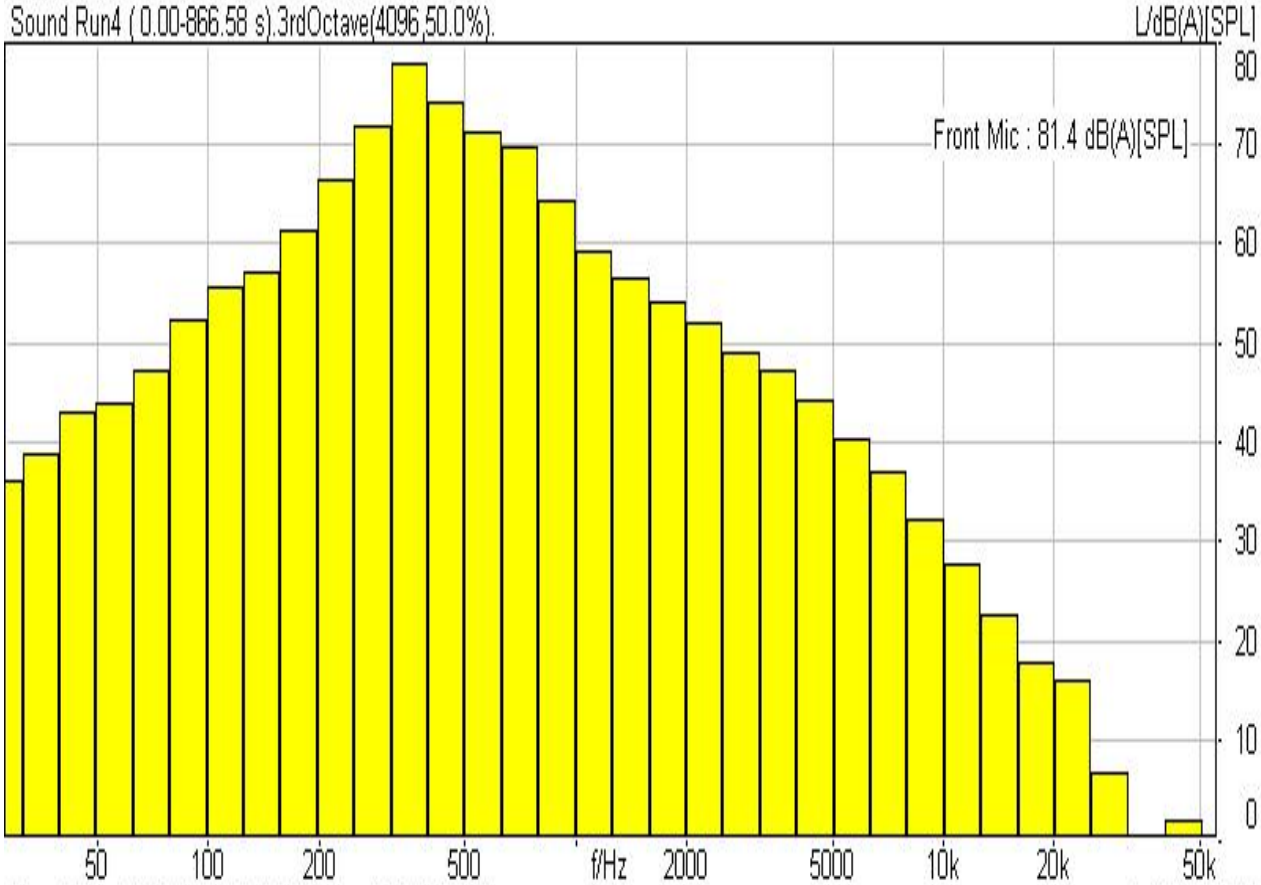


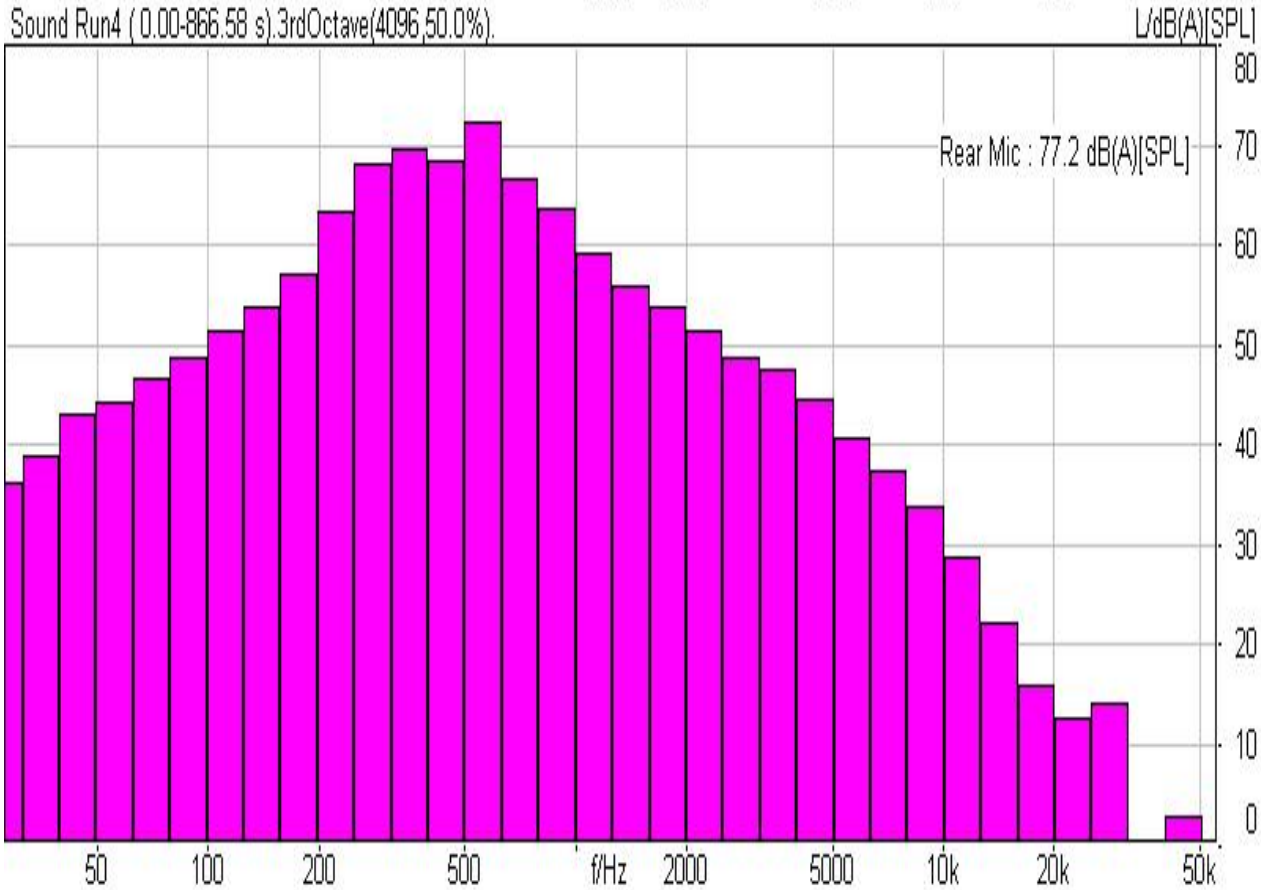

Sound Run2 (0.00-867.06 s).3rdOctave(4096,50.0%).
L/dB(A)[SPL]
Front Mic : 81.5 dB(A)[SPL]
80
70
60
50
40
30
20
10
0
50
100
200
500
f/Hz
2000
5000
10k
20k
50k


Sound Run2 (0.00-867.06 s).3rdOctave(4096,50.0%).
L/dB(A)[SPL]
Rear Mic : 77.1 dB(A)[SPL]
80
70
60
50
40
30
20
10
0
50
100
200
500
f/Hz
2000
5000
10k
20k
50k

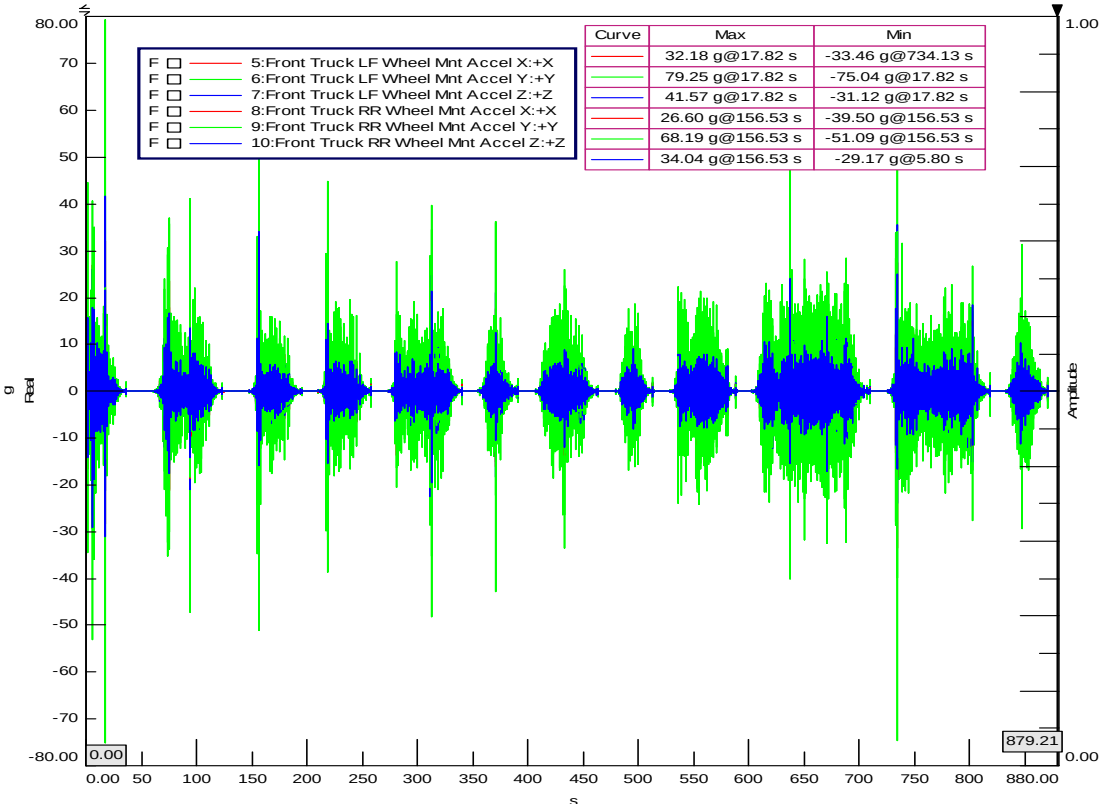

Sound Run3 (0.00-891.87 s).3rdOctave(4096,50.0%).
L/dB(A)[SPL]
Front Mic : 81.3 dB(A)[SPL]
80
70
60
50
40
30
20
10
0
50
100
200
500
f/Hz
2000
5000
10k
20k
50k

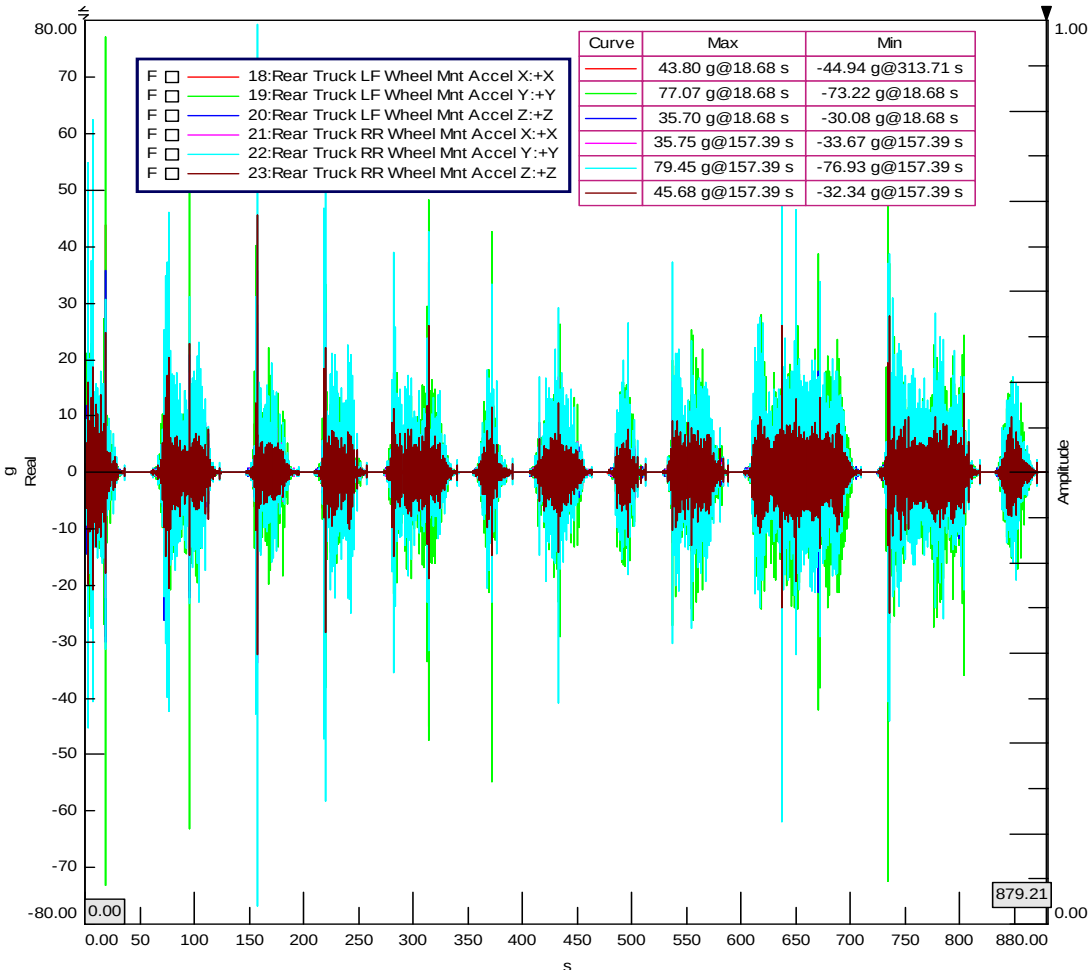

Sound Run3 (0.00-891.87 s).3rdOctave(4096,50.0%).
L/dB(A)[SPL]
Rear Mic : 76.9 dB(A)[SPL]
80
70
60
50
40
30
20
10
0
50
100
200
500
f/Hz
2000
5000
10k
20k
50k


Sound Run4 (0.00-866.58 s).3rdOctave(4096,50.0%).
L/dB(A)[SPL]
Front Mic : 81.4 dB(A)[SPL]
80
70
60
50
40
30
20
10
0
50
100
200
500
f/Hz
2000
5000
10k
20k
50k

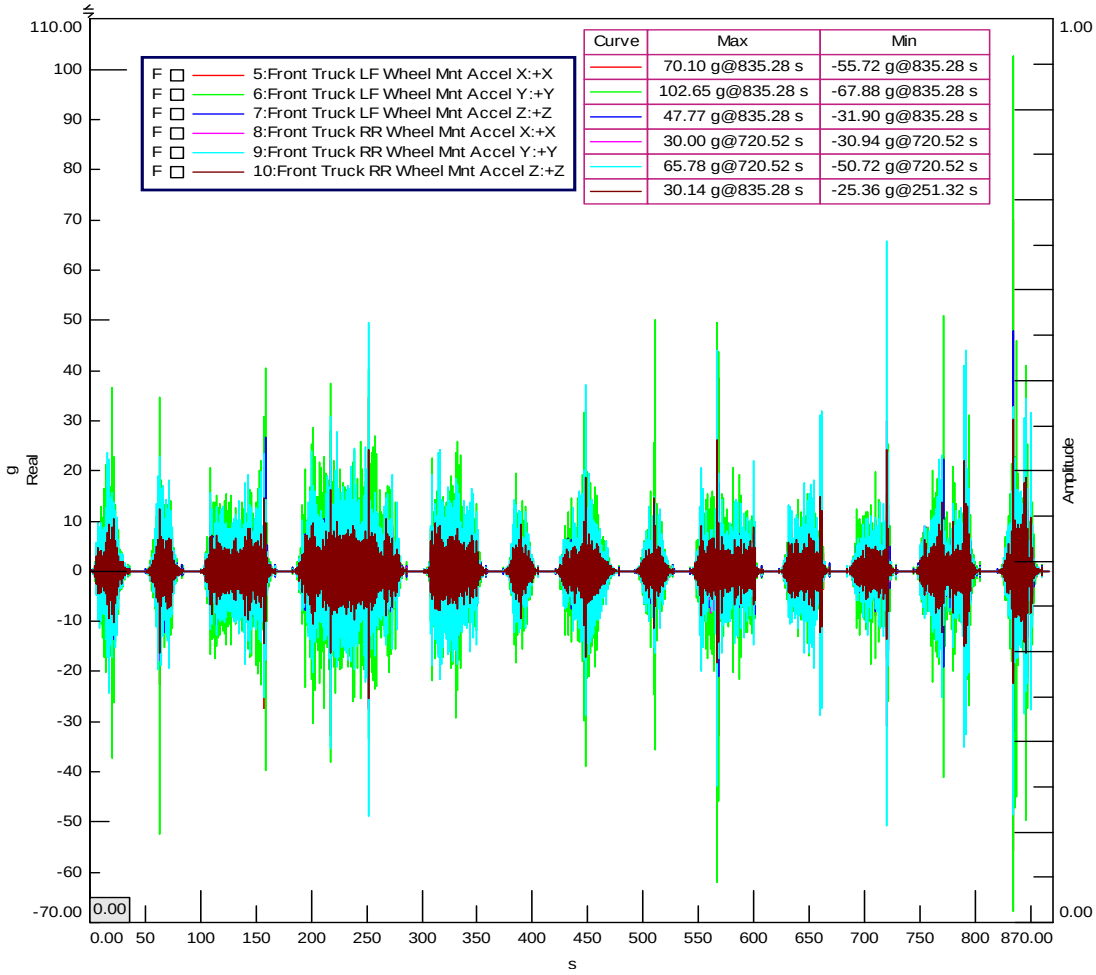

Sound Run4 (0.00-866.58 s).3rdOctave(4096,50.0%).
L/dB(A)[SPL]
Rear Mic : 77.2 dB(A)[SPL]
80
70
60
50
40
30
20
10
0
50
100
200
500
f/Hz
2000
5000
10k
20k
50k

Run1 Wheel Mount Acceleration Time Plots with Max/Min

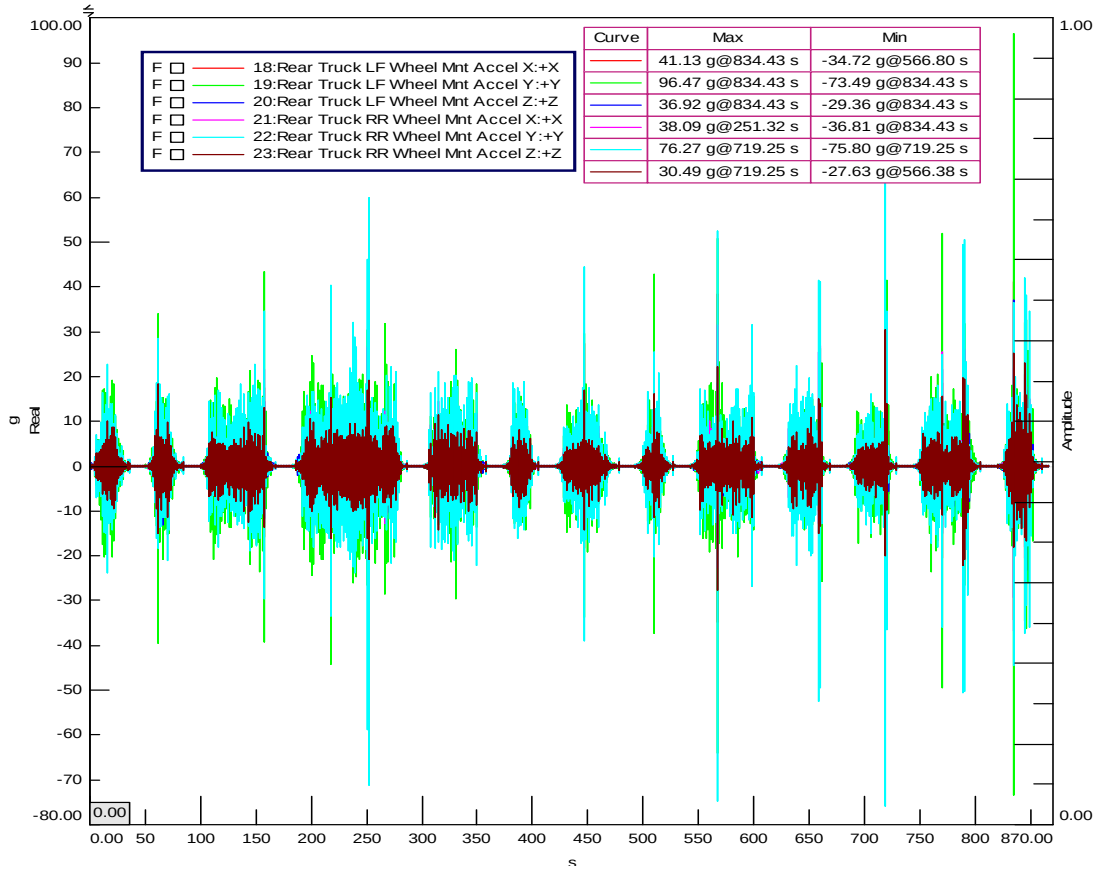




Run2 Wheel Mount Acceleration Time Plots with Max/Min

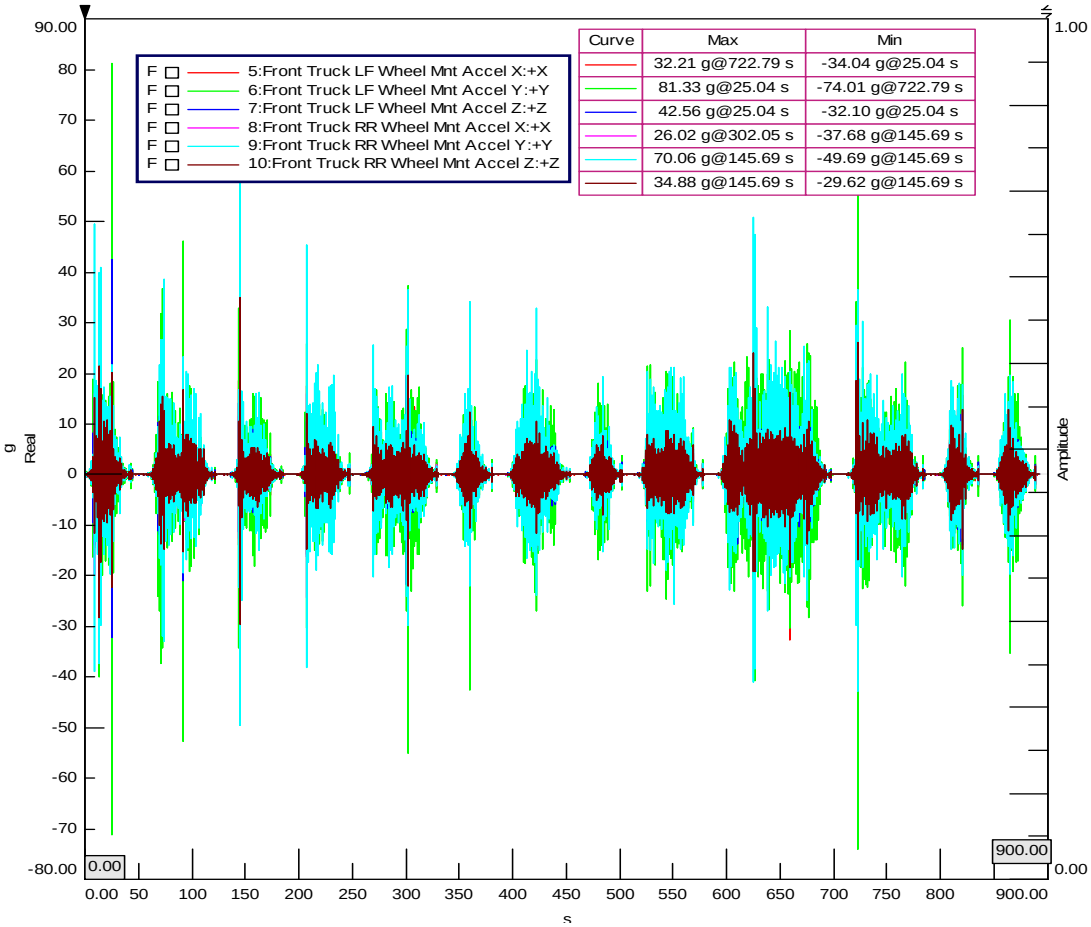


Curve	Max	Min
	70.10 g@835.28 s	-55.72 g@835.28 s
	102.65 g@835.28 s	-67.88 g@835.28 s
	47.77 g@835.28 s	-31.90 g@835.28 s
	30.00 g@720.52 s	-30.94 g@720.52 s
	65.78 g@720.52 s	-50.72 g@720.52 s
	30.14 g@835.28 s	-25.36 g@251.32 s

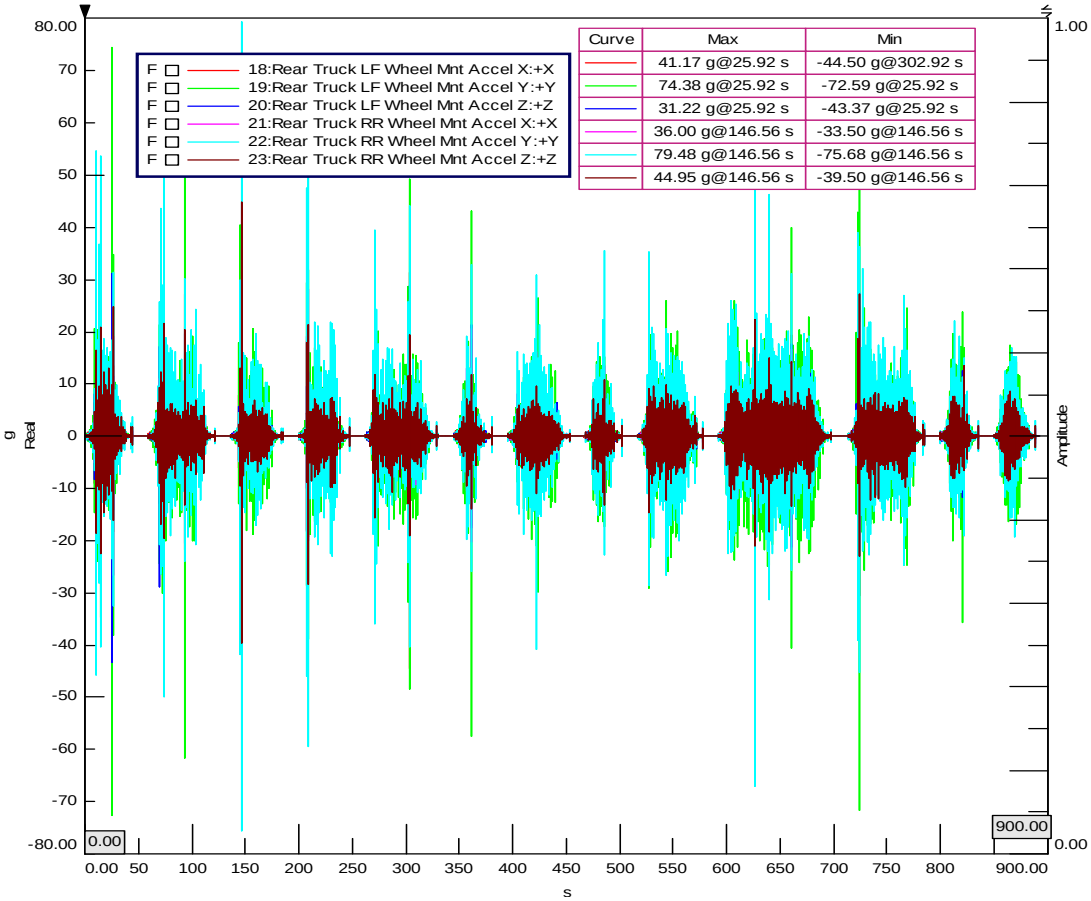


Curve	Max	Min
	41.13 g@834.43 s	-34.72 g@566.80 s
	96.47 g@834.43 s	-73.49 g@834.43 s
	36.92 g@834.43 s	-29.36 g@834.43 s
	38.09 g@251.32 s	-36.81 g@834.43 s
	76.27 g@719.25 s	-75.80 g@719.25 s
	30.49 g@719.25 s	-27.63 g@566.38 s

Run3 Wheel Mount Acceleration Time Plots with Max/Min

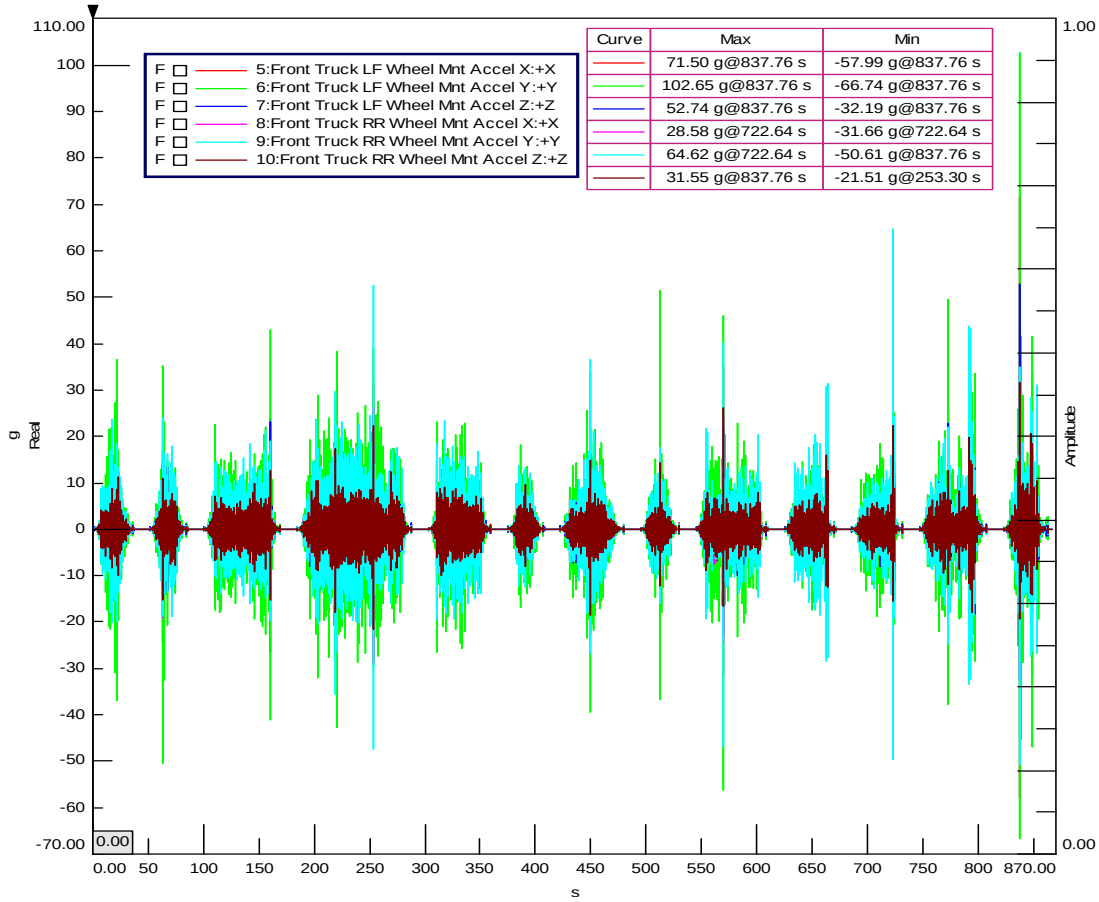


Curve	Max	Min
	32.21 g@722.79 s	-34.04 g@25.04 s
	81.33 g@25.04 s	-74.01 g@722.79 s
	42.56 g@25.04 s	-32.10 g@25.04 s
	26.02 g@302.05 s	-37.68 g@145.69 s
	70.06 g@145.69 s	-49.69 g@145.69 s
	34.88 g@145.69 s	-29.62 g@145.69 s

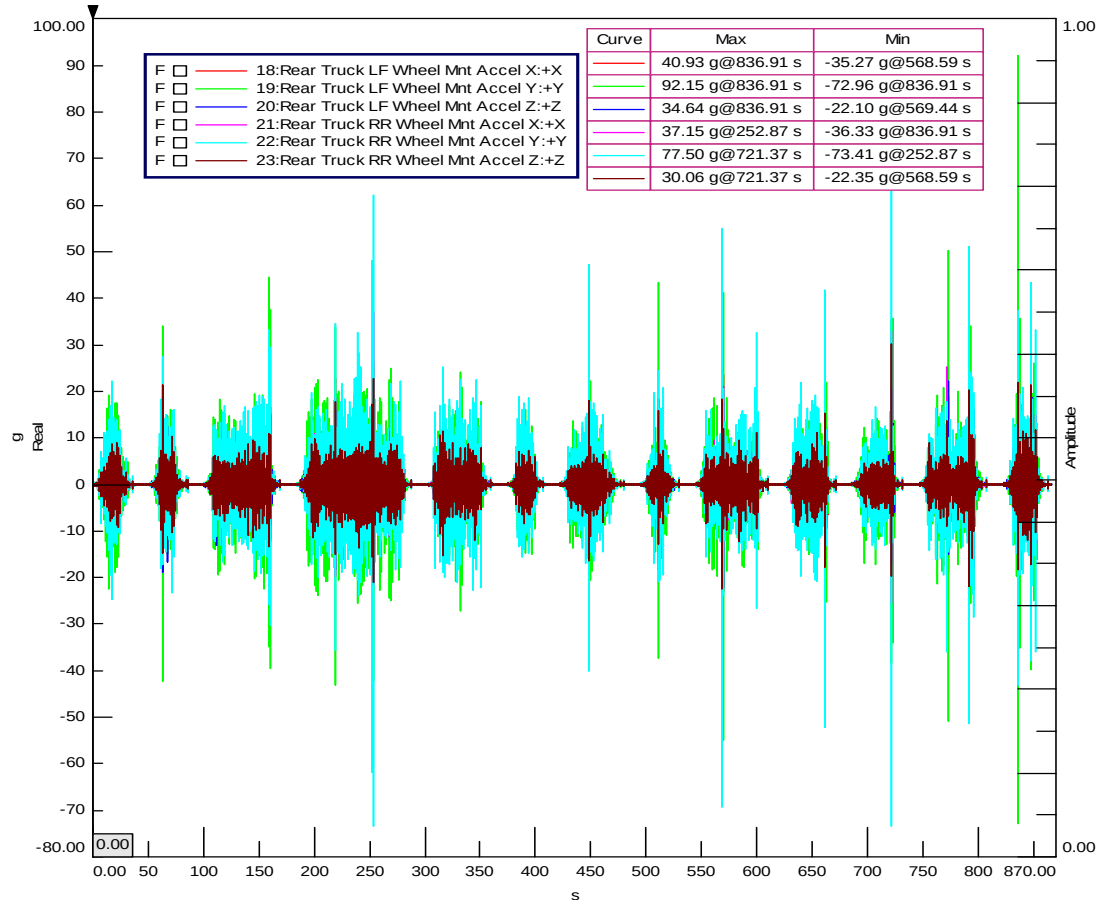


Curve	Max	Min
	41.17 g@25.92 s	-44.50 g@302.92 s
	74.38 g@25.92 s	-72.59 g@25.92 s
	31.22 g@25.92 s	-43.37 g@25.92 s
	36.00 g@146.56 s	-33.50 g@146.56 s
	79.48 g@146.56 s	-75.68 g@146.56 s
	44.95 g@146.56 s	-39.50 g@146.56 s

Run4 Wheel Mount Acceleration Time Plots with Max/Min



Curve	Max	Min
	71.50 g@837.76 s	-57.99 g@837.76 s
	102.65 g@837.76 s	-66.74 g@837.76 s
	52.74 g@837.76 s	-32.19 g@837.76 s
	28.58 g@722.64 s	-31.66 g@722.64 s
	64.62 g@722.64 s	-50.61 g@837.76 s
	31.55 g@837.76 s	-21.51 g@253.30 s



Curve	Max	Min
	40.93 g@836.91 s	-35.27 g@568.59 s
	92.15 g@836.91 s	-72.96 g@836.91 s
	34.64 g@836.91 s	-22.10 g@569.44 s
	37.15 g@252.87 s	-36.33 g@836.91 s
	77.50 g@721.37 s	-73.41 g@252.87 s
	30.06 g@721.37 s	-22.35 g@568.59 s

Appendix D

Equipment List

Manufacturer/Model	SN / Asset	Calibration Due Date
B&K4166 Microphone	0013137	4/9/2012
B&K4166 Microphone	0038314	4/9/2012
PCB 356A15 Triaxial Accelerometer	0039246	8/1/2012
PCB 356A15 Triaxial Accelerometer	0041738	8/1/2012
PCB 356A15 Triaxial Accelerometer	0041739	8/1/2012
PCB 356A15 Triaxial Accelerometer	0039243	8/1/2012
PCB 356A15 Triaxial Accelerometer	0039241	8/1/2012
PCB 356A15 Triaxial Accelerometer	0041736	8/1/2012
PCB V352C67 Accelerometer	0039258	10/12/2011
PCB V352C67 Accelerometer	0039266	10/12/2011
PCB V352C67 Accelerometer	0039267	10/12/2011
PCB V352C67 Accelerometer	0039261	10/12/2011
PCB V352C67 Accelerometer	0039263	10/12/2011
PCB V352C67 Accelerometer	0039257	10/12/2011
PCB V352C67 Accelerometer	0039255	10/12/2011
PCB V352C67 Accelerometer	0039274	10/12/2011
LMS SCADAS MOBILE	53092617	N/A
LMS Test Lab 10A	N/A	N/A