Measurement of Sound Levels using an NTi XL2 SLM

B.Sc.(Honours) in Environmental Science and Sustainable Technology

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Project Background

Why noise measurement?

Environmental noise, "unwanted outdoor sound generated by human activity" [1] is classed as a pollutant and regulated under Directive 2002/19/EC, the Environmental Noise Directive (END). Noise must be monitored to ensure enforcement of the END. The ISO 1996 Acoustics Standards series informs the conditions under which noise data can acquired, analysed and assessed.

Project Aims

Project aims include:

1. Demonstrate the functionality of the XL2 SLM and its accompanying analysis software Data Explorer.
2. Acquire and analyse data from field measurements.
3. Assess data for compliance with the END and national regulations as stipulated in the EPA's NG4 [2].
4. Compare the data acquired by the CR811C SLM to the XL2.

Instruments

Two Sound Level Meters were used for this Project:

- An Nti Audio XL2 Analyzer with an M4261 Class 2 microphone
- A Cirrus CR811C Type 1 Meter with a removable preamplifier

Figure 1: XL2 and CR811C SLM's

Data Acquisition and Analysis

Data Acquisition

Data was acquired using both instruments in concurrent measurements at 5 locations:

- Ahanesk, an Area of Low Background Noise
- On the bank of the Owenacurra river
- At Midleton Train Station
- At an Industrial Site
- At the N25, a busy national primary road

All data acquisition met free-field and optimal meteorological conditions.

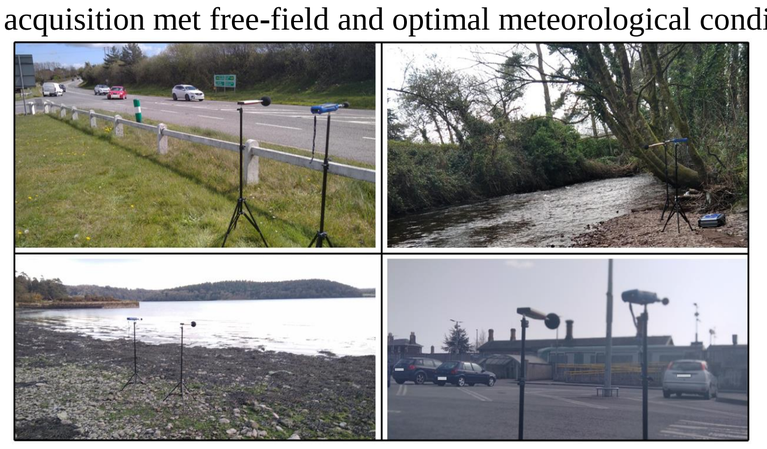

Figure 2: Clockwise from top left– N25 road, Owenacurra river, Ahanesk, Midleton Train Station.

Data Analysis

The XL2 data was analysed using Data Explorer:

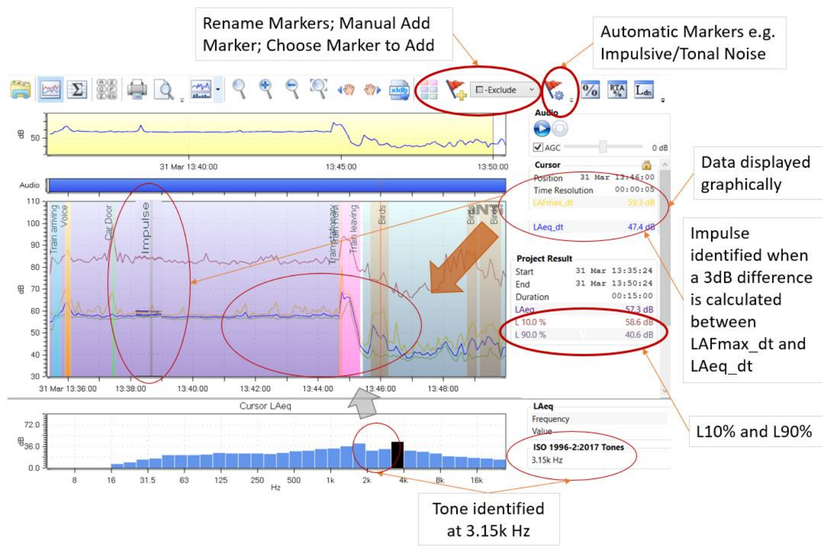

Figure 3: Data Explorer graphical view of Train Station data. Tools for analysis are in the icons along the ribbon. On the graph the LAeq is visible, the peak caused by the train horn is indicated by the pink marker and an impulsive noise is identified. A tone is visible on the 1/3 Octave chart beneath the graph.

Data collected using the XL2 SLM was analysed using the Data Explorer software. Deaf Deffier3.3 was the software used to analyse the CR811C data.

The noise parameters used to analyse the data were:

- LAeq: The average noise level over the entire data file.
- LAeq_dt: The running average (integrated over 1s)
- L10%: 10th percentile level. Indicates intermittent noise.
- L90%: 90th percentile level. Indicate background noise.
- Presence of tones: causes annoyance. 5dB penalty to Leq.
- Presence of impulsive noise: causes annoyance.
- L_{Ar}: LAeq with the additional 5dB penalty.

The CR811C data was analysed using Deaf Deffier3.3:

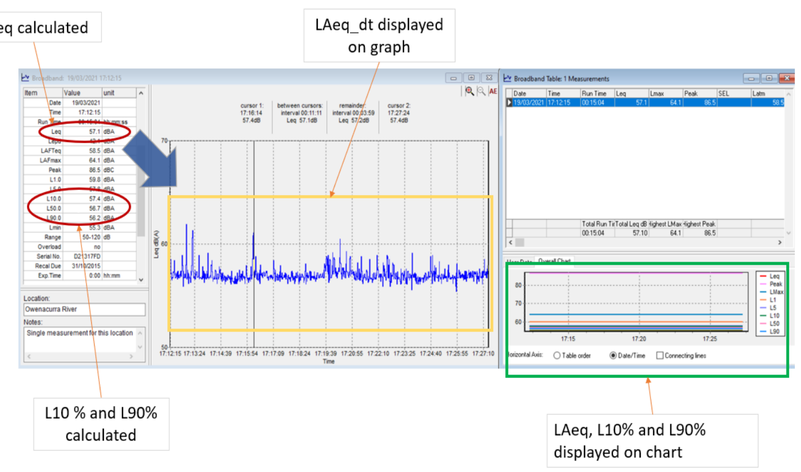

Figure 4: Deaf Deffier3.3 displaying Owenacurra river data. The LAeq, L10% and L90% are shown calculated and displayed on the right-hand chart. The running average (LAeq_dt) is seen on the graph.

Results and Conclusion

Results

The LAeq, L10% and L90% values for the XL2 data can be seen in Table 1. The data collected by the CR811C was very similar – a comparison of the LAeq collected by the two instruments can be seen in Figure 5.

Location	Date	Duration [min]	LAeq [dB]	L10% [dB]	L90% [dB]	Exceeds L_{Ar}
Ahanesk	18/03/2021	15:06	40.5	43.3	36.8	
Owenacurra	19/03/2021	15:05	55.8	56.2	55.2	✓
Train Station	31/03/2021	15:00	57.3	58.6	40.6	✓
Industrial Site 1	19/03/2021	15:52	57.4	59.7	50.6	✓
Industrial Site 2	19/03/2021	13:06	60.4	64.7	49.6	✓
N25 Survey: Night	14/04/2021	15:01	61.7	52.3	32.6	✓ Note 1
N25 Survey: Night	14/04/2021	15:01	65.5	62.8	34.4	✓ Note 1
N25 Survey: Day1	13/04/2021	15:00	77.0	81.5	62.0	✓
N25 road traffic	31/03/2021	15:00	77.8	81.9	65.4	✓
N25 Survey: Day2	13/04/2021	14:59	78.7	82.4	66.3	✓
N25 Survey: Day2	13/04/2021	15:00	79.5	83.4	67.7	✓
Note 1: Night-time noise level is an LAeq, All others are L_{Ar}.						

Table 1: Summary of the XL2 data at each location ordered from quietest to loudest. All except Ahanesk exceed the noise limits as set out in the EPA's NG4 [2].

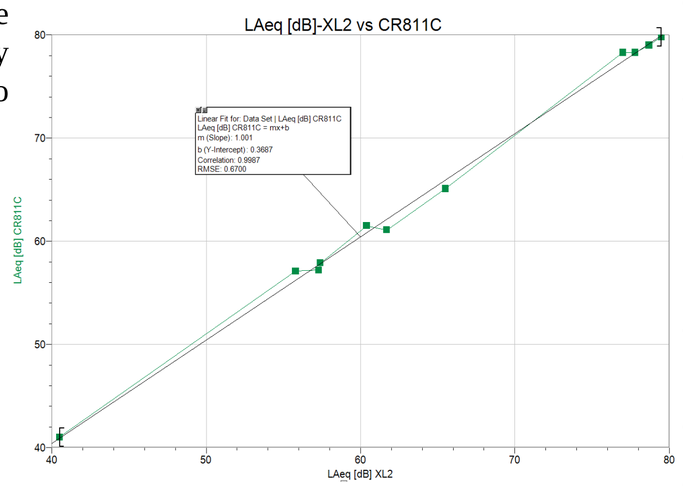

Figure 5: XL2 LAeq dB data for each location vs CR811C LAeq. Fit of 1.001 demonstrates very little difference between instruments.

Conclusion

- All locations exceeded the noise limits and were thus non-compliant, except for the area with low background noise.
- Noise mitigation procedure should be assessed for the N25 location.
- The CR811C SLM was more limited in its range of functions than the XL2. However, the data indicates very little difference between the two instruments for data successfully collected in concurrent measurements.
- Current noise regulations are very strict. Even the Owenacurra river data, where little urban noise was detected, exceeded the noise limits.
- It can be difficult to identify the precise source of a noise emission.
- Even with the software human analysis and interpretation of data is necessary.

References and Acknowledgments

1. The European Commission, *Directive/2002/49/EC,* 2002

2. EPA, "Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)," EPA, 2016

International Organisation for Standardisation (ISO), *ISO1996-1: 2016*, ISO, 2016

International Organisation for Standardisation (ISO), *ISO1996-2: 2017*, ISO, 2017

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