

Aim and Scope

To study the noise generated by the petards and other firework articles that produce impulse noise. Furthermore, the report includes professional opinion regarding the danger to health from the exposure to impulse noise.

Harmful effects to health from impulse noise

The petard noise was measured during the Birkirkara St. Helena fiesta. This type of firework generate very loud and sharp noise almost occurring in an instant; less than a second. The noise intensity varies between 120 and 140 dB.

Impulse noise is significantly more harmful than steady noise. The impulse noise pressure is very high and the impulses duration is too brief, that the acoustic reflex has not enough time to counteract. These sudden bursts of noise can startle and cause stress by their fast and surprising nature. Those close to the explosion can suffer instant hearing damage or permanent tinnitus.

[WHO](#) specifically suggests that children should not be exposed to impulsive noise that exceed 100 dB for more than 5 seconds.

[Science Direct](#)

Effect of fireworks in residential areas

Non auditory effect of noise: This effect, which is characterized by irritation, can result from noise by interfering with daily activities; communication, concentration or rest, and can be accompanied by negative responses, such as: anger, disgust, fatigue, and stress-related symptoms

[UK. Gov. Office for Product Safety & Standards](#)

Several studies were undertaken to understand the negative effects of noise, have on different species of animals. It has been stated in literature that excessive noise has an influence on behaviour and coordination. Mammals in particular appear to react to sudden higher intensity noise, with responses including the startle response, freezing, and fleeing from the sound source.

[RSPCA](#)

Very loud fireworks can be a source of fear and stress to domestic and other animals

Noise legislation EU and Local

S.L. 33.03 Control of Fireworks and Other Explosives, is the only piece of local legislation related to fireworks. The regulations stipulate the total number of petards let-offs for the fiesta days; in total 78. These are spread over 5 days of the fiesta celebration. Nevertheless, the regulations do not specify the noise level threshold.

Although the EU Fireworks Directive stipulates the noise level threshold, 120dB(A), nevertheless the Maltese fireworks manufacturer is not bound by this Directive : preamble (11) below:

Directive 2013/29/EU

Harmonisation of the laws of the Member States relating to the making available on the market of pyrotechnic articles

Preamble

(11) Fireworks which are built by a manufacturer for his own use and approved for use exclusively on its territory by the Member State in which the manufacturer is established, and which remain on the territory of that Member State, should not be considered as having been made available on the market and should therefore not need to comply with this Directive.

Acceptable sound levels:

WHO Guidelines for Community Noise’ (GCN)
Annoyance: The capacity of a noise to induce annoyance depends upon its physical characteristics, including the sound pressure level, spectral characteristics and variations of these properties with time.
During daytime, few people are highly annoyed at LAeq levels below 55 dB (A), and few are moderately annoyed at LAeq levels below 50 dB (A). Sound levels during the evening and night should be 5–10 dB lower than during the day.

Table 1 Indoor ambient noise levels for dwellings			
Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB Laeq 16hour	
Dining	Dining room/area	40 dB Laeq 16hour	
Sleeping (daytime resting)	Bedroom	35 dB Laeq 16hour	30 dB Laeq 8hour

BS 8233:2014

BS 8233:2014 Guidance on sound insulation and noise reduction for buildings
In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values in Table 1

Noise reports

Table 1.

Monitoring point	Report	Date	Time		Duration	Noise level at monitoring point			Date
						LCpeak	LAE	LAFMax	
JF residence 1000 m from Let off site	84	17/08/2023	17:45	18:52	01.07	69.3	86.0	72.0	17/8/23
	85	18/08/2023	07:24	08:27	01.03	122.7	101.0	97.5	18/8/23
	87	19/08/2023	11:51	12:31	00.40	122.6	101.3	99.4	19/8/23
	88	19/08/2023	19:47	20:55	01.18	127.4	109.7	102.6	
	89	20/08/2023	07:42	09:00	01.18	125.2	109.3	100.4	20/8/23
	92	20/08/2023	20:29	20:57	00.28	122.0	105.3	99.7	

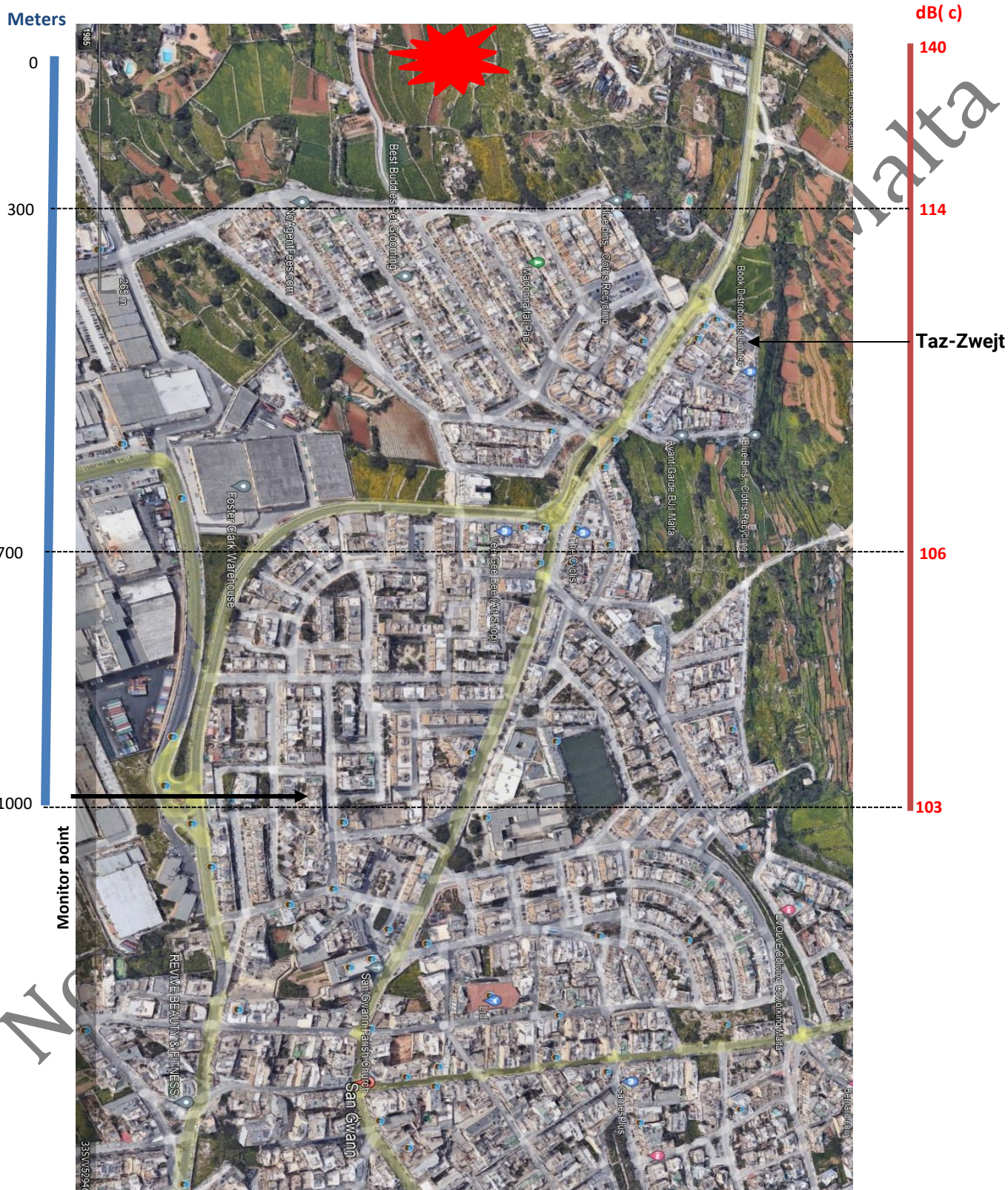
The noise of interest in all the reports, with the exception of report 84, is the impulsive noise generated by petards.

Type of Petard

The petard dimensions relative to this report are: 10cms in diameter and 10cms in length. Most fireworks articles are designed to explode at an altitude between 60 and 150 meters. This can vary depending on the type of firework and the specific display.
As a norm 6 petards are let off at intervals of 10 minutes. It is also the case that several petards are let off without interval , total time vary between 5 and 10 minutes.

Sound level descriptors relative to impulsive noise; LCpeak - Peak Sound pressure level; LAFmax ; Maximum Sound level and LAE - Sound Exposure level . The petard’s intensive noise level is identified by these descriptors in the noise reports; pages 8 to 10.

Petards let off point at San Gwann



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Protection from noise

Noise pollution can cause health problems for people and animals , both on land and in the sea.

Loud noise , especially Impulsive noise can damage our hearing, leading to hearing loss, tinnitus (ringing in the ears), and difficulty communicating especially in background noise. Permanent noise-induced hearing damage is incurable.

Protection

Keep a safe distance from loud noise, reduce exposure time or wear hearing protectors.

How loud? Exposure time? What distance? Type of ear protectors?

For the continuous exposure to a noise level of 85dB(A); at the ear, safe time is **8hours**

Leisure noise :

Safe Exposure time of **2 hours** for continuous sound of 91 dB(A)

Each 3 dB increase of the noise level reduces safe time exposure by half.

Impulsive noise:

Children should not be exposed for more than **5 seconds** to impulsive exceeding 95 dB(C).

Adults should not exceed more than **5 seconds** exposed to impulsive noise of 120 dB(C).

Safe distance:

Rule of thumb – for each doubling of the distance away from the noise source the noise intensity is reduced by 6 dB(C).

Nevertheless, damage to hearing varies from one individual to another, hence it is best to wear hearing protectors if exposed to loud noise.

Ear plugs or ear muffs :

Proper fit and noise reduction level are the two important factors to make sure that the hearing is protected. Ear plugs or ear muffs with a protection of 30 dB noise reduction allows:

2 hours safe exposure time to a noise level of 91 dB ,or

15minutes safe exposure time to impulsive noise level of 130 dB

Protect domestic animals from noise

Their ears are far more sensitive than ours, so help them by drowning out the noise. This includes making sure all windows, screens and doors are closed tightly. Find a quiet, comfortable area for your pet indoors and turn on the TV or radio to help reduce the ability for him to hear the fireworks.

Or an anti-anxiety medication regimen that your veterinarian can work with you, to create for your pet's individual needs.

Best, but not always practical, is to keep away from the location until the fireworks are over.

How can I protect my ears from noise?

<https://www.torbayandsouthdevon.nhs.uk/services/audiology/hearing-hearing-loss/>

Earmonix Shooting & Impulse Noise Reducing Ear Plugs

[https://www.earmonix.net/shooting-impulse-ear-](https://www.earmonix.net/shooting-impulse-ear-plugs.html#:~:text=REDUCE%20NOISE%20LEVELS%20WHILE%20STAYING,comfortable%20and%20safe%20to%20use)

[plugs.html#:~:text=REDUCE%20NOISE%20LEVELS%20WHILE%20STAYING,comfortable%20and%20safe%20to%20use](https://www.earmonix.net/shooting-impulse-ear-plugs.html#:~:text=REDUCE%20NOISE%20LEVELS%20WHILE%20STAYING,comfortable%20and%20safe%20to%20use)

Hazard to health from exposure to noise

WHO

Children and noise

Periodicity and Duration: Impulse noise is more harmful than continuous because it bypasses the natural protective reaction, the damping-out of the ossicles mediated by the facial nerve. Loud noise may result in temporary decrease in the sensitivity of hearing and tinnitus, but repeated exposure may cause these temporary conditions to become permanent.

<https://apps.who.int/iris/bitstream/handle/10665/336966/WHO-HSE-PHE-AMR-09.01.05-eng.pdf>

Noise exposure for children

A limit for impulse noise cannot be directly derived using the ISO 1999 standard. However, as can be seen in Figure 4, allowable exposure times at noise levels greater than 100 dBA are on the scale of seconds, suggesting that a *de facto* limit of 100 dBA for impulse noise for children may be appropriate. When exposure to impulse noise is expected (e.g. firearms, explosives, etc.) double hearing protection (i.e. ear plugs and earmuffs) should be utilized to prevent any risk to hearing loss.

<https://cdn.who.int/media/docs/default-source/documents/health-topics/deafness-and-hearing-loss/monograph-on-noise-exposure-limit-for-children-in-recreational-settings.pdf>

UK. Gov. Office for Product Safety & Standards

6. Fireworks and animal health

The auditory systems of humans and dogs are similar, so it is likely that noise levels that damage human hearing will have the same effect on dogs (Garvey, Stella, & Croney, 2006). • Dogs can however hear across a much greater frequency range and can therefore are exposed to a greater risk of noise distress. The bark of a dog can reach 100 dB, with noise levels recorded at between 85-122 dB in kennels (Garvey et al., 2006). Previous studies have shown that noise blasts of 120 dB are particularly stressful to dogs, although this did not seem to result in chronic stress (Haverbeke, Diederich, Depiereux, & Giffroy, 2008).

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/929161/fireworks-evidence-submission-opss-noise-levels.pdf

RSPCA

Fireworks can be a source of fear and distress for many animals – in particular the sudden, loud noises. For example, it is estimated that 45 percent of dogs show signs of fear when they hear fireworks¹, and a New Zealand survey recorded 79 percent of horses as either anxious or very anxious around fireworks over the Guy Fawkes period². Animals affected not only suffer psychological distress but can also cause themselves injuries – sometimes very serious ones – as they attempt to run or hide from the noise.

<https://www.rspca.org.uk/documents/1494939/0/Bang+out+of+order+-+fireworks+frighten+animals+%28PDF+706KB%29.pdf/ebcfb65c-40f4-58a0-88d2-0896845a3127?t=1571669349793>

Science Direct

Exposure assessment to fireworks

Non auditory effect of noise: The response that shows the highest prevalence in relation to the existence of environmental noise is annoyance. Annoyance contributes substantially to the burden of disease produced by this agent. This effect, which is characterized by irritation, can result from noise by interfering with daily activities, feelings, thoughts, sleep or rest, and can be accompanied by negative responses, such as: anger, disgust, fatigue, and stress-related symptoms

<https://www.sciencedirect.com/science/article/abs/pii/S0003682X21002371>

Weather Conditions

Wind conditions (applicable to all tests)

Wind speed : less than Force 2 (Beaufort scale),

Wind direction: variable

Weather conditions : Calm

Precipitation : none

RH: ~ 70%

Measuring instruments specification:

Sound Level Meter

Make: Cirrus

Model : CK 171A

Class : 1

Octave band analyser: 1:1

Data logger

Acoustic Calibrator

Make: Cirrus

Model: CR515

Class: 1

Last calibration: December 2022

John Fenech

www.nasomalta.org

Noise Abatement Society of Malta

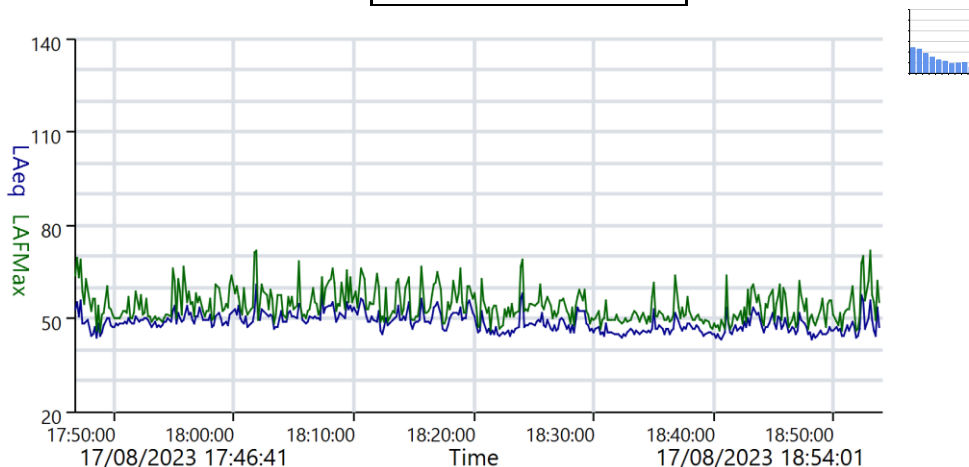
Measurement Summary Report

Name	Report 84			
Time	17/08/2023 17:46:41	Person		Place
Duration	01:07:20	john fenech	37 Triq Ir-Rummien	Project
Instrument	G080702, CR:171A			Measure Background noise

Calibration

Before	Offset	After	18/08/2023 07:23	Offset	-0.37 dB
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Basic Values		Statistical Levels (Ln)	
L _{Aeq}	49.9 dB	LAF1	58.9 dB
L _{AE}	86.0 dB	LAF5	53.8 dB
L _{AFMax}	72.0 dB	LAF10	51.9 dB
		LAF50	47.7 dB
		LAF90	44.1 dB
		LAF95	43.5 dB
		LAF99	42.7 dB



Notes

During the monitoring of the Ambient noise the specific noise was suppressed
The noise monitored from JF residence. Distance between monitoring point and noise source 1000 meters.

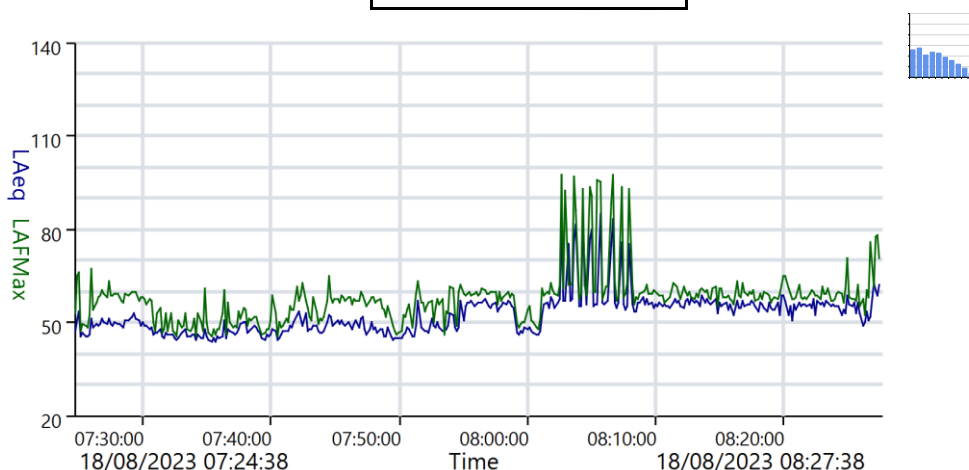
Measurement Summary Report

Name	Report 85			
Time	18/08/2023 07:24:38	Person		Place
Duration	01:03:00	john fenech	37 Triq Ir-Rummien	Project
Instrument	G080702, CR:171A			Measure the Ambient and specific noise

Calibration

Before	18/08/2023 07:23	Offset	-0.37 dB	After	19/08/2023 07:16	Offset	-0.40 dB
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Basic Values		Statistical Levels (Ln)		Peak		
L _{Aeq}	65.2 dB	LAF1	63.6 dB	LCPeak	122.6	dB
L _{AE}	101.0 dB	LAF5	58.3 dB	LAFMax	97.5	db
LAFMax	97.5 dB	LAF10	57.3 dB			
		LAF50	49.8 dB			
		LAF90	44.9 dB			
		LAF95	44.4 dB			
		LAF99	43.7 dB			



Notes

During the Ambient noise monitoring , the specific noise was on for ~ 5 minutes - 9 petards
The noise monitored from JF residence. Distance between monitoring point and noise source 1000 meters.

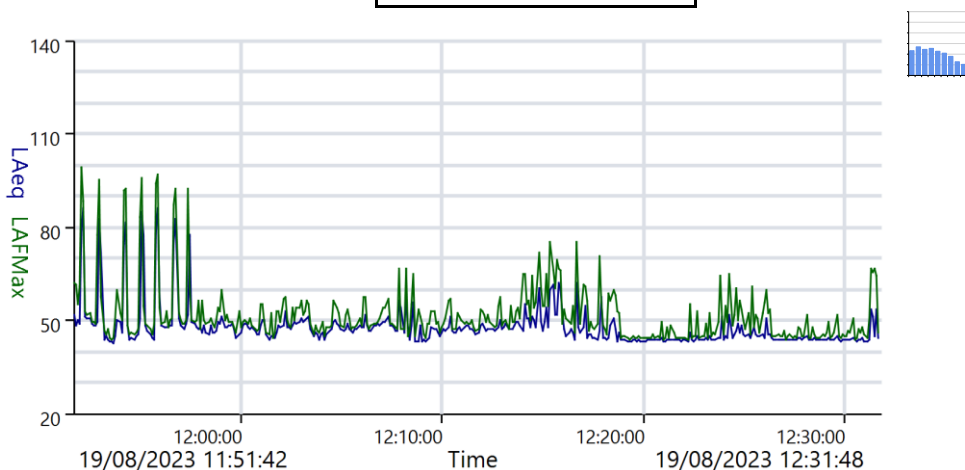
Measurement Summary Report

Name	Report 87			
Time	19/08/2023 11:51:42	Person		Place
Duration	00:40:06	john fenech		37 Triq Ir-Rummien
Instrument	G080702, CR:171A			Project
				Measure Ambient and firework noise

Calibration

Before	19/08/2023 11:50	Offset	-0.37 dB	After	19/08/2023 19:46	Offset	-0.40 dB
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Basic Values		Statistical Levels (Ln)		Peak		
L _{Aeq}	67.5 dB	LAF1	75.7 dB	LCPeak	122.6	dB
L _{AE}	101.3 dB	LAF5	52.0 dB	LAFMax	99.4	db
LAFMax	99.4 dB	LAF10	49.7 dB			
		LAF50	46.0 dB			
		LAF90	43.3 dB			
		LAF95	43.1 dB			
		LAF99	42.7 dB			



Notes

Monitoring the Specific noise - fireworks during St Helena fiesta - 19 Aug 2023
Background noise level ~ 67 dB(A)
Noise monitored from JF residence. Distance between monitoring point and noise source 1000 meters.

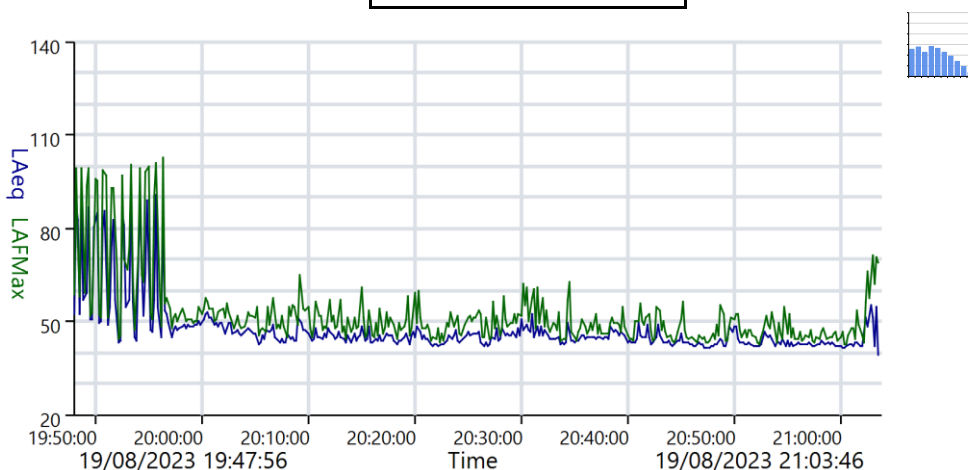
Measurement Summary Report

Name	Report 88			
Time	19/08/2023 19:47:56	Person		Place
Duration	01:15:50	john fenech		37 Triq Ir-Rummien
Instrument	G080702, CR:171A		Frank	Project
				Measure Ambient and fireworks noise

Calibration

Before	19/08/2023 19:46	Offset	-0.40 dB	After	20/08/2023 07:40	Offset	-0.43 dB
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Basic Values		Statistical Levels (Ln)		Peak		
L _{Aeq}	73.1 dB	LAF1	83.4 dB	LCPeak	127.4	dB
L _{AE}	109.7 dB	LAF5	53.1 dB	LAFMax	102.6	dB
LAFMax	102.6 dB	LAF10	50.1 dB			
		LAF50	44.1 dB			
		LAF90	41.9 dB			
		LAF95	41.6 dB			
		LAF99	40.9 dB			



Notes

Monitoring Specific noise - fireworks during St. Helena fiesta 19 Aug 2023
Noise measured from JF residence. Distance between monitoring point and noise source 1000 meters.

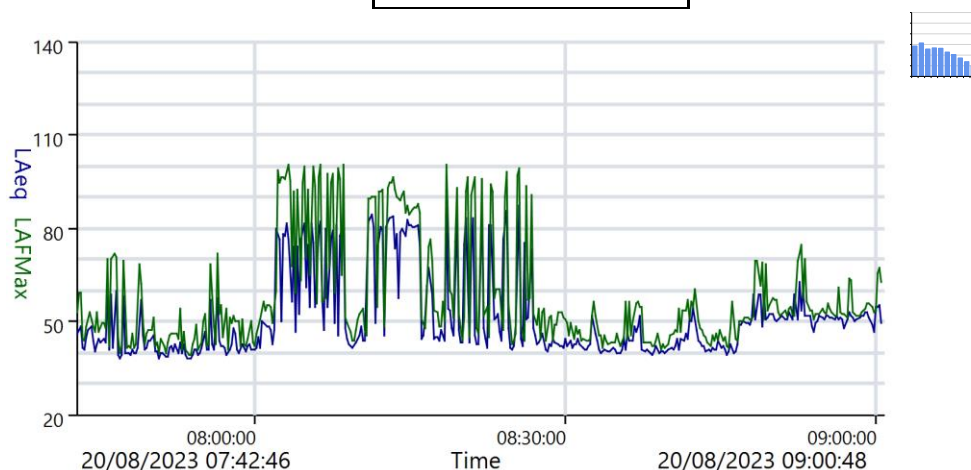
Measurement Summary Report

Name	Report 89			
Time	20/08/2023 07:42:46	Person		Place
Duration	01:18:02	john fenech		37 Triq Ir-Rummien
Instrument	G080702, CR:171A			Project
				Measure fireworks noise

Calibration

Before	20/08/2023 07:40	Offset	-0.43 dB	After	Offset
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Basic Values		Statistical Levels (Ln)		Peak		
L _{Aeq}	72.6 dB	LAF1	85.7 dB	LCPeak	126.3	dB
L _{AE}	109.3 dB	LAF5	70.3 dB	LAFMax	100.4	dB
LAFMax	100.4 dB	LAF10	54.5 dB			
		LAF50	43.6 dB			
		LAF90	39.5 dB			
		LAF95	38.9 dB			
		LAF99	37.8 dB			



Notes

Monitoring the specific noise- fireworks, during St. Helena fiesta. 20 August 2023
The noise monitored from JF residence. Distance between monitoring point and noise source 1000 meters.

Measurement Summary Report

Name Report 92
Time 20/08/2023 20:29:57 **Person** john fenech **Place** 37 Triq Ir-Rummien **Project** Measuring firework noise
Duration 00:28:16
Instrument G080702, CR:171A

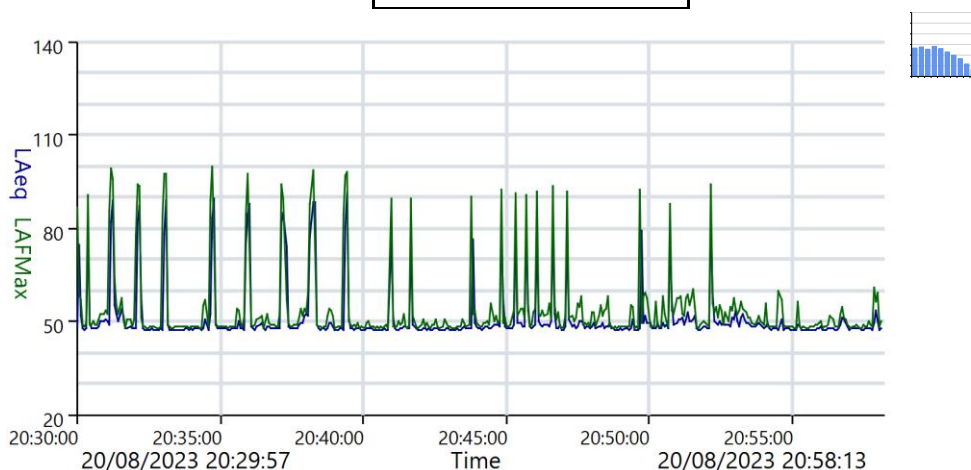
Calibration

Before 20/08/2023 19:54 Offset -0.12 dB **After** 20/08/2023 21:00 Offset -0.43 dB

Basic Values	
L _{Aeq}	73.0 dB
L _{AE}	105.3 dB
L _{AFMax}	99.7 dB

Statistical Levels (L _n)	
L _{AF1}	86.3 dB
L _{AF5}	56.4 dB
L _{AF10}	51.3 dB
L _{AF50}	47.6 dB
L _{AF90}	47.1 dB
L _{AF95}	46.9 dB
L _{AF99}	46.7 dB

Peak		
L _{CPeak}	124.6	dB
L _{AFMax}	99.7	dB



Notes

Monitoring the Specific noise - fireworks during St Helena fiesta - 20 Aug 2023
 Background noise level ~ 67 dB(A)
 Noise monitored from JF residence. Distance between monitoring point and noise source 1000 meters.

Noise Abatement Society of Malta