Rangebank BESS

Compliance Noise Monitoring

S7794C18

February 2025

sonus.

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Document Title	: Rangebank BESS Compliance Noise Monitoring
Client	: Fluence Energy Pty Ltd
Document Reference	: S7794C18
Date	: February 2025
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1 INTRODUCTION

The Rangebank BESS (the **Subject Site**) is a 200MW/400MWh battery energy storage system (**BESS**), located in Cranbourne West, Victoria. The Subject Site was approved on 29 September 2022 (Permit No. PA2101362) and the approval was subsequently amended on 14 February 2023 and 10 August 2023.

Condition 12 of the planning permit states the following:

> *Within 1 month of the commencement of the use, a Post-Construction Acoustic Assessment Report must be prepared by a suitably qualified acoustic engineer and must be submitted to the Responsible Authority. The Acoustic Report must be made available to the public. The report must assess the compliance of the use with the Noise Protocol and, where necessary, make recommendations to limit the noise impacts in accordance with the Noise Protocol. If recommendations to limit the noise impacts are made, they must be implemented to the satisfaction of the responsible authority.*

This report has been prepared in accordance with Condition 12 to outline the procedure and results of compliance noise measurements taken in the vicinity of the Subject Site on the 16th of January 2025.

2 NOISE LEGISLATION

The *Environment Protection Act 2017* (VIC) (the **Act**) outlines the principles of environment protection that are applicable to developments in Victoria. The *Environment Protection Regulations 2021* (VIC) (the **Regulations**) furthers the purposes of the Act by, among other things, specifying matters in relation to noise. Clause 113 of the Regulations states the following:

> ***113. Prediction, Measurement, assessment and analysis of noise must be in accordance with Noise Protocol***
>
> *A person who conducts a prediction, measurement, assessment or analysis of noise within a noise sensitive area for the purposes of the Act or these Regulations, other than Division 5 of this Part, must conduct the prediction, measurement, assessment or analysis in accordance with the Noise Protocol.*
>
> ***Note***
>
> *The Noise Protocol sets out how to conduct the following noise-related assessments –*
>
> *(a) noise limits;*
>
> *(b) background levels;*
>
> *(c) alternative assessment criterion at an alternative assessment location, including when the Live music entertainment venues provisions (which include reference to agent of change) set out in the VPPs apply;*
>
> *(d) effective noise levels.*

The Noise Protocol referenced in the Regulations refers to the EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (the **Noise Protocol**). The Noise Protocol defines two methods for determining noise limits, an urban area method and a rural area method.

For the urban area method (applicable for the Subject Site), the zoning noise limit is first determined, then this may be adjusted, depending on existing background noise levels. Excerpts of the relevant clauses from the Noise Protocol are attached in Appendix A.

3 CRITERIA

The current planning permit for the Subject Site was granted in February 2023 (permit no. PA2101362-1) (the **Permit**). Condition 10 of the Permit requires the use of the land to comply with the noise criteria documented in the Noise Protocol. It is noted that no specific noise criteria are provided in the Permit conditions, only referencing the method for determining appropriate conditions. Appropriate noise criteria have therefore been determined in accordance with the urban area method of the Noise Protocol.

As noted in the Noise Legislation section of this report, the criteria determined in accordance with the Noise Protocol are influenced by the background noise level in the area. It is noted that background noise monitoring was previously conducted in February 2021 by Marshall Day Acoustics (**MDA**), however these measurements are not considered to be representative of the conditions on site for the following reasons:

- Noise monitoring was conducted during COVID, where activities were much reduced.
- Short term noise measurements were taken on a limited number of occasions as opposed to continuous long term noise monitoring.
- Noise measurements were not representative of the closest residences to the Subject Site and were instead taken at locations setback further from the site and often shielded by other residences.

As such, contemporary background noise measurements were conducted to better determine the site conditions, prior to the operation of the BESS. This noise monitoring was conducted at two locations near to the Subject Site between 5 August 2024 and 13 August 2024. The noise monitoring locations and receiver locations can be seen in Figure 1. Noise monitoring equipment was placed on Breens Road and Evans Road at similar distances from major noise sources (roads) as residences.

Figure 1: Site layout and receivers

The background noise level is determined as the arithmetic average of all $L_{A90,1\ hour}$ measurements for each of the day, evening, and night periods, as defined in EPA Publication 1997 *Technical guide: Measuring and analysing industry noise and music noise* (the **Technical Guide**). The resultant background noise levels based on the measurements can be seen in Table 1. It is noted that during the background noise monitoring period, there was construction activity occurring on the opposite side of Evans Road during the day period. As such, the background noise levels for this period have been conservatively assumed to be the same as for the evening period. This results in lower criteria during the day than would otherwise be the case.

Table 1: Background Noise Levels

Location	Time Period		
	Day	Evening	Night
Breens Road	44 dB(A)*	44 dB(A)	42 dB(A)
Evans Road	56 dB(A)*	56 dB(A)	46 dB(A)

* Background noise levels as per evening period.

The Noise Protocol defines noise limits based on the background classification of the area. This is determined, as per the method in clause 4 of the Noise Protocol, by comparing the zoning levels with the background noise levels. The noise limits are then determined using the background classification in accordance with clauses 5 and 6. Given the zoning levels and the measured background levels, the noise limits can be seen in Table 2. It is noted that the criteria reported below have been decreased by 3 dB(A) to account for the potential cumulative noise from other industrial sources in the vicinity. This is in accordance with the equal sharing principle outlined in the Technical Guide, which adjusts the noise limits based on the total number of industrial noise sources in the vicinity. The applied correction is based on there being a total of 2 industrial premises at the time of application.

Table 2: Noise Protocol noise limits

Receiver	Representative Logging Location	Zoning Level			Background Classification	Noise Limits		
		Day	Evening	Night		Day	Evening	Night
R1	Breens Road	53	47	42	High	47	44	42
R2		53	47	42	High	47	44	42
R3		53	47	42	High	47	44	42
R4		54	48	43	High	47	44	42
R5		54	48	43	High	47	44	42
R6		55	48	43	High	47	44	42
W1	Evans Road	58	51	46	High	59	56	46
W2		58	52	46	High	59	56	46
W3		58	52	47	High	59	56	46
W4		58	52	47	High	59	56	46

4 MEASUREMENT PROCEDURE

Attended noise measurements were taken on the night of the 16th of January 2025. Measurements were initially taken at the most exposed residence, R1. This location was, however, not located downwind from the Subject Site and was therefore not exposed to the worst case conditions for noise propagation. Where the noise level is affected by atmospheric conditions, clause 76 of the Noise Protocol requires an alternate assessment location to be used, as stated below:

> *Where the effective noise level at the noise sensitive area is likely to be affected by atmospheric conditions, an alternative assessment location located near to the commercial, industrial or trade premises must be used unless there is no appropriate alternative assessment location (refer clause 77).*

An alternate assessment location was therefore chosen that was downwind from the Subject Site, D1. The location where the measurements were taken can be seen in Table 3 and graphically in Figure 2.

Table 3: Measurement Location

Location	Coordinates (UTM WGS84 55H)	
	Easting	Northing
R1	347325	5783025
D1	347329	5783450

The BESS was operated at maximum capacity (200MW) for the duration of the testing. The schedule in Table 4 outlines the operating modes and conditions during the testing.

Table 4: Operating Schedule

Time	Mode	Inverter Fan Speed	Battery Cooling Mode
11:00pm to 11:30pm	200MW charge	80%	Mode 8*
11:30pm to Midnight	200MW discharge	80%	Mode 8*

* Mode 8 = long duration cubes operating with the *Envicool* chiller and HVAC both switched on.

Fluence has indicated that these operating conditions represent "*worst case" acoustic contribution with the site under full load, inverter fans operating at 80% and all chillers and HVAC in standard operating modes*.

Figure 2: Measurement Location

Noise measurements were taken using a Rion NL-53 sound level meter (serial number 00240810), last calibrated on 4 March 2024. The calibration certificate and datasheet for the sound level meter can be seen in Appendix B. The sound level meter was placed on a tripod to facilitate the measurements, with the measurement setup shown in Figure 3. The sound level meter was calibrated before and after the noise measurements to a level of 94.0 dB(A) with no significant drift observed. The measurements were taken using the 'fast' time weighting and 'A' frequency weighting.

Figure 3: Measurement Setup

It is noted that the operation of the site was barely audible while conducting the measurements at R1, with noise from traffic being the dominant noise source observed. There was a clear sky and a slight breeze blowing towards the site from R1 during the measurements. Therefore, measurements were subsequently taken at an alternate assessment location positioned downwind of the site during this period. Site operations were the dominant noise source at this alternate location. The measurements were paused to remove the effects of extraneous noise, primarily from traffic, however it is noted that there is likely still some contribution from traffic in the measurements. The potential for tonality was observed during the measurements at D1.

5 MEASUREMENT RESULTS

The results of the measurements and the atmospheric conditions at the time of the measurements can be seen in Table 5. The atmospheric conditions have been taken from the nearest Bureau of Meteorology station to the Subject Site, being the station at Frankston (Ballam Park). The observations for the time closest to the start of the measurement have been reported.

Table 5: Measurement Results

Measurement Number	Measurement Location	Measurement Time	Measured Noise Level	Temperature	Humidity	Wind Speed	Wind Direction
1	R1	16/01 11:00pm	40 dB(A)	14°C	83%	-	Calm
2	R1	16/01 11:00pm	39 dB(A)	14°C	83%	-	Calm
3	D1	16/01 11:15pm	49 dB(A)	13.9°C	86%	-	Calm
4	D1	16/01 11:30pm	49 dB(A)	13.9°C	86%	-	Calm

It is noted that although the Frankston weather station indicates that conditions were calm, direct observations at the time of the noise measurements at D1 indicated that the location was downwind of the BESS during the noise measurements.

In order to determine compliance based on the measurements taken at the alternate assessment location, the noise levels were extrapolated back to the primary assessment location, R1, using the alternate assessment criterion principles of the Noise Protocol. This was accomplished by comparing the predicted noise levels at these two locations. The results of this extrapolation can be seen in Table 6.

Table 6: Extrapolated Noise Level

Measurement Number	Extrapolated Noise Level
3	40 dB(A)
4	39 dB(A)

The Noise Protocol requires the measured noise level to be adjusted for noise character where it is found to contain excessive tonality, impulsiveness, or intermittency. Tonality was observed during the attended measurements at D1 (but not at R1). The data were then further analysed in accordance with the procedure outlined in Annex C of the Noise Protocol. This further analysis indicated that a 2 dB(A) penalty for tonality is warranted for the measurements at D1. It is noted that with the additional distance and masking influence of ambient noise, the prominence of the tonality would be less at R1 than at D1.

An overall noise level for each location has been determined based on the average of the measured noise levels. In addition, a 2 dB(A) penalty has been conservatively applied to the extrapolated noise levels for a tonal noise character. This results in a level of 39 dB(A) at R1 and a level of 42 dB(A) when extrapolating from the measurements conducted at D1. Both of these levels will achieve the criterion of 42 dB(A) applicable at R1.

The measurement results have also been extrapolated out to the other nearby noise sensitive receivers. The average results at these locations, inclusive of a conservative 2 dB(A) penalty for a tonal noise character, can be seen in Table 7 alongside the relevant noise criteria.

Table 7: Extrapolated Noise Levels - Additional Receivers

Receiver	Extrapolated Noise Level	Night Period Criterion	Receiver	Extrapolated Noise Level	Night Period Criterion
R1	42 dB(A)	42 dB(A)	R6	38 dB(A)	42 dB(A)
R2	41 dB(A)	42 dB(A)	W1	44 dB(A)	46 dB(A)
R3	38 dB(A)	42 dB(A)	W2	44 dB(A)	46 dB(A)
R4	34 dB(A)	42 dB(A)	W3	43 dB(A)	46 dB(A)
R5	37 dB(A)	42 dB(A)	W4	35 dB(A)	46 dB(A)

It can therefore be seen that the operation of the Subject Site complied with the relevant criterion from the Noise Protocol at the nearest noise sensitive location at the time of the measurements.

6 CONCLUSION

The planning permit for the Rangebank BESS includes the requirement for the use of the land to comply with the noise criteria documented in the Noise Protocol.

The noise criteria were determined in accordance with the Noise Protocol, including background noise monitoring conducted in August 2024, prior to operation of the BESS.

Noise monitoring was conducted on the evening of 16 January 2025. Fluence has confirmed that at the time of the monitoring, equipment was operating under *"worst case" acoustic contribution, with the site under full load, inverter fans operating at 80% and all chillers and HVAC in standard operating modes*.

At the times of noise monitoring, the noise from the BESS was barely audible at the closest residence. However, as the wind was not blowing toward the measurement location, an additional analysis was conducted by measuring the noise at an alternate location, as required by the Noise Protocol. The measured noise levels were then extrapolated to the location of nearest residence, under worst case meteorological conditions (wind toward residences) in accordance with the Noise Protocol. These levels therefore represent the worst case operational conditions (confirmed by Fluence), under the worst case meteorological conditions.

Based on the above, the measured noise levels complied with the Noise Protocol. At all other times (in lower noise operating conditions and/or with different meteorological conditions), it is expected that noise levels will be lower at residences. The results of the noise monitoring have been summarised in the below table.

Receiver	Planning Night Period Criterion	Updated Night Period Criterion	Average Measured Noise Level (November 2024)	Average Measured Noise Level (January 2025)
R1	39 dB(A)	42 dB(A)	36 dB(A)	39 dB(A)
R1 (extrapolated)			42 dB(A)	42 dB(A)

APPENDIX A: RELEVANT NOISE PROTOCOL CLAUSES

Part I:

Commercial, industrial and trade premises

A: Determining noise limits for commercial, industrial and trade premises

1. Noise limits – urban area method

(1) Noise limits must be set at an assessment location within a *noise sensitive area* as defined by the Regulations. The values of the noise limits must be whole numbers, rounded to the nearest decibel.

(2) Determine the zoning level for each period using the method in clauses 7 to 15.

(3) Assess the background level in accordance with clauses 39 to 51.

(4) Determine whether the background level, relative to the zoning level, for each period as relevant is neutral, low or high:

a. for the day period the background level is –

i. neutral when it is at least 6 dB, and no more than 12 dB, below the zoning level;

ii. high when the background level plus 6 dB exceeds its respective zoning level; and

iii. low when the background level is 13 dB or more below the zoning level.

b. for the evening and night periods the background level is –

i. neutral when it is at least 3 dB and no more than 9 dB below the zoning level;

ii. high when the background level plus 3 dB exceeds the zoning level; and

iii. low when the background level is 10 dB or more below the zoning level.

(5) If the background level is neutral, the noise limit for the respective period is the zoning level determined according to clauses 7 to 15.

(6) Where the background noise level is not neutral, the noise limit for each period is based on whether the background relative to the zoning level is low or high (and having regard to the base noise limits in Regulation 118(2)(a) and the night period noise limit in Regulation 118(3) –

a. for the day period:

i. if the background level relative to the zoning level is high, the noise limit for the day period is the background level plus 6 dB;

ii. if the background level relative to the zoning level is low, the noise limit for the day period must be calculated from the following formula –

noise limit = ½ (zoning level + background level) + 4.5 dB.

b. for the evening period:
   i. if the background level relative to the zoning level is high, the noise limit for the evening period is the background level plus 3 dB;
   ii. if the background level relative to the zoning level is low, the noise limit for the evening period must be calculated from the following formula –
   noise limit = ½ (zoning level + background level) + 3 dB.
c. for the night period:
   i. if the background level relative to the zoning level is high, the noise limit for the night period is the background level plus 3 dB, but no greater than 55 dB(A);
   ii. if the background level relative to the zoning level is low, the noise limit for the night period must be calculated from the following formula –
   noise limit = ½ (zoning level + background level) + 3 dB.

1.1 Zoning level

(7) To determine the zoning level, the relevant planning scheme or schemes for the area under consideration must be used. (Refer to Annex A).

(8) Two concentric circles of diameter 140 metres and 400 metres must be drawn or reproduced to scale on the relevant map, centred on the measurement point in the noise sensitive area (but if an alternative assessment location is specified, the centre of the two circles must be located at an appropriate point in the noise sensitive area).

(9) The zones and reservations specified by the planning scheme or schemes within each circle must be designated by the Authority as type 1, type 2 or type 3 according to the tables in Annex A to this Noise Protocol, as amended from time to time.

(10) In designating a zone or reservation as a type, the Authority must have regard to the nature of uses permitted in that zone or reservation and must generally designate –
   a. residential, rural and open spaces as type 1; and
   b. commercial, business and light industry as type 2; and
   c. general industry and major roads as type 3.

(11) If a zone or reservation is not listed in Annex A to this Noise Protocol, the Authority, having regard to the nature of the uses permitted in similar zones or reservations, will designate a type accordingly.

(12) A type designated by the Authority under clause 11 must be published on the Authority's website.

(13) The total area of the 140 metre circle and the 400 metre circle must be measured from the relevant map specified in clause 8 above.

(14) The area of all type 2 and 3 zones and reservations must be measured for each of the two circles from the same map and the following applies –

a. The influencing factor (IF) must be calculated from the following formula:

$$IF = \tfrac{1}{2}\left(\frac{\text{area type 3} + \tfrac{1}{2}(\text{area type 2})}{\text{total area of circle}}\right)_{140\text{m circle}} + \tfrac{1}{2}\left(\frac{\text{area type 3} + \tfrac{1}{2}(\text{area type 2})}{\text{total area of circle}}\right)_{400\text{m circle}}$$

b. Alternatively, the fraction of each circle occupied by type 2 and 3 zones and reservations must be measured and the influencing factor (IF) calculated from the following equivalent formula:

IF = 0.25 (Sum of type 2 fractions for both circles) + 0.5 (Sum of type 3 fractions for both circles).

(15) The zoning level for a day period, evening period or night period must be determined from figure 1 below and must be rounded to the nearest decibel.

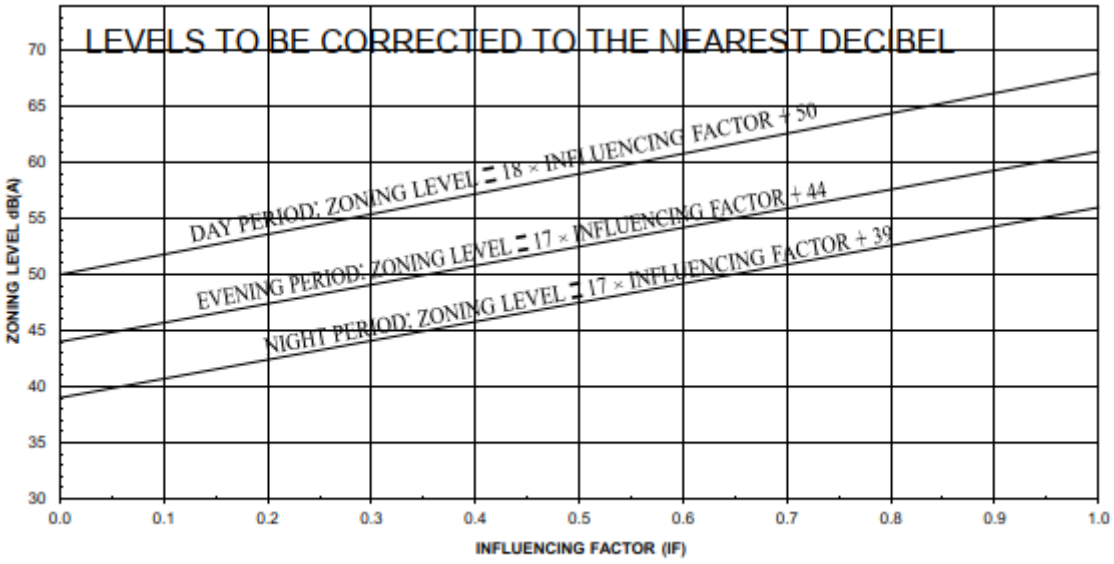

Figure 1: Zoning Level vs Influencing Factor

4. Assess background level to set noise limits for the urban area method or the rural area method

4.1 Measurement of background level

(39) The background level must, where possible, be measured outdoors at the assessment location in the noise sensitive area.

(40) Where it is not possible for the measurement of the background level to be made in the noise sensitive area, then the measurement may be made at another point (background equivalent location) which is representative of the likely background level at the assessment location in the noise sensitive area.

(41) The background level must be measured during dry conditions with wind conditions satisfying Beaufort Wind Scale 0, 1, 2 or 3.

(42) The background level must include all noise sources except noise from any commercial, industrial or trade premises which appears to be intrusive at the point where the background level is measured.

(43) When the microphone is located outdoors and 1 to 2 metres from an acoustically reflecting surface an adjustment of -2.5 dB must be made to the measured L_{A90}.

(44) No adjustment for noise character is applied to the measured background level.

(45) The background level must be rounded to the nearest decibel.

(46) To determine the background level, the L_{A90} must be measured continuously over each hour of the day, evening and night period that the commercial, industrial or trade premises under investigation normally operates.

(47) Where the conditions of clause 46 cannot be met, the L_{A90} may be measured over less than the full period using the short background method in clause 48.

(48) For the short background method, at least two measurements of the L_{A90} must be made, each of at least 10-minutes duration, in each period, so as to obtain a representative measure of the background level for the periods when the commercial, industrial or trade premises normally operates.

4.2 Determination of background level

(49) Where the hourly L_{A90} levels ($L_{A90,\ 1\ hour}$) have been measured, the background level is determined for each period as the arithmetic average of the $L_{A90,\ 1\ hour}$ for each hour of that period for which the commercial, industrial or trade premises under investigation normally operates.

(50) For the purpose of clause 49, for the relevant period, the background level must be based on valid $L_{A90,\ 1\ hour}$ measurements for each and every hour that the premises under investigation normally operates.

(51) Where the L_{A90} levels have been measured using the short background method in clause 48, the measurements in each period must be arithmetically averaged to obtain the background level during the relevant period.

APPENDIX B: SOUND LEVEL METER DETAILS

RION CO., LTD.

3-20-41 Higashimotomachi Kokubunji Tokyo 185-8533
Phone:042(359)7888, Facsimile:042(359)7442

Certificate of Calibration

Name : **Class 1 Sound Level Meter**

Model : **NL-53** **S/No.** : **00240810**

Date of Calibration : **March, 04, 2024**

We hereby certify that the above product was tested and calibrated according to the prescribed Rion procedures, and that it fulfills specification requirements.
The measuring equipment and reference devices used for testing and calibrating this unit are managed under the Rion traceability system and are traceable according to official Japanese standards and official standards of countries belonging to the International Committee of Weights and Measures.

RION CO., LTD.

J. Kawamura

Manager, Quality Control Department

■ Specifications

			Class 1 Sound Level Meter NL-63	Class 1 Sound Level Meter NL-53	Class2 Sound Level Meter NL-43
Applicable standards			IEC 61672-1: 2013 class 1, ISO 7196: 1995, ANSI/ASA S1.4-2014/Part1 class 1, JIS C 1509-1:2017 class 1, JIS C 1516: 2020 class 1 ISO 7196: 1995	IEC 61672-1: 2013 class 1, ANSI/ASA S1.4-2014/Part1 class 1, JIS C 1509-1: 2017 class 1, JIS C 1516: 2020 class 1	IEC 61672-1: 2013 class 2, ANSI/ASA S1.4-2014/Part1 class 2, JIS C 1509-1: 2017 class 2, JIS C 1516: 2020 class 2
			CE Marking • EMC Directive Directive 2014/30/EU EN 61326-1:2013 • RoHS Directive Directive 2011/65/EU EN IEC 63000:2018 • Low Voltage Directive Directive 2014/35/EU EN 61010-1:2010/A1:2019 UKCA Marking, China RoHS, KC mark, VCCI Class B	●	●
Measurement function			Simultaneous measurement of up to four conditions (Main channel, Sub1 to Sub3 channels) with selected time weighting and frequency weighting	●	●
	Instantaneous value		Time-weighted sound pressure level L_p	●	●
	Calculated value		Equivalent continuous sound level: L_{eq}, I-time-weighted equivalent continuous sound level: L_{Ieq}, Moving L_{eq}: $L_{eq,\ mov}$ Sound exposure level: L_E, Maximum sound level: L_{max}, Minimum sound level: L_{min}, Percentile sound level: L_N, Peak sound leve: L_{peak}, Takt-max sound level: L_{tm5}	Equivalent continuous sound level: L_{eq}, I-time-weighted equivalent continuous sound level: L_{Ieq}※2, Moving L_{eq}: $L_{eq,\ mov}$※2, Sound exposure level: L_E, Maximum sound level: L_{max}, Minimum sound level: L_{min}, Percentile sound level: L_N, Peak sound level: L_{peak}, Takt-max sound level: L_{tm5}	
Microphone	Type		UC-59L	UC-59	UC-52
	Sensitivity level (representative value)		−27 dB	−27 dB	−33 dB
Measurement level range			A-weighting: 25 dB to 138 dB, C-weighting: 33 dB to 138 dB, G-weighting: 43 dB to 138 dB, Z-weighting: 50 dB to 138 dB, C-weighted peak sound level: 60 dB to 141 dB, Z-weighted peak sound level: 65 dB to 141 dB	A-weighting: 25 dB to 138 dB, C-weighting: 33 dB to 138 dB, Z-weighting: 38 dB to 138 dB, C-weighted peak sound level: 55 dB to 141 dB, Z-weighted peak sound level: 60 dB to 141 dB	
Self-generated noise	A-weighting		17 dB or less	17 dB or less	19 dB or less
	C-weighting		25 dB or less	25 dB or less	27 dB or less
	Z-weighting		42 dB or less	30 dB or less	32 dB or less
	G-weighting		35 dB or less	—	
Measurement frequency range			1 Hz to 20 kHz	10 Hz to 20 kHz	20 Hz to 8 kHz
Frequency weighting			A, C, G, Z	A, C, Z	
Filter	Digital processing		High-pass filter Low-pass filter Cutoff frequency: 100 Hz, 500 Hz	—	
Time weighting			F (Fast), S (Slow), I (Impulse), 10 s	F (Fast), S (Slow), I (Impulse)※2	
Input range			Automatic switching	●	●
Bar graph display	Upper range		70 dB to 130 dB can be set in 10 dB increments	●	●
	Lower range		20 dB to 60 dB can be set in 10 dB increments	●	●
Sampling interval			L_p, L_{eq}, L_E, L_{max}, L_{min}, L_{peak}, L_{Ieq}: 20.8 µs (Sampling frequency: 48 kHz), L_N: 100 ms (L_p), 1 s (L_{eq}), $L_{eq,\ mov}$: 1 s (L_{eq}), L_{tm5}: 5 s (L_{max})	●	●
Calibration			A reference signal is input using sound calibrator NC-75/NC-74 or pistonphone NC-72B/NC-72A, and the signal input sensitivity is adjusted. Up to 30 calibrations can be managed in the calibration history, and saved to an SD card	●	●
Reference signal output to external devices	Frequency		1 kHz	●	●
	Output level		Bar graph upper limit −6 dB	●	●
Correction function	Windscreen correction function		Corrects the influence on the frequency response when the windscreen is installed.	●	●
	Diffuse sound field correction function		Corrects the influence on the frequency response when used in a diffuse sound field.	●	●
Delay time			After the operation to start measuring, the device starts measuring after the specified time elapses (OFF, 1, 3, 5, 10 s)	●	●
Back erase function			Excludes, from the calculation, data from the specified time before using this function (OFF, 1, 3, 5 s , May not be used together with auto store mode and waveform recording)	●	●
Display			Backlit 3.5-inch TFT-LCD QVGA ※With touch panel function (resistive membrane type) Numerical display update frequency: 1 s, Graph showing time and sound level / bar graph refresh interval : 100 ms	●	●
Store	Manual store		Data for measurement results are stored manually in single address increments.	●	●
		Number of data	Internal memory: max. 1 000 sets SD Card: depends on the capacity of the SD Card※1	●	●
		Measurement time	10 s, 1 , 5 , 10 , 15 , 30 m, 1 , 8 , 24 h, User Setting (1 s to 24 h)	●	●
	Auto store※2		Instantaneous values (L_p store) and processed values (L_{eq} store) are stored continuously on the SD card and automatically at preset intervals.	●	●
		L_p store interval	Off, 10 ms, 25 ms, 100 ms, 200 ms, 1 s	●	●
		L_{eq} calculation interval	Off, 10 s, 1, 5, 10, 15, 30, 1, 8, 24 h, or User Setting (Min. 1 s to max. 24 h)	●	●
		Number of data	SD card: Data can be saved with store names from 0000 to 9999	●	●
		Measurement time	10 s, 1, 5, 10, 15, 30, 1, 8, 24 h, User Setting (Min. 1 s to max 1000 h), Continue (Perform measurements until the SD card runs out of space※1)	●	●

●● : Same content as NL-63

●● : Same content as NL-63

Data format			CSV file	●	●
Data recall			Browses stored data and screenshot images	●	●
Memorizing Settings			Setting information can be saved to the internal memory or SD card and recalled at startup or at a specified time	●	●
Waveform recording*2*3	File format		Uncompressed waveform WAVE file	●	●
	Sampling frequency		Select 48 kHz, 24 kHz, 12 kHz, 1200 Hz or 240 kHz	Select 48 kHz, 24 kHz or 12 kHz	
	Data length		Select 24 bit or 16 bit	●	●
Outputs	AC output		Output voltage: 1 V rms at the output level range (Enables simultaneous output of DC output and AC output)	●	●
	DC output		Output voltage: 2.5 V, 25 mV/dB at the output level range	●	●
	Output range		Can be linked to the bar graph upper limit, or set from 70 dB to 130 dB in 10 dB increments	●	●
	Comparator*2		The comparator output turns on when the specified channel exceeds the set level (Maximum input voltage 24 V, internal resistance approx. 480 Ω, Allowable power dissipation 300 mW)	●	●
RS-232C Communication			Measurement values can be acquired and settings can be changed by using communication commands	●	●
USB	Communication		Measurement values can be acquired and settings can be changed by using communication commands	●	●
	Data transfer		Enables the transferring of data by making the computer recognize the SD card as a removable disk	●	●
LAN*2	Communication		Measurement values can be acquired and settings can be changed by using communication commands	●	●
	Data transfer		Data on an SD card can be transfered to a computer	●	●
	Web browser display		Via a web browser, settings can be changed and measured values displayed. Via Google Chrome on PC, audio can be played.*3	●	●
Data continuous output*2	Type of data	Instantaneous value	L_p	●	●
		Processed value	L_{eq}, L_{max}, L_{min}, L_{peak}	●	●
	Output interval		100 ms (0.1 s)	●	●
Power supply			4 × AA batteries, power supply to DC jack and USB port	●	●
	Operating time (at 23°C, ECO setting)		Alkaline battery LR6: Approx. 12 hours Ni-MH rechargeable battery HR6: Approx. 12 hours Portable charger: Approx. 20 hours of power at 5000 mAh *When making Auto store mode and ECO settings The operating time varies depending on the device settings and the battery manufacturer	Alkaline battery LR6: Approx. 16 hours Ni-MH rechargeable battery HR6: Approx. 16 hours Portable charger: Approx. 24 hours of power at 5000 mAh *When making Auto store mode*2 and ECO settings The operating time varies depending on the device settings and the battery manufacturer	
	AC adapter		NE-21P (Input: 100 to 240 V AC, 50/60 Hz, Output: 12 V DC)	●	●
	External power supply voltage		5.7 V to 15 V (rated voltage 12 V) USB port: 5 V (See precautions on mobile battery usage)	●	●
	Primary side (100 V side) power consumption		Approx. 3 W (With NE-21P usage)	●	●
Operating temperature and humidity range	Temperature		–10 °C to 50 °C	●	●
	Humidity		10 % to 90 % RH (no condensation)	●	●
Dustproof and waterproof performance*4			IP rating: IP54 (excluding microphone)	●	●
Dimensions, weight			Approx. 265 mm (H) × 83.5 mm (W) × 34.5 mm (D), approx. 400 g (including batteries)	Approx. 258 mm (H) × 83.5 mm (W) × 34.5 mm (D), approx. 400 g (including batteries)	
Accessories			Carrying case ×1, Windscreen WS-10 ×1, Windscreen fall prevention rubber ×1, Hand strap ×1, Size AA alkaline batteries ×4, SD card 512 MB	Carrying case ×1, Windscreen WS-10 ×1, Windscreen fall prevention rubber ×1, Hand strap ×1, Size AA alkaline batteries ×4, SD card 512 MB (NX-43EX preinstalled model only)	

Options

Product name	Product number	Compatible models
Extended Function Program (Inst.on 512 MB SD card)	NX-43EX	NL-43/53
Waveform Recording Program (Inst.on 2 GB SD card)	NX-43WR	NL-43/53/63
Octave-1/3 Octave Real-time Analysis Program (Inst.on 512 MB SD card)	NX-43RT	NL-43/53
Octave-1/3 Octave Real-time Analysis Program (Inst.on 512 MB SD card)	NX-63RT	NL-63
FFT Analysis Program (Inst.on 512 MB SD card)	NX-43FT	
512 MB SD Card	MC-51SD1	
2 GB SD Card	MC-20SD2	
32 GB SD Card	MC-32SP3	
AC adapter (100 V to 240 V AC)	NE-21P	
Battery pack (Using four D alkaline batteries)	BP-21A	
Microphone extension cable	EC-04 series	
BNC pin output cable	CC-24/CC-24S	NL-43/53/63
Printer cable	CC-42P	
RS-232C serial I/O cable	CC-42R	
Comparator Output / Trigger Input Cable	CC-43CT	
AC/DC Output Splitter Cable	CC-43S	
DC Polarity Converter	CC-43J	
USB cable (Type-C)	–	
Sound calibrator	NC-75	

Product name	Product number	Compatible models
Pistonphone	NC-72B	
Dedicated soft case	–	
Rubber cover for external power use	–	
All-Weather Windscreen	WS-15	
Windscreen mounting adapter	WS15006	NL-43/53/63
Rain-protection Windscreen	WS-16	
Tripod for sound level meter	ST-80	
Tripod extension rod (For ST-80)	ST-80-100	
Tripod for All-Weather Windscreen	ST-91	
Data Management Software for Environmental Measurement	AS-60	
Data Management Software for Environmental Measurement (Includes the Octave and 1/3 Octave Data Management Software)	AS-60RT	See.p.8
Waveform Analysis Software	AS-70	

*1 Use Rion fully guaranteed products. *2 NX-43EX required for NL-43/NL-53 (sold separately) *3 NX-43WR required (sold separately).
*4 Protection against harmful dust and water splashing from any direction.

Precautions on portable charger usage
Avoid portable charger with functions that monitor device power consumption and are capable of interrupting the power supply.
The power consumption of NL-43/53/63 is relatively low compared to smartphones; portable charger equipped with such features may erroneously terminate power supply to the unit.