Ref: VA4729.230522.L1

24 May 2023

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Jackie Ford
JMS Planning

Dear Jackie

VA4729 SHELL SHOREHAM AIRPORT, 151 BRIGHTON ROAD, SHOREHAM-BY-SEA

Substation Noise

Environmental Health has raised the following concern regarding noise from the new substation at Shell Shoreham Airport.

> *Substations emit a 100Hz hum that is very difficult to block, therefore I need to check if the enclosure is sufficiently robust as the nearest property is only around 10m away.*
>
> *Please can I get some more details on the electrical substation and its enclosure. I note the plans state it is a GRP Enclosure, however is it acoustically treated and with acoustic louvres for example?*

Schneider Electric has provided spectral noise level measurements data for the 1500kVA unit, which are appended to this letter.

These levels have been used to calculate the noise level 1m outside the window of the most affected noise sensitive receiver, at first floor level in Princes Court. Measurements from the scale drawing show this window to be 13m from the substation, so calculations have been predicted to 1m outside the window, 12m from the unit.

The spectral calculations are attached in Appendix B.

The calculations show a predicted noise levels of 24dB(A) outside the nearest window, 12m away.

The objective method from Annex C of BS4142 provided guidance as to identification of tones using linear third octave noise data. For tonal characteristics to be positively identified by this analysis, the third octave band of interest must exceed both the adjacent one-third octaves by the amounts shown below.

- 15 dB in the low-frequency one-third-octave bands (25 Hz to 125 Hz);
- 8 dB in the middle-frequency one-third-octave bands (160 Hz to 400 Hz);
- 5 dB in the high-frequency one-third-octave bands (500 Hz to 10 000 Hz).

Interrogation of the noise levels at the receiver show only a single tone at 2500 Hz. However, the noise level in this one-third octave band at the receiver is predicted to 10dB, which is expected to be generally inaudible at all times, and so would not in practice be tonal at the receiver.

The overall noise level of an un-enclosed substation is predicted to be 24dB(A).

BS8233 states that a partially open window provides a loss of 10-15dB, and so internal noise levels would be expected to below 15dB(A), and so would be also expected to be inaudible.

The above is based upon an unpackaged substation. With the unit installed within a GRP enclosure, noise levels would be expected to be reduced by at least 10dB.

Considering the above, it is expected that the substation will be broadly inaudible and therefore not tonal, and as such will not cause an adverse impact on the nearest residents.

Yours sincerely
on behalf of Venta Acoustics

Jamie Duncan
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Test Certificate

N°: I231675-01

Schneider Electric

Type : MINERA	Determination of Sound Level	Page Nr. : 12 of 14 pages
Customer : WPD	Fb Nr : 231675 Mach. Nr : 231675-01	
Power (kVA) : 1500	Voltage (kV) : 11.0 / 0.433	Standard IEC 60076-10

Measurement method : Sound pressure [X] Sound intensity [ ]

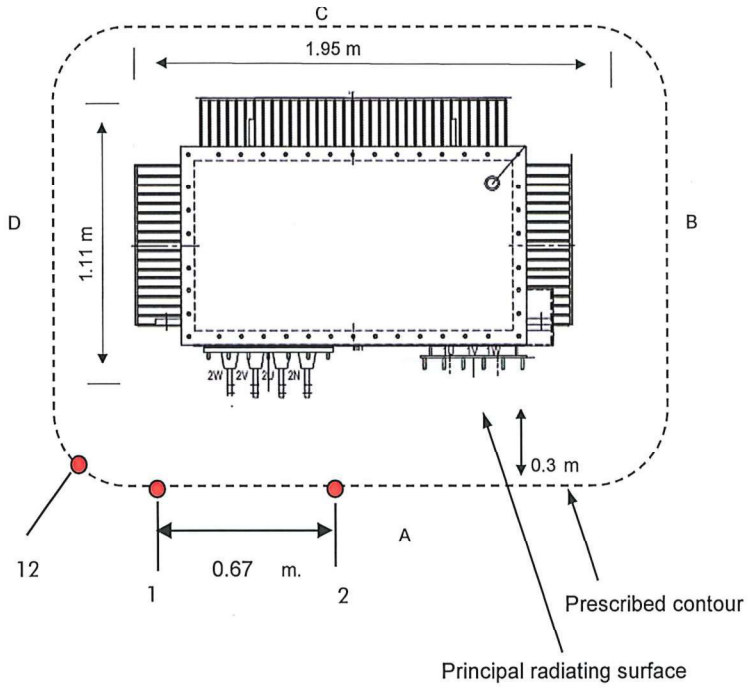
Test conditions :

Test laboratory	CRT	
Ambient temperature	21.2(±2)	°C
Height of mic. above grd. 1/2 h	0.82	m
Excitation voltage	0.433	kV
Frequency	50	Hz
Tap position	3	
Measurement distance	0.3	m
Length of prescribed cont.	8.0	m
Height of test object, h	1.65	m
Area of meas. surface (S)	15.6	m^2
10lg(S/So)	11.9	

A-weighted sound pressure levels of the background noise :

Pos.	At start of test	At end of test	
A	37.8	37.6	
B	38.8	38.6	
C	41.0	40.6	
D	39.2	38.6	
L_{bg}	39.3	39.0	(A)

Plan of test object :

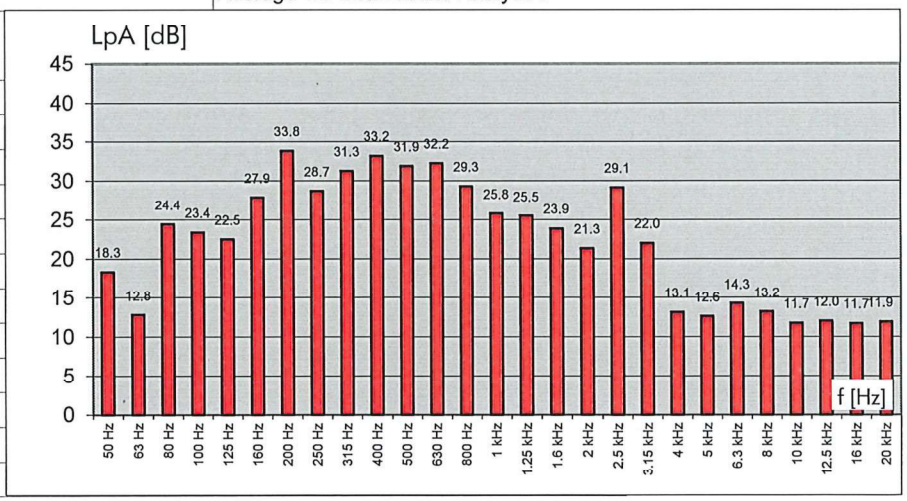


A-weighted sound pressure levels L_{pAi}

Pos.	1/2 h	-			
1	38.5				
2	40.6				
3	39.9				
4	39.0				
5	40.6				
6	41.0				
7	41.4				
8	41.5				
9	41.2				
10	40.6				
11	42.1				
12	39.9				

$\overline{L_{pA0}}$ 40.6 dB(A)

Average 1/3 Octaveband Analyse :



As stated in IEC 60076-10 (2016-03) sub clause 11.2.4; since the higher of two average A-weighted background noise pressure levels is less than 3 dB lower than the uncorrected average A-weighted sound pressure level of the subject transformer, the measurements are declared invalid.
The calculated uncorrected sound power level is 52.6 dB(A) for this transformer, considering that the uncorrected sound pressure level is 40.6 dB(A).
Since uncorrected average A-weighted sound pressure level is less than the guaranteed value, transformer is consider to have met the guaranteed level as per the same sub clause of IEC 60076-10 (2016-03).

L_{pA} :	Guaranted		dB(A)	Result :	-
L_{wA} :	Guaranted	61	dB(A)	Result :	Passed

Measuring instrument :

Manuf. : 01dB-Metravib Meter type : NETdB
Serial number : LCF026330-262
Microphone type : MCE 212
Serial number : 101069
Power Analyser: NORMA D600
Serial number : K63714-010

Tested by : D.ŞENCİ Test Engineer Date : 12.05.2022	Checked by : H.SEVİL Test Team Leader Date : 12.05.2022	Customer or Representative : Date :	Revision No -

APPENDIX A

1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
Noise	Sound that is unwanted by or disturbing to the perceiver.
Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A.
L_{eq} :	A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90} :	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max} :	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.

1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

APPENDIX A

1.3 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

APPENDIX B

VA4729 - Shell Shoreham Airport, 151 Brighton Road, Shoreham-by-sea

Noise Impact Assessment

			50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k	dB(A)
a	Lp (a-weighted)		18	13	24	23	23	28	34	29	31	33	32	32	29	26	26	24	21	29	22	13	13	14	13	12	12	12	12	42
b	A-weighting		-30	-26	-22	-19	-16	-13	-11	-9	-7	-5	-3	-2	-1	0	1	1	1	1	1	1	1	0	-1	-2	-4	-7	-9	
c	Lp (linear)	a+b	49	39	47	43	39	41	45	37	38	38	35	34	30	26	25	23	20	28	21	12	12	14	14	14	16	18	21	42
d	Measurement surface area	$15.6m^2$																												
e	Lw	c+10*log* d	61	51	59	54	51	53	57	49	50	50	47	46	42	38	37	35	32	40	33	24	24	26	26	26	28	30	33	54
f	Distance Loss (20*logr*)	12m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
g	Radiation correction		-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	
h	Level at receiver	e+f+g	31	21	29	25	21	23	27	20	20	20	17	16	12	8	7	5	2	10	3	-6	-6	-3	-3	-3	-1	1	4	24