

NATIONAL PHYSICAL LABORATORY

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Test Report

'MOSQUITO' SOUND SOURCE
1050

FOR Compound Security Systems Limited
Unit 7 Glynmil Close
Bradley Gardens
Merthyr Tydfil
Mid Glamorgan CF47 0GE

FOR THE
ATTENTION OF Mr H Stapleton

DESCRIPTION Compound Security Systems Mosquito sound source


IDENTIFICATION serial no. 1050


DATE OF TEST 07 December 2005

Reference: S 5341

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Date of issue: 08 December 2005

Signed:  (Authorised Signatory)

Checked by: 

Name: Mrs S P Dowson for Managing Director

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Dear Mr Stapleton

You requested an opinion on the measurements reported in our Test Report reference S5341 in relation to specified safety limits for high frequency sound. I hope the following fulfils this request.

HSE Report 343/2001[1] reviews the limits prescribed internationally for levels of very high frequency sound (8 kHz - 20 kHz) and ultrasound (above 20 kHz), from the 1960s to present. A mixture of limits are reported relating to both the onset of unpleasant, but not necessarily harmful, subjective effects, and actual hearing damage. Indeed the report's conclusion on limits, states that limits were mostly 'set to avoid unpleasant subjective effects'. The specified limits vary between 75-90 dB. The lowest limit of 75 dB derives from one particular researcher (Action, 1968) and is stated as being applicable to subjective effects. Interestingly, the limits are given in terms of unweighted sound pressure level (dB), rather than A-weighted levels (dBA). The corresponding figure for the Mosquito at 3 m is 83.2 dB.

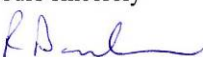
Limits for occupational hearing damage in the context of an 8 hour working day are also given as between 75-85 dB and between 84-97 dB for 1 hour exposure. These '1 hour exposure' limits are perhaps the most relevant in the report and the Mosquito is seen to be just under this.

An alternative point of view can be to consider current UK Noise at Work regulations[2] which specify a level of 85 dBA for an 8 hour working day, equivalent to 94 dBA for 1 hour. At 76 dBA at 3 m the Mosquito clearly would not present as noise hazard under the terms of these regulations. Even when the 8 hour limit is reduced to 80 dBA in 2006, over 16 hours of exposure to a level of 76 dBA is required to reach the daily noise limit. However consideration must be given to differences in the acoustical environment, the reproducibility of the acoustic output of the device and the actual distance to the observer in-situ.

References

- [1] http://www.hse.gov.uk/research/crr_pdf/2001/crr01343.pdf
[2] http://www.opsi.gov.uk/si/si1989/Uksi_19891790_en_1.htm

Yours sincerely


Richard Barham

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RESULTS

Key result

The A-weighted sound pressure level at a distance of 3 m from the test device was determined to be 76.0 dBA. Further details of the derivation of this result can be found below.

Supporting results

Figure 1 shows the variation in r.m.s. amplitude of the sound pressure during one modulation cycle, measured at a distance of 1 m. The corresponding average sound pressure level (SPL) was found to be 92.4 dB. The determination of the average sound pressure level was repeated a further four times and found to be with 0.1 dB of this result. These measurements were made with a drive voltage of 11.91 V applied to the sound source.

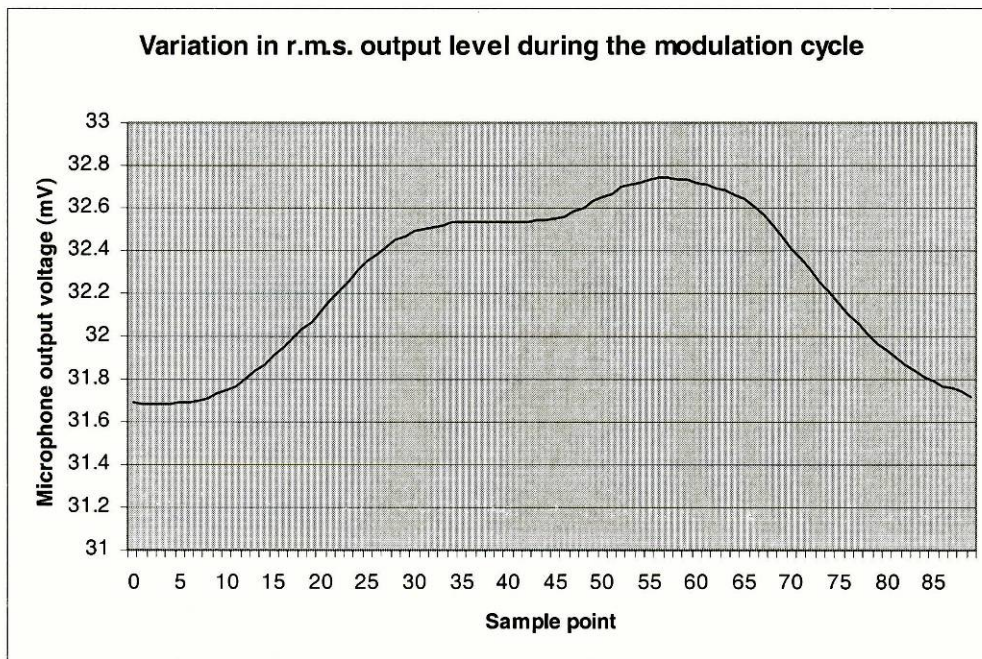


Figure 1. Output variation during modulation cycle

The average sound pressure level was measured at a distance of 2 m and the reduction in sound pressure level found to be 5.8 dB. This is close to the ideal 6 dB expected for a point source radiating spherically into a free field. However the test device is known to produce a directional sound field which may account for the difference. From this data it is possible to estimate the variation in sound pressure with distance from the source in a free-field environment. This is shown in Figure 2. However it should be noted that the

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variation in sound pressure level with distance, in other acoustic environments will depend on local conditions.

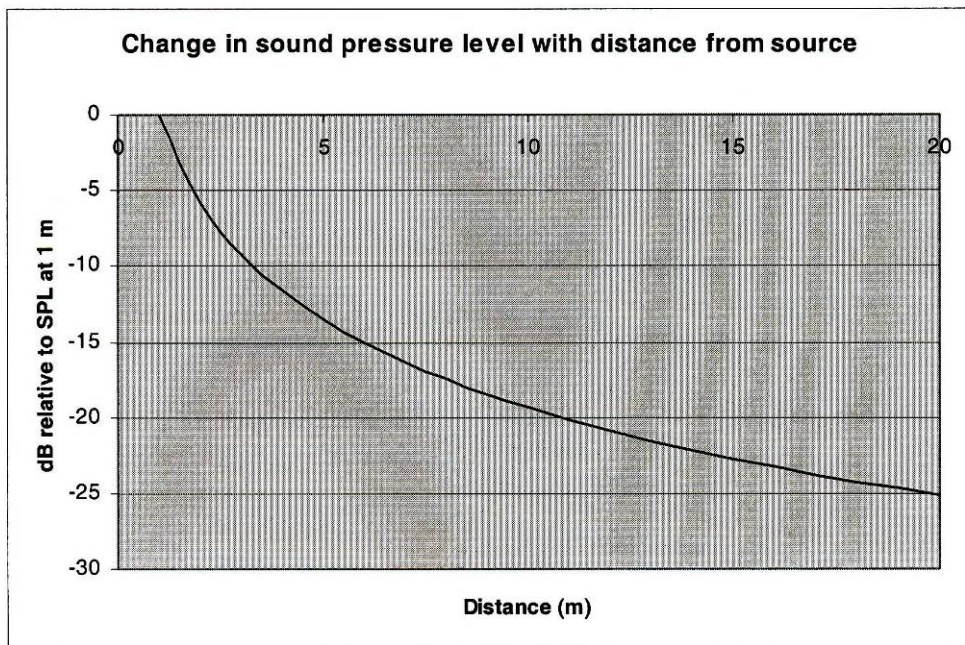


Figure 2. Variation of sound pressure level with distance from source

The fundamental frequency of the acoustic output was determined ten times and found to have a mean of 16.8 kHz (range 16.0 kHz to 17.2 kHz). At this mean frequency the A-weighting factor is -7.2 dB.

The A-weighted sound pressure level at 3 m is therefore estimated to be 76.0 dBA based on the data presented above.

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Table 1 shows the variation in the modulated acoustic output as a function of the voltage used to drive the sound source. The measurements were made at a distance of 1 m.

Drive voltage (V)	Max SPL during modulation cycle (dB)	Min SPL during modulation cycle (dB)
12.0	92.3	91.8
12.5	93.6	93.2
13.0	94.1	93.9
13.5	94.9	94.4
14.0	94.9	94.4
17.0	99.4	96.8

Table 1. Maximum and minimum SPL during the modulation cycle as a function of drive voltage.

The maximum frequency the device was able to output (via internal adjustment) was also determined and found to be 18.6 kHz.

During the measurements the room temperature was in the range 22 °C to 23 °C and the static pressure was in the range 101.4 kPa to 101.5 kPa.

The estimated uncertainty in all sound pressure levels quoted in this report is 0.5 dB. This is based on a standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95%.