

Appendix 11.4: Candidate turbine manufacturer's noise emission data



Third octave sound power levels

Nordex N149/5.X

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Third octave sound power levels with serrated trailing edge – Mode 0

Mode 0

hub height 105 m – 105.6 dB(A)

third octave sound power levels [dB(A)] at standardized wind speeds v_s										
Frequency	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
10 Hz	37.6	38.8	42.3	46.7	48.1	48.5	48.5	48.5	48.5	48.4
12.5 Hz	42.4	43.6	47.2	51.6	53.0	53.3	53.3	53.3	53.3	53.3
16 Hz	47.0	48.2	51.8	56.2	57.6	57.9	57.9	57.9	57.9	57.9
20 Hz	51.4	52.6	56.1	60.5	61.9	62.3	62.3	62.3	62.3	62.3
25 Hz	55.8	57.0	60.5	64.9	66.3	66.2	66.2	66.2	66.2	66.2
31.5 Hz	59.9	61.1	65.0	69.4	70.8	71.7	71.7	71.7	71.7	71.7
40 Hz	65.8	67.0	69.4	73.8	75.2	75.3	75.3	75.3	75.3	75.3
50 Hz	67.0	68.2	72.7	77.1	78.5	80.4	80.4	80.4	80.4	80.4
63 Hz	71.9	73.1	75.2	79.6	81.0	81.7	81.7	81.7	81.7	81.7
80 Hz	74.8	76.0	78.9	83.3	84.7	84.5	84.5	84.5	84.5	84.5
100 Hz	75.8	77.0	80.9	85.3	86.7	89.2	89.2	89.2	89.2	89.2
125 Hz	78.0	79.2	81.9	86.3	87.7	87.7	87.7	87.7	87.7	87.7
160 Hz	81.3	82.5	84.9	89.3	90.7	89.0	89.0	89.0	89.0	89.0
200 Hz	80.4	81.6	84.9	89.3	90.7	90.3	90.3	90.3	90.3	90.3
250 Hz	81.7	82.9	86.4	90.8	92.2	91.2	91.2	91.2	91.2	91.2
315 Hz	82.9	84.1	88.0	92.4	93.8	94.5	94.5	94.5	94.5	94.5
400 Hz	83.3	84.5	88.3	92.7	94.1	94.1	94.1	94.1	94.1	94.1
500 Hz	82.0	83.2	88.0	92.4	93.8	94.3	94.3	94.3	94.3	94.3
630 Hz	83.2	84.4	89.6	94.0	95.4	96.3	96.3	96.3	96.3	96.3
800 Hz	82.5	83.7	89.2	93.6	95.0	95.4	95.4	95.4	95.4	95.4
1000 Hz	83.8	85.0	90.6	95.0	96.4	96.2	96.2	96.2	96.2	96.2
1250 Hz	83.4	84.6	90.1	94.5	95.9	95.5	95.5	95.5	95.5	95.5
1600 Hz	82.9	84.1	89.8	94.2	95.6	94.5	94.5	94.5	94.5	94.5
2000 Hz	81.4	82.6	88.1	92.5	93.9	93.3	93.3	93.3	93.3	93.3
2500 Hz	79.1	80.3	85.7	90.1	91.5	91.3	91.3	91.3	91.3	91.3
3150 Hz	76.9	78.1	81.5	85.9	87.3	88.6	88.6	88.6	88.6	88.6
4000 Hz	76.8	78.0	76.7	81.1	82.5	84.6	84.6	84.6	84.6	84.6
5000 Hz	72.2	73.4	74.3	78.7	80.1	79.8	79.8	79.8	79.8	79.8
6300 Hz	68.5	69.7	72.7	77.1	78.5	79.6	79.6	79.6	79.6	79.6
8000 Hz	66.6	67.8	70.6	75.0	76.4	77.7	77.7	77.7	77.7	77.7
10000 Hz	62.7	63.9	66.7	71.1	72.5	73.5	73.5	73.5	73.5	73.5
Total sound power level	94.0	95.2	99.8	104.2	105.6	105.6	105.6	105.6	105.6	105.6

Third octave sound power levels with serrated trailing edge – Mode 0

hub height 120 m – 105.6 dB(A)

third octave sound power levels [dB(A)] at standardized wind speeds v_s										
Frequency	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
10 Hz	37.6	39.1	42.6	47.1	48.1	48.5	48.5	48.5	48.5	48.4
12.5 Hz	42.4	43.9	47.5	52.0	53.0	53.3	53.3	53.3	53.3	53.3
16 Hz	47.0	48.5	52.1	56.6	57.6	57.9	57.9	57.9	57.9	57.9
20 Hz	51.4	52.9	56.4	60.9	61.9	62.3	62.3	62.3	62.3	62.3
25 Hz	55.8	57.3	60.8	65.3	66.3	66.2	66.2	66.2	66.2	66.2
31.5 Hz	59.9	61.4	65.3	69.8	70.8	71.7	71.7	71.7	71.7	71.7
40 Hz	65.8	67.3	69.7	74.2	75.2	75.3	75.3	75.3	75.3	75.3
50 Hz	67.0	68.5	73.0	77.5	78.5	80.4	80.4	80.4	80.4	80.4
63 Hz	71.9	73.4	75.5	80.0	81.0	81.7	81.7	81.7	81.7	81.7
80 Hz	74.8	76.3	79.2	83.7	84.7	84.5	84.5	84.5	84.5	84.5
100 Hz	75.8	77.3	81.2	85.7	86.7	89.2	89.2	89.2	89.2	89.2
125 Hz	78.0	79.5	82.2	86.7	87.7	87.7	87.7	87.7	87.7	87.7
160 Hz	81.3	82.8	85.2	89.7	90.7	89.0	89.0	89.0	89.0	89.0
200 Hz	80.4	81.9	85.2	89.7	90.7	90.3	90.3	90.3	90.3	90.3
250 Hz	81.7	83.2	86.7	91.2	92.2	91.2	91.2	91.2	91.2	91.2
315 Hz	82.9	84.4	88.3	92.8	93.8	94.5	94.5	94.5	94.5	94.5
400 Hz	83.3	84.8	88.6	93.1	94.1	94.1	94.1	94.1	94.1	94.1
500 Hz	82.0	83.5	88.3	92.8	93.8	94.3	94.3	94.3	94.3	94.3
630 Hz	83.2	84.7	89.9	94.4	95.4	96.3	96.3	96.3	96.3	96.3
800 Hz	82.5	84.0	89.5	94.0	95.0	95.4	95.4	95.4	95.4	95.4
1000 Hz	83.8	85.3	90.9	95.4	96.4	96.2	96.2	96.2	96.2	96.2
1250 Hz	83.4	84.9	90.4	94.9	95.9	95.5	95.5	95.5	95.5	95.5
1600 Hz	82.9	84.4	90.1	94.6	95.6	94.5	94.5	94.5	94.5	94.5
2000 Hz	81.4	82.9	88.4	92.9	93.9	93.3	93.3	93.3	93.3	93.3
2500 Hz	79.1	80.6	86.0	90.5	91.5	91.3	91.3	91.3	91.3	91.3
3150 Hz	76.9	78.4	81.8	86.3	87.3	88.6	88.6	88.6	88.6	88.6
4000 Hz	76.8	78.3	77.0	81.5	82.5	84.6	84.6	84.6	84.6	84.6
5000 Hz	72.2	73.7	74.6	79.1	80.1	79.8	79.8	79.8	79.8	79.8
6300 Hz	68.5	70.0	73.0	77.5	78.5	79.6	79.6	79.6	79.6	79.6
8000 Hz	66.6	68.1	70.9	75.4	76.4	77.7	77.7	77.7	77.7	77.7
10000 Hz	62.7	64.2	67.0	71.5	72.5	73.5	73.5	73.5	73.5	73.5
Total sound power level	94.0	95.5	100.1	104.6	105.6	105.6	105.6	105.6	105.6	105.6

Cumulative Turbines Operating: All turbines are Vestas V90-3MW except Kilgarvin which 6 turbines, V52 0.85MW.

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1/1 Octaves According to General Specification V90–3.0 MW VCS, 50 Hz

DMS 0005 1000

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3.1.2 1/1 Octaves

V90-3.0 MW-VCS-50 Hz-Mode 0 - Hub Height 80 m											
Wind speed 10 m	3	4	5	6	7	8	9	10	11	12	13
Power	97	282.9	572.4	1023.3	1599.6	2200.8	2699.9	2955.4	2996.6	3000	3000
1/1 octaves	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA
[Hz]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]
16	64.1	65.2	60.5	60.5	62.3	67.1	67.1	66.5	67.6	67.7	67.8
31.5	69.1	67.1	70.0	76.6	80.8	83.2	83.5	82.3	82.6	82.7	82.8
63	78.9	76.6	82.1	85.7	89.7	91.8	92.3	91.3	91.0	91.1	91.2
125	87.0	84.6	86.9	90.9	93.3	94.0	94.2	93.0	92.6	92.7	92.8
250	89.1	89.3	91.5	94.0	96.1	97.3	96.9	95.5	95.2	95.3	95.4
500	91.1	91.7	93.5	96.5	98.3	99.6	99.5	98.2	97.9	98.0	98.1
1000	92.3	92.3	95.9	99.1	100.8	101.8	101.7	100.4	100.1	100.2	100.3
2000	91.1	91.1	94.6	98.2	100.1	100.5	100.4	99.2	98.6	98.7	98.8
4000	86.6	86.8	90.5	94.3	96.2	96.7	96.4	94.9	94.2	94.3	94.4
8000	75.5	75.2	79.1	83.7	85.7	86.7	86.6	85.0	84.2	84.3	84.4
Spectra Value	97.9	97.9	100.9	104.2	106.1	107.0	106.9	105.6	105.2	105.3	105.4

Table 3-2: Octaves for V90-3.0 MW-VCS-50 Hz-mode 0, hub height = 80 m.

V90-3.0 MW-VCS-50 Hz-Mode 0 - Hub Height 105 m											
Wind speed 10 m	3	4	5	6	7	8	9	10	11	12	13
Power	114.4	316.4	647.8	1142.5	1756.4	2364.6	2835.3	2978.1	2999.4	3000	3000
1/1 octaves	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA
[Hz]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]
16	64.2	64.3	60.6	61.3	65.9	66.5	67.4	66.3	67.6	67.8	67.9
31.5	69.3	67.3	70.8	77.8	80.9	83.2	83.5	82.0	82.7	82.8	82.9
63	79.1	77.2	82.8	86.6	89.5	92.0	92.1	91.0	90.9	91.2	91.3
125	86.8	84.7	87.6	91.8	92.9	94.1	94.1	92.7	92.6	92.8	92.9
250	89.4	89.5	92.1	94.8	96.5	97.2	96.7	95.2	95.2	95.4	95.5
500	91.4	91.8	94.2	97.3	99.1	99.6	99.3	97.9	97.9	98.1	98.2
1000	92.6	92.7	96.6	99.9	101.4	101.8	101.5	100.1	100.1	100.3	100.4
2000	91.5	91.5	95.4	99.0	99.9	100.5	100.2	99.0	98.6	98.8	98.9
4000	86.9	87.2	91.2	95.1	95.9	96.7	96.1	94.6	94.2	94.4	94.5
8000	75.7	75.7	80.0	84.6	85.6	86.7	86.3	84.7	84.2	84.4	84.5
Spectra Value	98.2	98.2	101.6	105.0	106.4	107.0	106.7	105.3	105.2	105.4	105.5

Table 3-3: Octaves for V90-3.0 MW-VCS-50 Hz-mode 0, hub height = 105 m.

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1/1 Octaves According to General Specification
 V90–3.0 MW
 Appendix A

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V90-3.0 MW-VCS-50 Hz-Mode 0 - Hub Height 90 m											
Wind speed 10 m	3	4	5	6	7	8	9	10	11	12	13
Power	104.6	297.4	603.4	1074.9	1667.6	2271.7	2758.6	2969.4	2997.8	3000	3000
1/1 octaves	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA	LWA
[Hz]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]
16	64.0	64.2	60.4	60.8	63.8	66.8	67.3	66.4	67.6	67.7	67.8
31.5	69.1	67.1	70.5	77.1	80.8	83.2	83.6	82.1	82.6	82.7	82.8
63	78.9	77.0	82.5	86.0	89.6	91.9	92.3	91.1	90.9	91.1	91.2
125	86.7	84.5	87.3	91.3	93.1	94.0	94.3	92.8	92.6	92.7	92.8
250	89.2	89.3	91.8	94.3	96.2	97.3	96.9	95.3	95.2	95.3	95.4
500	91.2	91.7	93.9	96.8	98.6	99.6	99.5	98.0	97.9	98.0	98.1
1000	92.4	92.4	96.3	99.4	101.1	101.8	101.7	100.2	100.1	100.2	100.3
2000	91.3	91.3	95.1	98.5	100.0	100.5	100.4	99.0	98.6	98.7	98.8
4000	86.7	87.0	90.9	94.6	96.0	96.7	96.4	94.7	94.2	94.3	94.4
8000	75.5	75.5	79.7	84.0	85.6	86.7	86.5	84.8	84.2	84.3	84.4
Spectra Value	98.0	98.0	101.3	104.5	106.2	107.0	106.9	105.4	105.2	105.3	105.4

Table 3-4: Octaves for V90-3.0 MW-VCS-50 Hz-mode 0, hub height = 90 m.

Class 1
Document no. 946506 V10
2008-10-08

General Specification Vestas V52-850 kW 50/60 Hz OptiSpeed[®] – Wind Turbine



1.1 OptiSpeed® Description

OptiSpeed®, also called Vestas Converter System (VCS), ensures a steady and stable electric power supply from the turbine.

VCS consists of

- an effective asynchronous generator with wound rotor and sliprings.
- a power converter with *Insulated Gate Bipolar Transistor* (IGBT) switches.
- contactors and protection.

VCS enables variable speed operation in a range of approx. 60 % of nominal RPM. VCS along with the pitch regulation OptiTip®, ensures energy optimisation, low noise operation and reduction of loads on the gearbox and other vital components.

VCS controls the current in the rotor circuit in the generator. This gives precise control of the reactive power and gives an accurate and precise connection between the generator and the grid.

1.2 Type Approvals

The V52-850 kW OptiSpeed® turbine is currently approved according to the following standards:

Country	Design criteria	Conditions	Hub height [m]
Denmark	DS472 + Teknisk Grundlag	Roughness Class 0, 1, 2, 3	40, 44, 49, 55, 60, 65, 74
Germany	DIBt	Zone III	60, 65
		Zone II	60, 65, 74, 86
Holland	NVN11400/0	Class II _A	36.5, 40, 44, 49, 55, 60, 65, 70
IEC	IEC 61400-1	Class I _A	40, 44, 49, 55, 60, 65
IEC		Class II _A	55, 60, 65, 74

1.3 Climatic Conditions

The V52-850 kW OptiSpeed® turbine is as standard designed for operation in ambient temperatures ranging from -20°C to +40°C. The turbine will be put in PAUSE-mode outside these temperatures. Restart-temperatures after stop on lower/upper ambient temperature limit are -20°C and +38°C accordingly. Special precautions must be taken outside the standard operating temperatures. See section 1.7 "General Reservations" as well as Low Temperature (LT) appendix (Vestas doc. no. 946507) and High Temperature (HT) appendix (Vestas doc. no. 951614).

The turbines can be placed in wind farms with a distance of at least five times the rotor diameter (260 m) between the turbines. If the turbines are placed in one row, perpendicular to the predominant wind direction, the distance between turbines must be at least 4 rotor diameters (208 m).

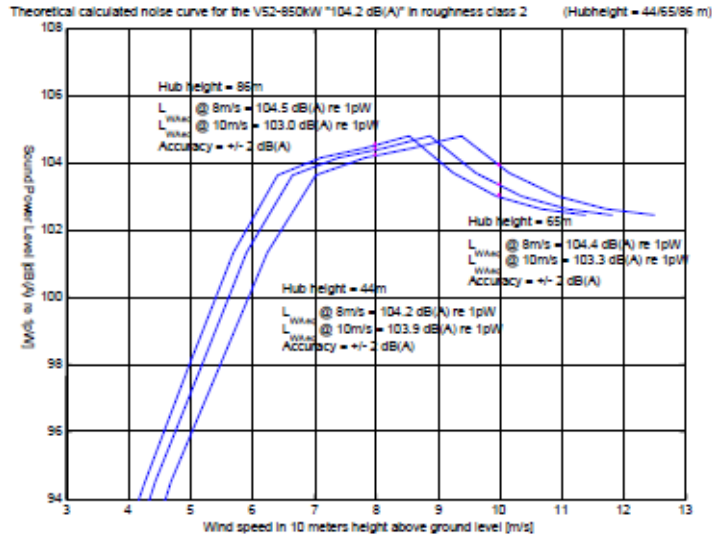
A relative humidity of 100 % is acceptable max. 10 % of the time.

General corrosion classes, nacelle:

Protection against internal corrosion, according to ISO 12944, Class C3/High.

2.4 Noise Emission Plots

2.4.1 104.2 dB(A)



2.4.2 103.0 dB(A)

