NORTHLAND POWER

North Burgess Solar Project

Noise Assessment Study Report

December 22, 2011

Northland Power Inc.
on behalf of
Northland Power Solar
North Burgess L.P.
Toronto, Ontario

Noise Assessment Study Report

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Executive Summary

This report presents the results of the Noise Assessment Study required for Solar Facilities under Ontario Regulation 359/09 and 521/10, as part of the Renewable Energy Approval (REA) Process. Northland Power Solar North Burgess L.P. ("Northland") is proposing to develop a 10-Megawatt (MW) solar photovoltaic (PV) project titled North Burgess Solar Project (the "Project"). The Project will be located on approximately 40 hectares (ha) of land near Narrow Locks Road in the Township of Tay Valley within the Lanark County, Ontario.

This Noise Assessment Study Report has been prepared based on the document entitled "Basic Comprehensive Certificates of Approval (Air) – User Guide" by the Ontario Ministry of the Environment (MOE, 2004). The sound pressure levels at the points of reception (POR) have been estimated using ISO 9613-2, implemented in the CADNA-A computer code. The performance limits used for verification of compliance correspond to the values for rural areas of 40-dBA. The results presented in this report are based on the best available information at this time. It is the intention that, in the detailed engineering phase of the project, certified noise data based on final plans and designs will confirm the conclusions of this noise impact assessment study.

The results obtained in this study show that the sound pressure levels at POR will not exceed MOE requirements for rural areas of 40-dBA.

Project Report

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Table of Contents

List of Tables

List of Figures

.

1. Introduction

1.1 Project Description

Northland Power Solar North Burgess L.P. ("Northland") is proposing to develop a 10-megawatt (MW) solar photovoltaic (PV) project titled North Burgess Solar Project (the "Project"). The Project will be located on approximately 40 ha of land within the Township of Tay Valley, Ontario.

The proposed Project is a renewable energy generation facility which will use solar photovoltaic technology to generate electricity. Electricity generated by solar photovoltaic panels will be converted from Direct Current (DC) to Alternating Current (AC) by inverter clusters which will also step-up the voltage to 27.6 kV. A main transformer, located in the substation, will step up the voltage from the clusters to 44 kV prior to being transmitted to the existing local distribution line. In order to meet the Ontario Power Authority (OPA)'s Feed-In-Tariff (FIT) Program requirements, a specific percentage of equipment will be manufactured in Ontario.

The construction of the Project will begin once the Renewable Energy Approval (REA) has been obtained and a power purchase agreement is finalized with the OPA. The anticipated operational lifespan of the Project is 30 years.

1.2 Renewable Energy Approval Legislative Requirements

Ontario Regulation 359/09 and 521/10, made under the Environmental Protection Act identify the Renewable Energy Approval (REA) requirements for green energy projects in Ontario. As per Section 4 of these regulations, ground mounted solar facilities with a name plate capacity greater than 12 kilowatts (kW) are classified as a Class 3 solar facility, and therefore, require an REA.

Section 13 of the Ontario Regulation 359/09 requires proponents of Class 3 solar facilities to complete a Noise Study Report in accordance with Appendix A of the publication, "Basic Comprehensive Certificates of Approval (Air) – User Guide, 2004" by the Ministry of the Environment (MOE, 2004).

The Noise Study Report is to include a general description of the facility, sources and points of reception (POR), Assessment of compliance, as well as all the supporting information relevant to the Project. A draft of the Noise Study Report must be made available to the public, the local municipality and identified Aboriginal communities, at least 60 days prior to the final public consultation meeting in accordance with Ontario Regulation 359/09 and 521/10.

2. Facility Description

The Project will utilize photovoltaic (PV) panels installed on fixed racking structures mounted on the ground. The PV panels generate DC electricity which will be converted to AC electricity by inverters. The Project layout is based on 7 inverter clusters each one containing two inverters and one medium-voltage (27.6-kV/1.6-MVA) transformer, and one 44-kV/10-MVA substation transformer. The 27.6-kV power, collected from the inverter clusters, will be stepped-up to 44-kV by the substation transformer prior to being transmitted to the existing local distribution line.

Since the panels will be ground-mounted and the total nameplate capacity is over 12 kW, the Project is considered to be a Class 3 Solar Facility according to the classification presented in Ontario Regulation 521/10.

Table 2.1 General Project Description

Project Description	Ground-mounted Solar PV, Class 3
System Nameplate Capacity	10-MW AC
Local Distribution Company	Hydro One Networks Inc.

2.1 Project Location

The Project Location[1] will be sited on privately owned land totalling approximately 40 ha. The Project Location is zoned as rural in accordance to the zoning by-law for the Township of Tay Valley. Figure A.1 in Appendix A shows the zoning designation plan. Also, Figure A.2 presents the Project Area Location Plan.

For modeling purposes, the vegetation that blocks some of the POR from the sources has not been incorporated.

2.2 Acoustical Environment

The Project will be surrounded by farmland, with some forested areas to the west and southwest. The background noise levels are expected to be typical of rural areas, classified as a Class 3 based on Publication NPC-232 by the MOE. Some traffic noise is expected from RR 14 to the east, Stanley Road to the south and from Scotch Line RR-10 to the northwest, mainly during day hours. There are no airports within 5 km of the Project Location. Perth is the nearest urban center and it is located about 10 km northeast of the proposed location. There are no large industrial facilities within 5 km of the Project Location.

2.3 Life of Project

The expected life of the Project is 30 years. The manufacturer's warranty on the PV modules is 25 years and the expected life of solar power plants of this type is typically 35 to 40 years. At that time (or earlier if the 20-yr power purchase agreement is not extended), the Project will be decommissioned or refurbished depending on market conditions and/or technological changes.

2.4 Operating Hours

Solar PV facilities produce electricity during the day hours, when the sun's rays are collected by the panels. After sunset the facility will not receive solar radiation to generate any electricity. Under these conditions the inverters will not produce any noise and the transformers will be energized, but not in operation (no fans in operation).

2.5 Approach to the Study

The sound pressure levels at the POR were predicted using procedures from ISO 9613-2, which is a widely used and generally accepted standard for the evaluation of noise impact in environmental Assessments. The sound power level for the inverters was provided by the manufacturer while the sound power level for the transformers was estimated. The software package CADNA-A, which implements ISO-9613-2, was used to predict the noise levels at the POR. This numerical modeling software is able to simulate sound sources as well as sound mitigation measures taking into account atmospheric and ground attenuation. Some of the CADNA-A configurations used in the modeling are shown in Figure 2.1. The height contours for the site were taken from the Ontario Base Maps (OBM).

[1] "Project Location" in the context of this study is an area occupied by the Project infrastructure.

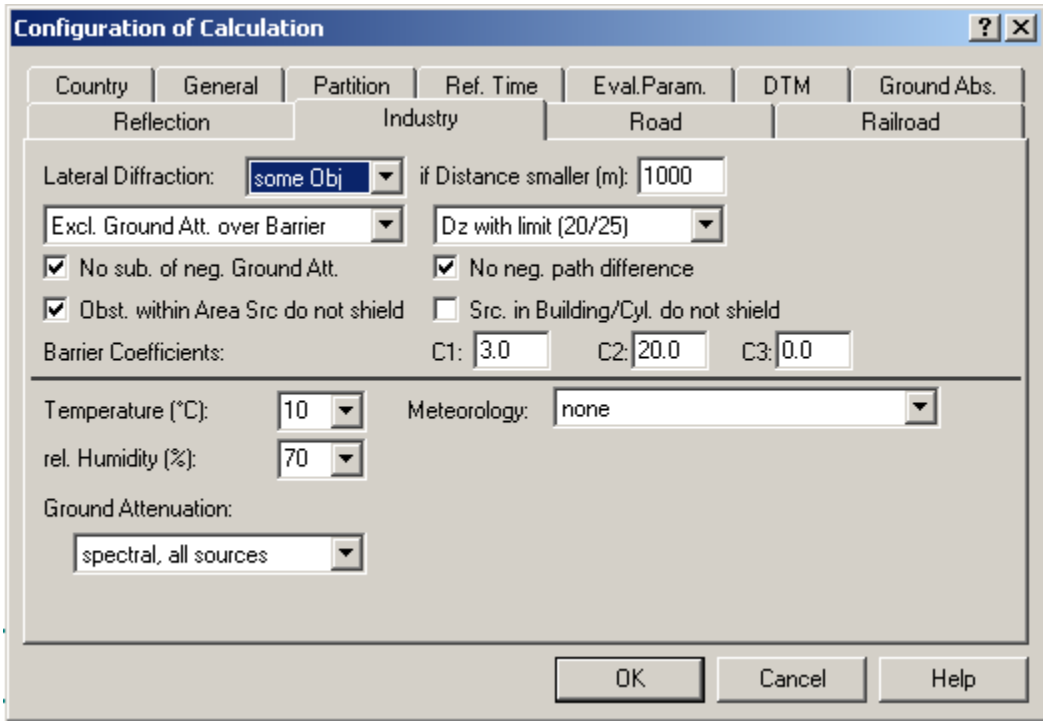

Figure 2.1 CADNA-A Configurations

3. Noise Sources

The main sources of noise from the Project will be seven inverter clusters, each one containing two inverters and one medium-voltage transformer, and a substation containing the main step-up transformer. The Project layout is provided in Figure A.2. The coordinates of each noise source are presented in Table B.1 of Appendix B.

All noise sources were modeled as non-directional point sources.

Switchgear and a small step-down transformer used for lighting, located at the substation, do not emit any significant noise and consequently have not been considered as sources of noise.

For the purpose of this study it is assumed that all inverters and transformers will be operating 24 hours at full capacity.

3.1 Substation Transformer

A 10-MVA step-up transformer that will step-up the 27.6-kV power to 44 kV, required by the local distribution company, will be located in the substation. Since the transformer make and model has not been selected at this point (although it is known that the transformer will be of ONAF (oil natural air forced) type), a conservative estimate of sound power level was based on the data from NEMA TRI – 1993 (2000) and 35-m^2 transformer surface area. This standard provides maximum sound level values for transformers, and manufacturers routinely meet this specification. Hence, the results based on NEMA may slightly overestimate the impact on POR since the actual transformer is expected to be quieter. The NEMA levels were then converted into frequency spectra using empirical correlations for transformer noise (Crocker, 2007). This calculation is available in Figure B.3 of Appendix B. The transformer configurations are expected to be similar to those shown in Figure B.2. Noise source height representing the transformer was assumed 3.5-m.

Power transformers are considered by the MOE to be tonal noise sources. A 5-dB penalty was added to the sound power spectrum, as recommended by Publication NPC-104, "Sound Level Adjustments" for tonality. Table B.2 in Appendix B shows the frequency spectrum used to model the substation transformer.

3.2 Inverter Clusters

Northland is planning to use inverters manufactured by SMA. Seven inverter clusters will be installed as part of the Project. Each cluster comprises of two SMA Sunny Central 800CP inverters and one medium voltage transformer. A schematic layout with approximate dimensions of such cluster is available in Figure 3.1, additional information regarding details of the inverter cluster can be found in Appendix B). The cluster components listed above were modeled as point sources shown in Figure 3.2. *Note that the planned enclosure over the inverters was not taken into account as a mitigation measure in the noise model.*

The installed capacity of each Sunny Central 800CP inverter is 800-kW. SMA provided third-octave noise data for the Sunny Central 800CP inverter (Figure B.1 of Appendix B). The provided third octave spectrum was converted to a full octave spectrum and the contribution from two inverters was combined into a single sound power spectrum for use with CADNA-A model (calculations are available in Figure B.4 of Appendix B). A 5-dBA penalty was added to the frequency spectrum, as stipulated in Publication NPC-104, "Sound Level Adjustments," to allow for tonality. The frequency

spectrum used to model combined noise emission from the two inverters located next to each other within the same cluster is shown in Table B.2 of Appendix B.

A 1.6-MVA transformer used to step-up the 360-V power from the inverters to 27.6 kV will be located in close proximity to the inverters. Since the transformer make and model have not been selected at this point (although it is known that the transformer will be of ONAN (oil natural air natural) type), the sound power levels resulting from the operation of the transformer were evaluated using data from NEMA TR 1-1993 (R2000) and 14.88-m^2 transformer surface area. The NEMA levels were then converted into frequency spectrum using empirical correlations for transformer noise (Crocker, 2007). This calculation is available in Figure B.5 of Appendix B. Power transformers are considered by the MOE to be tonal noise sources. A 5-dB penalty was added to the sound power spectrum, as recommended by Publication NPC-104, "Sound Level Adjustments" for tonality. Table B.2 in Appendix B shows the frequency spectrum used to model the transformers located in the clusters.

Although for the modeling purposes it was assumed that the facility will operate 24-h at full capacity, in reality at night the facility will be idle. Under these conditions the inverters do not produce noise. The transformers (at the substation and clusters) are energized and make some magnetostrictive noise at a reduced level, but no cooling fans are in operation.

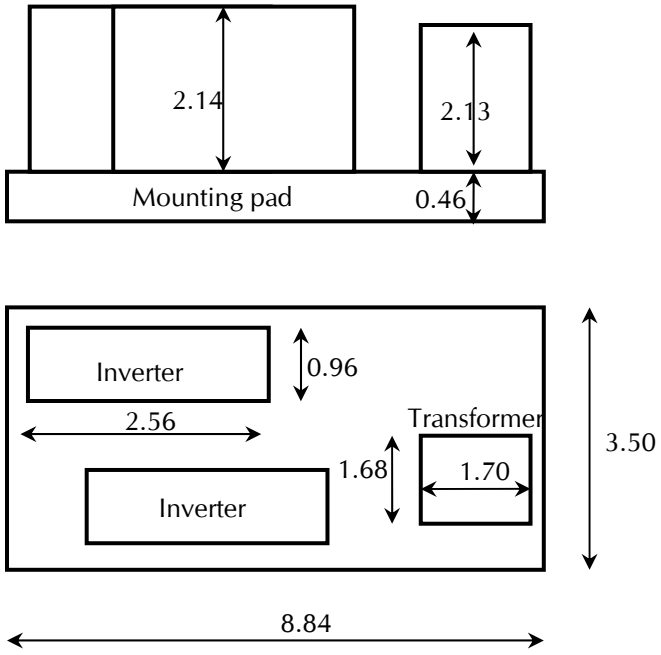

Figure 3.1 Schematic Inverter Cluster Layout
(all dimensions in metres)

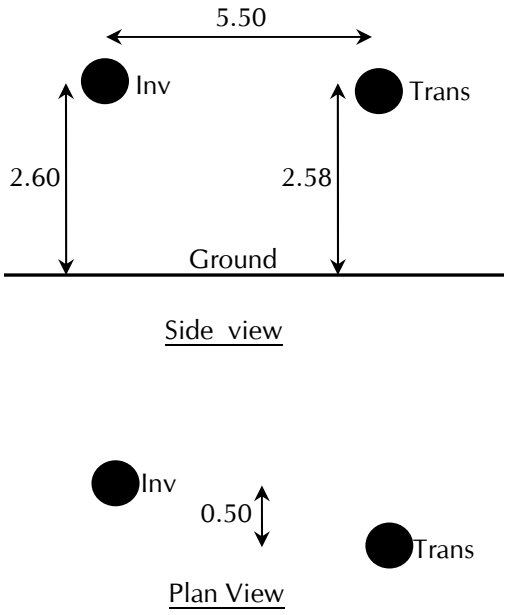

Figure 3.2 Inverter Cluster CADNA-A Acoustical Model

where: Inv = Noise Source Representing Two Sunny Central 800CP Inverters; and Trans = Noise Source Representing 27.6-kV/1.6-MVA Cluster Transformer (all dimensions in metres).

3.3 Noise Summary Table

A summary of the sound sources described above, including sound power level, characteristics and proposed noise control measures, is presented in Table 3.1.

Table 3.1 Noise Source Summary for North Burgess Solar Project

Source ID	Description	Total Sound Power Level (dBA)	Source Location	Sound Characteristics	Noise Control Measures
Sub	44-kV/10-MVA substation transformer	90.8	O	S-T	U
Inv1	Two Sunny Central 800CP inverters at Cluster 1	91.3	O	S-T	U
Inv2	Two Sunny Central 800CP inverters at Cluster 2	91.3	O	S-T	U
Inv3	Two Sunny Central 800CP inverters at Cluster 3	91.3	O	S-T	U
Inv4	Two Sunny Central 800CP inverters at Cluster 4	91.3	O	S-T	U
Inv5	Two Sunny Central 800CP inverters at Cluster 5	91.3	O	S-T	U
Inv6	Two Sunny Central 800CP inverters at Cluster 6	91.3	O	S-T	U
Inv7	Two Sunny Central 800CP inverters at Cluster 7	91.3	O	S-T	U
Trans1	27.6-kV/1.6-MVA cluster transformer at Cluster 1	80.1	O	S-T	U
Trans2	27.6-kV/1.6-MVA cluster transformer at Cluster 2	80.1	O	S-T	U
Trans3	27.6-kV/1.6-MVA cluster transformer at Cluster 3	80.1	O	S-T	U
Trans4	27.6-kV/1.6-MVA cluster transformer at Cluster 4	80.1	O	S-T	U
Trans5	27.6-kV/1.6-MVA cluster transformer at Cluster 5	80.1	O	S-T	U
Trans6	27.6-kV/1.6-MVA cluster transformer at Cluster 6	80.1	O	S-T	U
Trans7	27.6-kV/1.6-MVA cluster transformer at Cluster 7	80.1	O	S-T	U

Notes:
1. A 5-dBA penalty is included in this table.
2. Location: Inside building (I), Outside building (O).
3. Sound Characteristics: Steady (S), Tonal (T), Impulsive (I), Quasi-Steady Impulsive (QSI).
4. Noise Control: Silencer (S), Acoustic lining (A), Barrier (B), Lagging (L), Enclosure (E), Other (O), Uncontrolled (U).

3.4 Adjacent Solar Projects

To identify the adjacent solar projects, Hatch's internal database of solar projects and MOE records available in http://www.ene.gov.on.ca/environment/en/subject/renewable_energy/projects/index.htm were searched. (December 2, 2011)

There are no POR that are within 1 km of equipment in the Project and any adjacent project. As a result, there are no adjacent projects included in this study.

4. Points of Reception

The POR used in this study were identified from the OBM and Google Earth Pro aerial imagery (June 2005) within 1-km distance from the Project Site[2] boundary, and also from visual observations of the Project Site surroundings conducted in Summer 2010.

The POR corresponding to the vacant lots were added based on parcel information provided by First Base Solutions (Teranet Data) and located according to the requirements outlined in Ontario Regulation 359/09, and its amendment (Ontario Regulation 521/10). Note, upon inspection of Figure A.1, the parcel located just north-west of the substation, along Narrows Lock Road, may appear to be a vacant lot. However, due to the parcel location inaccuracy, this parcel has been treated as the land on which a cluster of four receptors, including POR 85, are located. As a result, no vacant lot receptor was assigned to this parcel.

The total number of POR within a 1-km distance from the Project Site of North Burgess Solar Project boundary is 129, including the vacant lots. Three of these noise receptors, identified in Table 4.1, were chosen as representative receptors for evaluating the noise contribution from each individual source. These three receptors were chosen in order to represent sound pressure level contributions on different areas around the Project Location. The complete set of results for all 129 noise receptors is provided in Table 6.2. For this study, the elevation above ground used for the POR is 4.5-m. Also, noise compliance was verified within 30 m distance from any given POR located at 1.5 m above the ground level.

[2] "Project Site" in the context of this study is the complete area designated for the Project but not necessary occupied with the project infrastructure. Project Location is always contained within Project Site.

Table 4.1 Point of Reception Noise Impact from Individual Noise Sources of North Burgess Solar Project

Source ID	POR 85		POR 98		POR 106	
	Distance (m)	L_{eq} Sound Level (dBA)	Distance (m)	L_{eq} Sound Level (dBA)	Distance (m)	L_{eq} Sound Level (dBA)
Sub	296	29.9	932	18.8	457	26.0
Inv1	930	18.8	221	32.4	886	19.4
Inv2	886	19.4	463	25.8	623	22.9
Inv3	835	20.0	324	29.1	791	20.5
Inv4	697	21.8	490	25.3	632	22.8
Inv5	550	24.1	651	22.5	520	24.7
Inv6	314	29.3	874	19.5	503	25.0
Inv7	417	26.8	840	19.9	875	19.5
Trans1	933	7.7	219	21.6	884	8.3
Trans2	882	8.3	461	14.9	624	11.9
Trans3	837	8.9	323	18.2	789	9.5
Trans4	700	10.7	489	14.3	630	11.8
Trans5	554	13.1	650	11.5	517	13.8
Trans6	310	18.6	879	8.4	500	14.1
Trans7	416	15.9	836	8.9	871	8.5

5. Mitigation Measures

The analysis indicates that no mitigation measures are necessary to meet the MOE requirement of 40 dBA for all POR.

6. Impact Assessment

The purpose of the acoustic Assessment report is to demonstrate that the facility is in compliance with the noise performance limits. The Project will be located in a Class 3 Area, based on the classification defined in Publication NPC-232 by the MOE. Class 3 area means a rural area with an acoustical environment that is dominated by natural sounds, with little or no traffic noise, such as an agricultural area.

Table 6.1 shows the performance limits set by the MOE for Class 3 Areas, according to Publication NPC-232.

Table 6.1 Performance Limits (One-Hour L_{eq}) by Time of Day for Class 3 Areas.

Time of Day	One Hour L_{eq} (dBA) Class 3 Area
07:00 to 19:00	45.0
19:00 to 23:00	40.0
23:00 to 07:00	40.0

The solar facility will be operating during daylight hours; assumed to be until 19:00 during most days of the year. It is noted that in the summer months the sun may shine until past 21:00, however the inverters will be well below 100% loading conditions. As such, during the summer the facility will be operating at the time the applicable performance limit changes from 45-dBA to 40-dBA. Also, the transformers remain energized at night. In order to account for this the noise model assumes that the cluster transformers and substation transformer will be operating 24 hours and compares the impact from the facility with the 40-dBA limit. In reality, the cooling fans will not be in operation at night.

For this study, the overall ground attenuation coefficient was estimated to be 0.7. Appendix D includes a list of all the parameters used in the CADNA-A model to predict the sound pressure levels at the POR.

The modelling does not consider the effect of the solar panels on the predicted sound pressure levels at the points of reception. The solar panels may act as barriers to further reduce noise at the POR.

6.1 Compliance With Performance Limits

Table 6.2 presents the predicted sound pressure levels for the POR located within 1-km from the Project Site. Sound pressure contours at 4.5-m and 1.5-m are available in Figure C.1 and Figure C.2. Appendix D includes a detailed calculation log of the representative POR with the highest Sound Pressure Level.

Effect of the noise emissions at the POR was also accessed by intersecting the 40-dBA sound pressure contours calculated at 1.5-m above ground with 30-m radius circles placed around the POR (Figure C.2). The results show that none of the 30-m radius zones are affected by the noise emissions.

Table 6.2 Calculated Sound Pressure Levels at POR within 1 km of North Burgess Solar Project
(Shaded rows correspond to representative POR)
Existing = Existing dwelling, Vacant = Vacant Lot.
The performance limit is 40.0-dBA**.**

POR ID	Description	Sound Pressure Level (dBA)	Performance Limit (dBA)	POR Height (m)	Min distance to Source (m)	UTM Coordinates Zone 18 NAD 83 (m)		
						X	Y	Z
1	Existing	23.2	40.0	4.5	1116	395261	4963261	153.3
2	Existing	21.5	40.0	4.5	1360	395270	4964494	154.8
3	Existing	23.4	40.0	4.5	1092	395278	4963288	152.2
4	Existing	23.3	40.0	4.5	1122	395295	4963160	153.1
5	Vacant	23.5	40.0	4.5	1014	395352	4963308	149.5
6	Vacant	24.1	40.0	4.5	1029	395383	4963191	152.9
7	Existing	23.8	40.0	4.5	949	395413	4963335	149.7
8	Existing	25.0	40.0	4.5	903	395452	4963363	151.2
9	Existing	25.0	40.0	4.5	923	395486	4963221	154.5
10	Existing	25.6	40.0	4.5	839	395517	4963369	154.5
11	Existing	25.8	40.0	4.5	812	395531	4963421	154.5

POR ID	Description	Sound Pressure Level (dBA)	Performance Limit (dBA)	POR Height (m)	Min distance to Source (m)	UTM Coordinates Zone 18 NAD 83 (m)		
						X	Y	Z
12	Existing	26.0	40.0	4.5	793	395547	4963430	154.5
13	Vacant	26.2	40.0	4.5	772	395576	4963406	154.5
14	Existing	26.6	40.0	4.5	748	395627	4963335	154.5
15	Existing	25.6	40.0	4.5	854	395645	4964153	149.5
16	Existing	26.8	40.0	4.5	735	395649	4963317	154.5
17	Existing	27.1	40.0	4.5	691	395657	4963418	154.5
18	Existing	26.9	40.0	4.5	724	395659	4963320	154.5
19	Existing	25.6	40.0	4.5	862	395660	4964184	149.5
20	Existing	23.7	40.0	4.5	1116	395670	4964535	154.5
21	Existing	27.5	40.0	4.5	671	395711	4963335	154.8
22	Vacant	27.6	40.0	4.5	653	395757	4963962	153.0
23	Existing	28.1	40.0	4.5	616	395761	4963357	156.2
24	Existing	26.1	40.0	4.5	833	395784	4964266	151.5
25	Existing	25.9	40.0	4.5	865	395795	4964316	152.2
26	Vacant	29.3	40.0	4.5	503	395818	4963557	155.6
27	Existing	29.5	40.0	4.5	487	395831	4963663	154.5
28	Existing	19.5	40.0	4.5	1650	395842	4965290	154.5
29	Existing	16.8	40.0	4.5	1669	395844	4965313	153.4
30	Existing	29.3	40.0	4.5	519	395844	4963410	158.0
31	Existing	27.2	40.0	4.5	801	395855	4962970	159.5
32	Existing	29.2	40.0	4.5	534	395860	4963346	159.0
33	Existing	29.6	40.0	4.5	498	395871	4963400	158.6
34	Existing	29.0	40.0	4.5	583	395898	4963219	159.5
35	Existing	28.9	40.0	4.5	601	395899	4963193	159.5
36	Vacant	25.5	40.0	4.5	958	395944	4964508	154.7
37	Existing	30.7	40.0	4.5	430	395951	4963398	159.5
38	Existing	31.4	40.0	4.5	378	395973	4963467	157.2
39	Existing	25.4	40.0	4.5	975	395978	4964547	156.6
40	Existing	25.3	40.0	4.5	989	395981	4964571	158.8
41	Existing	31.5	40.0	4.5	376	395989	4963439	158.3
42	Existing	24.7	40.0	4.5	1042	396010	4964668	159.5
43	Vacant	24.0	40.0	4.5	1097	396077	4964785	157.4
44	Existing	28.3	40.0	4.5	745	396080	4962873	160.7
45	Existing	24.8	40.0	4.5	1021	396134	4962360	168.4
46	Vacant	23.0	40.0	4.5	1209	396138	4964949	159.5
47	Existing	25.8	40.0	4.5	926	396148	4962473	167.0
48	Existing	23.9	40.0	4.5	1118	396157	4962224	169.5
49	Existing	28.5	40.0	4.5	713	396160	4962786	164.5
50	Existing	24.1	40.0	4.5	1093	396166	4962249	169.0
51	Existing	25.1	40.0	4.5	988	396171	4962374	169.2
52	Existing	22.9	40.0	4.5	1161	396173	4962164	167.4

POR ID	Description	Sound Pressure Level (dBA)	Performance Limit (dBA)	POR Height (m)	Min distance to Source (m)	UTM Coordinates Zone 18 NAD 83 (m)		
						X	Y	Z
53	Existing	27.9	40.0	4.5	745	396175	4962709	164.9
54	Existing	25.2	40.0	4.5	978	396176	4962382	169.3
55	Existing	24.7	40.0	4.5	1031	396179	4962315	168.7
56	Existing	25.0	40.0	4.5	993	396180	4962361	169.5
57	Vacant	22.3	40.0	4.5	1289	396182	4965057	159.5
58	Existing	25.0	40.0	4.5	988	396210	4962345	168.2
59	Existing	25.5	40.0	4.5	943	396214	4962398	169.1
60	Existing	27.2	40.0	4.5	786	396214	4962603	166.4
61	Existing	22.2	40.0	4.5	1138	396219	4962164	166.0
62	Existing	26.1	40.0	4.5	886	396225	4962461	169.5
63	Existing	26.9	40.0	4.5	814	396226	4962553	167.6
64	Existing	26.5	40.0	4.5	843	396232	4962510	168.9
65	Existing	24.8	40.0	4.5	970	396239	4962347	167.3
66	Existing	26.4	40.0	4.5	849	396242	4962494	169.5
67	Existing	25.0	40.0	4.5	951	396246	4962366	167.4
68	Existing	25.1	40.0	4.5	935	396257	4962378	167.3
69	Vacant	20.2	40.0	4.5	1579	396274	4965393	159.5
70	Existing	25.0	40.0	4.5	916	396277	4962388	167.0
71	Existing	26.3	40.0	4.5	852	396283	4962460	168.7
72	Vacant	23.6	40.0	4.5	982	396296	4962300	164.6
73	Existing	26.7	40.0	4.5	810	396309	4962492	169.3
74	Existing	25.5	40.0	4.5	871	396311	4962419	167.0
75	Existing	25.4	40.0	4.5	851	396327	4962433	167.1
76	Existing	27.1	40.0	4.5	775	396345	4962512	169.1
77	Vacant	24.1	40.0	4.5	924	396346	4962338	164.5
78	Existing	34.4	40.0	4.5	337	396374	4964017	154.8
79	Existing	26.2	40.0	4.5	774	396396	4962482	167.5
80	Existing	34.2	40.0	4.5	332	396403	4964056	156.3
81	Vacant	24.9	40.0	4.5	849	396408	4962391	164.9
82	Existing	28.1	40.0	4.5	684	396419	4962572	169.5
83	Existing	27.1	40.0	4.5	740	396420	4962508	168.2
84	Existing	34.1	40.0	4.5	326	396425	4964075	157.4
85	Existing	35.0	40.0	4.5	296	396427	4964027	157.5
86	Existing	31.1	40.0	4.5	469	396438	4964271	159.5
87	Existing	28.6	40.0	4.5	637	396447	4962611	169.5
88	Existing	31.3	40.0	4.5	454	396457	4964264	159.5
89	Vacant	19.7	40.0	4.5	1657	396540	4965517	159.5
90	Existing	30.1	40.0	4.5	504	396577	4962694	169.5
91	Existing	26.5	40.0	4.5	805	396584	4964666	159.5
92	Vacant	22.9	40.0	4.5	1200	396589	4965063	157.1
93	Existing	26.9	40.0	4.5	769	396595	4964631	159.5

POR ID	Description	Sound Pressure Level (dBA)	Performance Limit (dBA)	POR Height (m)	Min distance to Source (m)	UTM Coordinates Zone 18 NAD 83 (m)		
						X	Y	Z
94	Existing	26.6	40.0	4.5	792	396610	4964655	159.5
95	Existing	27.4	40.0	4.5	634	396620	4962545	167.5
96	Existing	26.7	40.0	4.5	781	396630	4964646	159.5
97	Vacant	24.5	40.0	4.5	1010	396681	4964876	159.5
98	Existing	36.0	40.0	4.5	219	396808	4962944	169.5
99	Existing	24.5	40.0	4.5	1010	396836	4964863	159.5
100	Existing	24.2	40.0	4.5	1049	396869	4964897	159.5
101	Existing	35.9	40.0	4.5	221	396873	4962964	169.5
102	Existing	29.0	40.0	4.5	545	397056	4962694	164.8
103	Existing	34.1	40.0	4.5	329	397085	4963040	166.9
104	Existing	35.7	40.0	4.5	235	397091	4963140	167.0
105	Existing	28.8	40.0	4.5	562	397101	4962704	164.5
106	Existing	32.5	40.0	4.5	457	397119	4963974	164.5
107	Existing	35.8	40.0	4.5	212	397133	4963187	165.7
108	Vacant	33.8	40.0	4.5	314	397134	4963072	165.6
109	Existing	32.2	40.0	4.5	476	397139	4963975	164.5
110	Vacant	33.7	40.0	4.5	298	397176	4963112	164.5
111	Existing	32.1	40.0	4.5	378	397218	4963044	164.5
112	Existing	30.8	40.0	4.5	447	397277	4963002	162.6
113	Existing	28.3	40.0	4.5	511	397304	4962942	161.1
114	Existing	30.4	40.0	4.5	432	397377	4963132	163.1
115	Existing	30.5	40.0	4.5	426	397382	4963152	163.6
116	Existing	29.9	40.0	4.5	456	397423	4963166	164.2
117	Existing	29.8	40.0	4.5	504	397512	4963405	164.5
118	Vacant	28.5	40.0	4.5	603	397603	4963472	164.5
119	Existing	24.9	40.0	4.5	864	397661	4962791	164.5
120	Vacant	22.8	40.0	4.5	1108	397707	4962498	164.5
121	Existing	27.1	40.0	4.5	738	397715	4963578	164.5
122	Existing	26.8	40.0	4.5	766	397738	4963599	164.5
123	Existing	26.9	40.0	4.5	773	397739	4963617	164.4
124	Existing	26.4	40.0	4.5	775	397745	4963607	164.5
125	Existing	25.2	40.0	4.5	896	397870	4963612	164.0
126	Vacant	25.3	40.0	4.5	931	397876	4963702	163.5
127	Vacant	21.5	40.0	4.5	1244	397914	4962506	164.5
128	Existing	21.7	40.0	4.5	1269	398279	4963379	164.5
129	Existing	21.5	40.0	4.5	1304	398314	4963339	164.5

The results of this study show that all POR are compliant with MOE guidelines based on the performance limit of 40-dBA.

7. Conclusions and Recommendations

For the North Burgess Solar Project, the sound pressure levels at the POR have been estimated using the CADNA-A model, based on ISO 9613-2. It has been determined that no mitigation measures are needed for the Project operation in accordance with Ontario Regulation 359/09 and 521/10.

Based on the results obtained in this study, it is concluded that the sound pressure levels at the POR will be below MOE requirements for Class 3 areas of 40-dBA at all time.

8. Signatures

Report Prepared By

Kyle Cassidy, Mechanical Engineering Intern

Report Reviewed and Approved By

LICENSED PROFESSIONAL ENGINEER
O. BELASHOV
100139126
PROVINCE OF ONTARIO

Dec 22, 2011

Oleg Belashov, M.A.Sc., P.Eng.

9. References

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Ontario Regulation 521/10 made under Environmental Protection Act amending O.Reg. 359/09.

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IEEE. 2006. C57.12.90-2006: Standard Test Code for Liquid-Immersed, Power and Regulating Transformers. pp 64 to 76.

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MOE. 1995. Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban). Publication NPC-205. Ontario Ministry of the Environment. 6 pp + Annex.

MOE. 1995. Sound Level Limits for Stationary Sources in Class 3 Areas (Rural). Publication NPC-232. Ontario Ministry of the Environment. 8 pp + Annex.

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International Organization for Standardization (ISO). Standard 1913-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of Calculation.

Appendix A

Land Use Zoning Designation Plan and Area Location Plan

394000 395000 396000 397000 398000 399000

4966000 4965000 4964000 4963000 4962000

NOONAN SIDERD
ALLANS MILL RD
SCOTCH LINE
MACKLER SIDERD
UPPER SCOTCH LINE
ARMOUR RD
FERRIER RD
STANLEY RD
NARROWS LOCK RD
POWERS RD
STANLEYVILLE RD
COUNTRY LANE
PIKE LK 5 ROUTE
PIKE LK 1 ROUTE
GRANTS CK

A RU R I M

Cluster 1 Cluster 2 Cluster 3 Cluster 4 Cluster 5 Cluster 6 Cluster 7 Sub

Key Map

Legend

- Inverter Cluster
- Substation Transformer
- Noise Receptor - Existing
- Noise Receptor - Vacant
- Representative Noise Receptor
- Road
- Parcel
- Project Site
- 1000 m from Project Site
- Waterbody
- Zone Boundary

ZONES

RU	Rural
A	Agriculture
R	General Residential
I	Institutional
M	General Industrial

Notes:
1. Produced by Hatch under licence from Ontario Ministry of Natural Resources, Copyright (c) Queens Printer 2011.
2. Spatial referencing UTM NAD 83.
3. Zoning information obtained from Zoning By Law 02-121 Schedule A1, Tay Valley Township, Dec. 2008

0 125 250 500 Meters

NORTH

1:20,000

Figure A.1
Northland Power Solar
North Burgess L.P.

North Burgess Solar Project
Zoning Designation Plan

HATCH™

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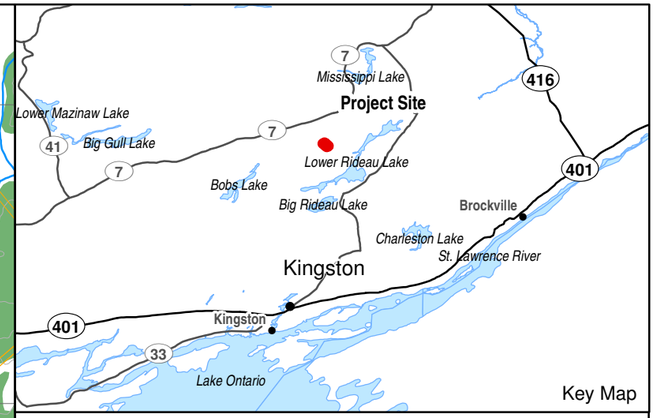
394000 395000 396000 397000 398000 399000

4966000 4965000 4964000 4963000 4962000

NOONAN SIDERD
ALLANS MILL RD
UPPER SCOTCH LINE
SCOTCH LINE
ARMOUR RD
FERRIER RD
MACKLER SIDERD
STANLEY RD
NARROWS LOCK RD
POWERS RD
STANLEYVILLE RD
GRANTS CK
COUNTRY LANE
PIKE LK 5 ROUTE

Sub
Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5
Cluster 6
Cluster 7



Key Map

Legend

- Inverter Cluster (Cluster #)
- Substation Transformer (SUB)
- Noise Receptor - Existing (#)
- Noise Receptor - Vacant (#)
- Representative Noise Receptor (#)
- Road
- Topographic Contour (5m interval)
- Watercourse
- Parcel
- Project Site
- 1000 m from Project Site
- Waterbody
- Woodland

Notes:
1. Produced by Hatch under licence from Ontario Ministry of Natural Resources, Copyright (c) Queens Printer 2011.
2. Spatial referencing UTM NAD 83.
3. Due to scale limitations, the three-part inverter unit is represented as a single point.

0 125 250 500 Meters

1:20,000

NORTH

Figure A.2
Northland Power Solar
North Burgess L.P.

North Burgess Solar Project
Scaled Area Location Plan

HATCH™

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Appendix B

Noise Sources

Table B.1 Point Sources from North Burgess Solar Project Used in CADNA-A, Includes Tonality Penalty of 5.0-dBA.

Source ID	Description	Spectra ID	Total sound power level (dBA)	Correction (dBA)	Height (m)	Coordinates, UTM NAD 83 Zone 18 (m)		
						X	Y	Z
Sub	44-kV/10-MVA substation transformer	T44kV_10MVA	90.8	5.0	3.50	396675.2	4963865.8	159.8
Inv1	Two Sunny Central 800CP inverters at Cluster 1	SMA_SC800CPX2	91.3	5.0	2.60	396767.6	4963160.9	167.6
Inv2	Two Sunny Central 800CP inverters at Cluster 2	SMA_SC800CPX2	91.3	5.0	2.60	397010.1	4963359.9	167.4
Inv3	Two Sunny Central 800CP inverters at Cluster 3	SMA_SC800CPX2	91.3	5.0	2.60	396767.6	4963264.9	167.6
Inv4	Two Sunny Central 800CP inverters at Cluster 4	SMA_SC800CPX2	91.3	5.0	2.60	396791.8	4963432.9	163.7
Inv5	Two Sunny Central 800CP inverters at Cluster 5	SMA_SC800CPX2	91.3	5.0	2.60	396765.2	4963592.9	161.5
Inv6	Two Sunny Central 800CP inverters at Cluster 6	SMA_SC800CPX2	91.3	5.0	2.60	396646.5	4963802.6	158.5
Inv7	Two Sunny Central 800CP inverters at Cluster 7	SMA_SC800CPX2	91.3	5.0	2.60	396316.1	4963624.9	156.3
Trans1	27.6-kV/1.6-MVA cluster transformer at Cluster 1	T27.6kV_1.6MVA	80.1	5.0	2.58	396773.1	4963160.4	167.6
Trans2	27.6-kV/1.6-MVA cluster transformer at Cluster 2	T27.6kV_1.6MVA	80.1	5.0	2.58	397004.6	4963360.4	167.5
Trans3	27.6-kV/1.6-MVA cluster transformer at Cluster 3	T27.6kV_1.6MVA	80.1	5.0	2.58	396773.1	4963264.4	167.6
Trans4	27.6-kV/1.6-MVA cluster transformer at Cluster 4	T27.6kV_1.6MVA	80.1	5.0	2.58	396797.3	4963432.4	164.0
Trans5	27.6-kV/1.6-MVA cluster transformer at Cluster 5	T27.6kV_1.6MVA	80.1	5.0	2.58	396770.7	4963592.4	161.5
Trans6	27.6-kV/1.6-MVA cluster transformer at Cluster 6	T27.6kV_1.6MVA	80.1	5.0	2.58	396647.0	4963808.1	158.5
Trans7	27.6-kV/1.6-MVA cluster transformer at Cluster 7	T27.6kV_1.6MVA	80.1	5.0	2.58	396321.6	4963624.4	156.5

Table B.2 Frequency Spectra Used for Modelling the Noise Sources, Not Including Tonality Penalty.

Spectra ID	Octave Spectrum (dBA)										
	31.5	63	125	250	500	1000	2000	4000	8000	A	lin
SMA_SC800CPX2		63.1	73.9	80.5	82.3	78.7	74.1	65.0	72.7	86.3	95.0
T27.6kV_1.6MVA	32.3	51.5	63.6	66.1	71.5	68.7	64.9	59.7	50.6	75.1	83.7
T44kV_10MVA	43.0	62.2	74.3	76.8	82.2	79.4	75.6	70.4	61.3	85.8	94.4

SC 720CP-10 / SC 760CP-10 / SC 800CP-10

Economic

- Direct deployment in the field due to outdoor enclosure
- Simplified shipping without concrete substation

Efficient

- Full nominal power at ambient temperatures up to 50 °C
- 10 % additional power for constant operation at ambient temperatures up to 25 °C

Flexible

- Powerful grid management functions (including LVRT)
- DC voltage range configurable

Reliable

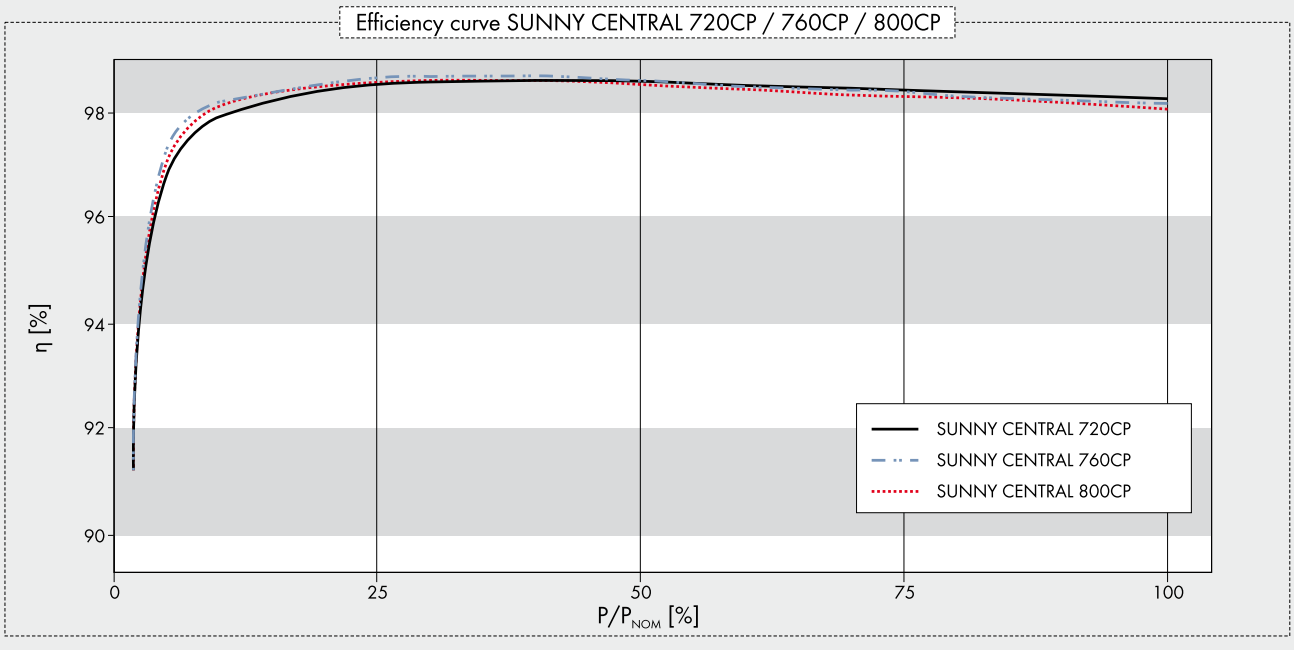
- Easy and safe installation due to a separate connection area
- Optional: extended input voltage range up to 1,100 V

SUNNY CENTRAL 720CP / 760CP / 800CP

High performance as standard

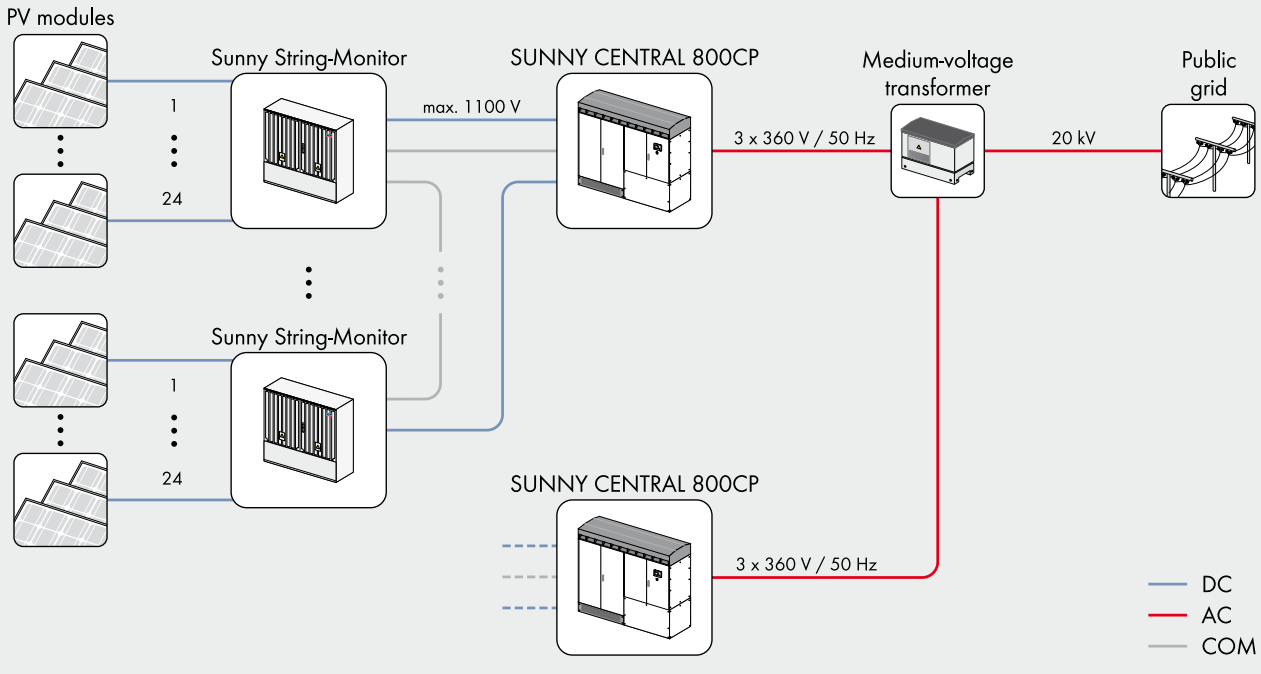
The completely new design of the Sunny Central CP series saves you real money. The compact and weatherproof enclosure is easy to load and transport and can be installed almost anywhere – there is no need for heavy protective concrete substations any longer. The innovative cooling concept OptiCool allows it to operate at full nominal power with ambient temperatures up to 50 °C. With the powerful grid management functions you are perfectly prepared for today's utility requirements as well as those still to come. The intelligent power management is the most important feature: in continuous operation, the Sunny Central 800CP can feed 880 kVA to the grid at ambient temperatures of up to 25 °C – that's 10 % more than the rated nominal power.

Technical data	Sunny Central 720CP	Sunny Central 760CP	Sunny Central 800CP
Input Data			
MPP voltage range	515 V – 820 V [3] [5]	545 V – 820 V [3] [5]	570 V – 820 V [3] [5]
Max. DC voltage		1000 V / 1100 V [1] Optional	
Max. DC current	1400 A	1400 A	1400 A
Number of DC inputs		9 fused inputs	
Output Values			
Nominal AC output @ 50 °C	720 kVA	760 kVA	800 kVA
Continuous AC power @ 25 °C	792 kVA	836 kVA	880 kVA
Max. AC current	1411 A	1411 A	1411 A
Nominal AC-current	1283 A	1283 A	1283 A
Nominal AC-voltage ±10 %	324 V	342 V	360 V
AC grid frequency 50 Hz	●	●	●
AC grid frequency 60 Hz	●	●	●
Power factor (cos φ)		0.9 leading ... 0.9 lagging	
Max. THD	< 3 %	< 3 %	< 3 %
Power consumption			
Internal consumption in operation	< 1500 W [4]	< 1500 W [4]	< 1500 W [4]
Standby consumption	< 100 W	< 100 W	< 100 W
External auxiliary voltage	3 x 230 V, 50 / 60 Hz	3 x 230 V, 50 / 60 Hz	3 x 230 V, 50 / 60 Hz
Dimensions and Weight			
Dimensions (W / H / D) in mm	2562 / 2279 / 956	2562 / 2279 / 956	2562 / 2279 / 956
Weight	1800 kg	1800 kg	1800 kg
Efficiency [2]			
Max. efficiency	98.6 %	98.6 %	98.6 %
Euro ETA	98.4 %	98.4 %	98.4 %
CEC-eta	98.4 %	98.4 %	98.4 %
Protection Rating and Ambient Conditions			
Protection rating (as per IEC 60529)	IP54	IP54	IP54
Protection rating (as per IEC 60721-3-3) Ambient conditions: fixed location, with protection against wind and weather	• Classification of chemically active substances: 3C2 • Classification of mechanically active substances: 3S2		
Operation temperature range	–20 °C ... +50 °C	–20 °C ... +50 °C	–20 °C ... +50 °C
Rel. humidity	15 % ... 95 %	15 % ... 95 %	15 % ... 95 %
Fresh air consumption	3000 m³/h	3000 m³/h	3000 m³/h
Max. altitude above sea level	2000 m	2000 m	2000 m

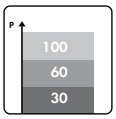


	Sunny Central 720CP	Sunny Central 760CP	Sunny Central 800CP
Features			
Sunny WebBox	●	●	●
Communication	Ethernet (optical fiber optional)	Ethernet (optical fiber optional)	Ethernet (optical fiber optional)
Communication with Sunny String-Monitor	RS485	RS485	RS485
LCD graphic display	●	●	●
Enclosure color	RAL 9016	RAL 9016	RAL 9016
Color of base	RAL 7005	RAL 7005	RAL 7005
Color of roof	RAL 7004	RAL 7004	RAL 7004
Ground fault monitoring / insulation monitoring	●	●	●
Circuit breaker AC side	●	●	●
Motor driven load disconnection switch on DC side	●	●	●
AC overvoltage protector	●	●	●
DC overvoltage protector	●	●	●
Overvoltage protectors for auxiliary supply	●	●	●
Certificates / Listings			
EMC	EN 61000-6-2 EN 61000-6-4		
CE conformity	●	●	●
BDEW-MSRL / FGW / TR8 [6]	●	●	●
RD 1633 / 2000	●	●	●
Arrêté du 23 / 04 / 08	●	●	●
● Standard features ❍ Optional features – Not available			
Type name	SC 720CP-10	SC 760CP-10	SC 800CP-10

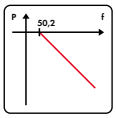
1) Startup at DC voltage < 1000 V
2) Efficiency measured without internal power supply
3) Further AC voltages, DC voltages and power classes can be configured (For detailed information see Technical Information „Innovations_CP“ at www.SMA.de)
4) Internal consumption at nominal power
5) At 1.05 $U_{AC,nom}$ and cos φ= 1
6) With complete dynamic grid support



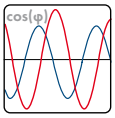
POWERFUL GRID MANAGEMENT FUNCTIONS



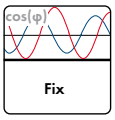
Remote controlled power reduction in case of grid overload
In order to avoid short-term grid overload, the grid operator presets a nominal active power value which the inverter will implement within 60 seconds. The nominal value is transmitted to the inverters via a ripple control receiver in combination with the SMA Power Reducer Box. Typical limit values are 100, 60, 30 or 0 per cent of the nominal power.



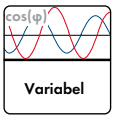
Frequency-dependent control of active power
As of a grid frequency of 50.2 Hz, the inverter automatically reduces the fed-in of active power according to a definable characteristic curve which thereby contributes to the stabilization of the grid frequency.



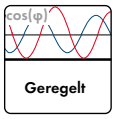
Static voltage support based on reactive power
To stabilize the grid voltage, SMA inverters feed reactive power (leading or lagging) into the grid. Three different modes are available:



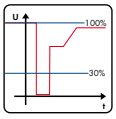
a) Fixed definition of the reactive power by the grid operator
The grid operator defines a fixed reactive power value or a fixed displacement factor between $\cos(\varphi)_{leading}$= 0.90 and $\cos(\varphi)_{lagging}$= 0.90.



b) Definition of a dynamic setpoint of the reactive power by the utility operator
The grid operator defines a dynamic displacement factor - any value between $\cos(\varphi)_{leading}$= 0.90 und $\cos(\varphi)_{lagging}$= 0.90. It is transmitted either through a communication unit the evaluation can e.g. be evaluated and processed by the SMA Power Reducer Box.

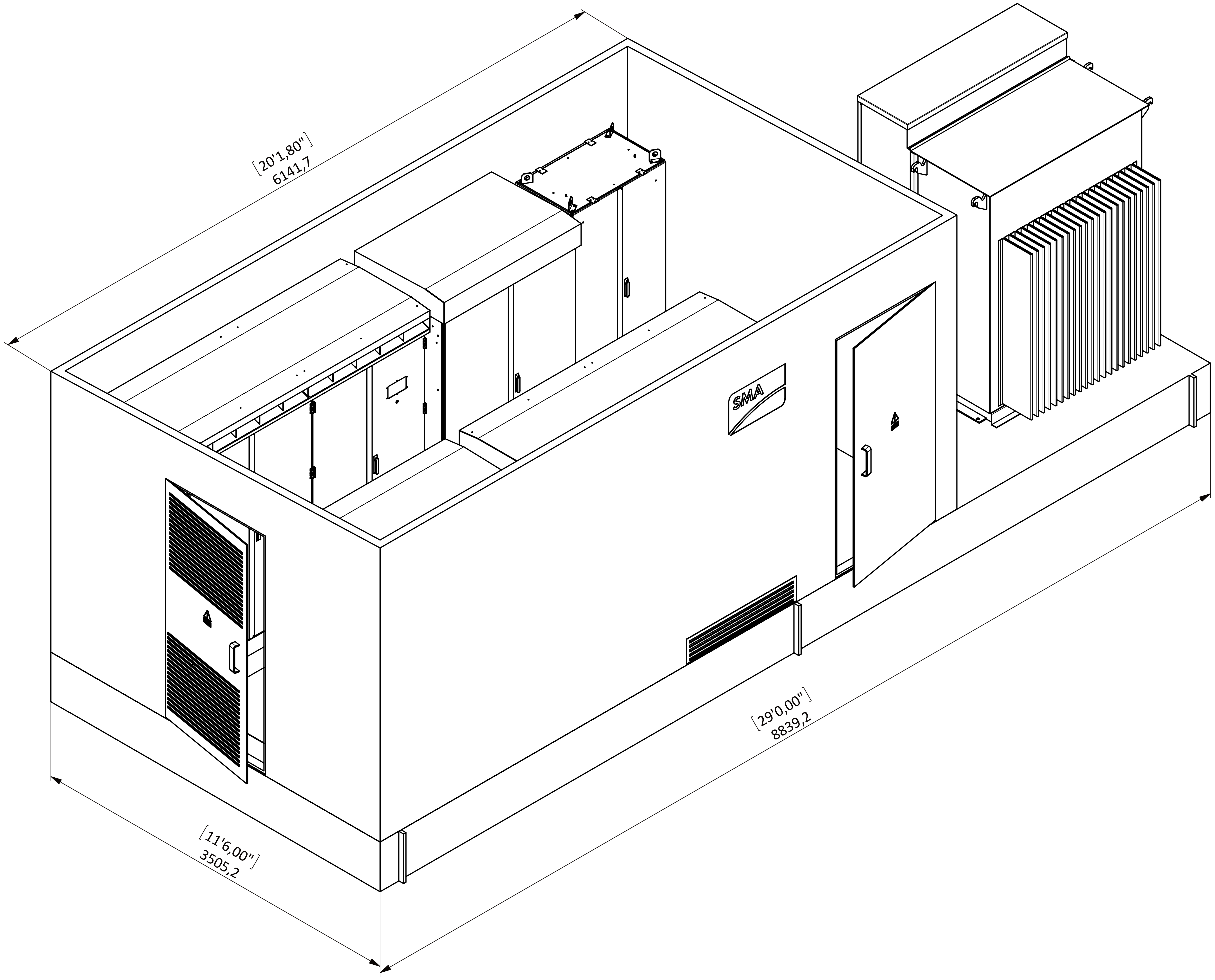


c) Control of the reactive power over a characteristic curve
The reactive power or the phase shift is controlled by a pre-defined characteristic curve – depending on the active power fed into the grid or the grid voltage.



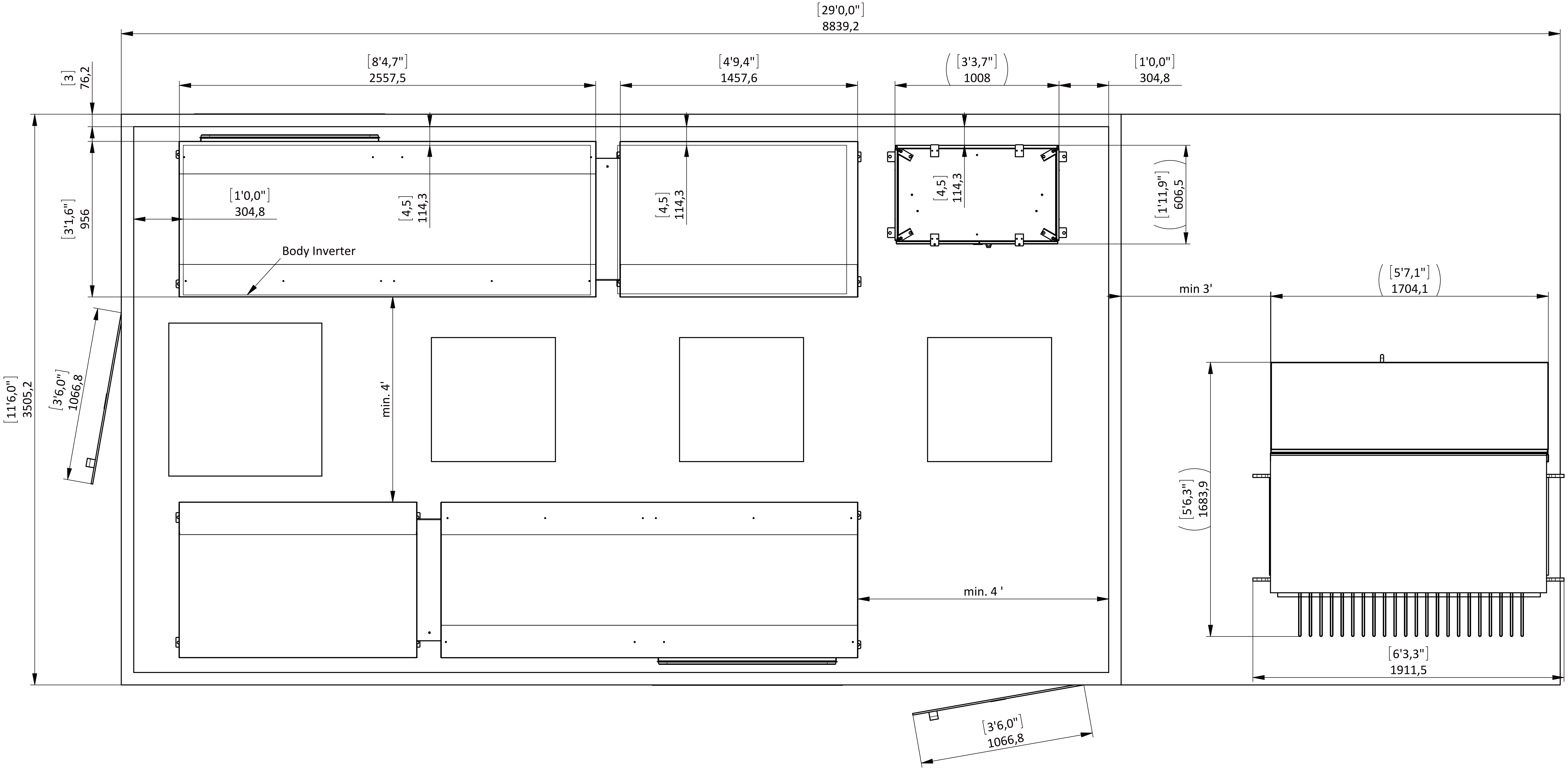
Limited Dynamic Grid Support
The inverter continues to feed to the grid after short term voltage drops – as long as the grid voltage is within a defined voltage window.

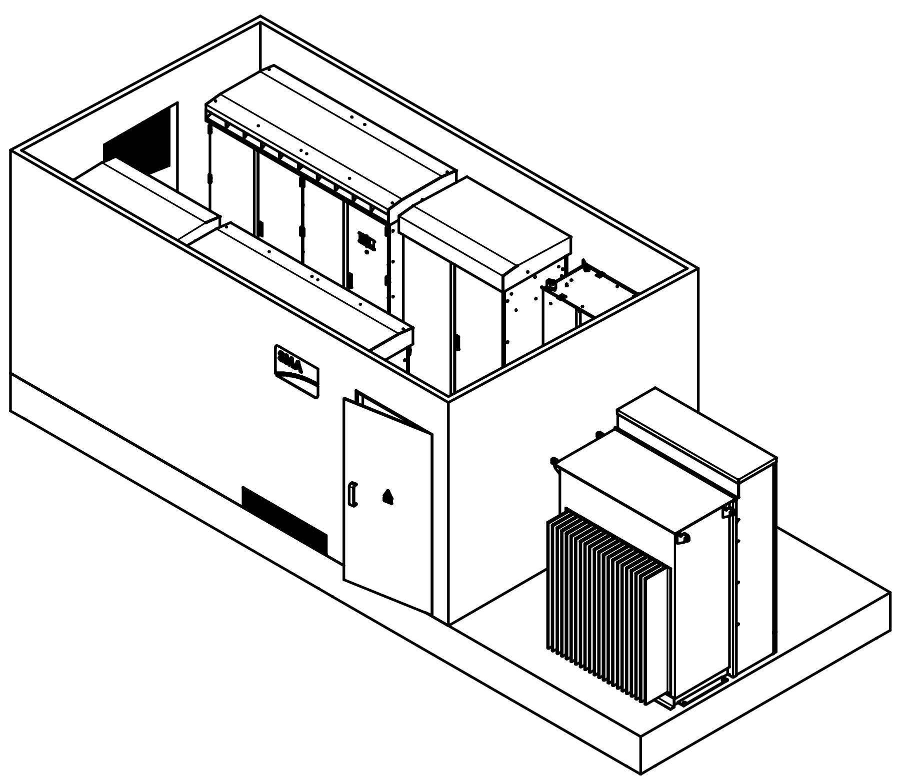
Dynamic Grid Support
LVRT (Low-Voltage Ride Through): The inverter stays connected to the grid during voltage drops and supports the grid by feeding reactive power.



Verwendbar für: / To be used for:			all dimensions and tolerances are in millimeters [feet / inches] alle Maß- und Toleranzangaben sind in mm [feet / inches]
SMA SKID			
	Datum / Date	Name	**Layout enclosure**
Bearb.	25.02.2011	Mihelic	
Gepr.			
Norm			
Freigabe			
SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0			Z-Nr.: D.-No.: — A2 — Blatt Page 1
			EDV-Nr.: — Bl. / o.P. 1
Urspr.: / Origin.:			Name : — Erstellt mit SolidWorks

Rev.	Datum	Name





Verwendbar für: / To be used for: **SMA SKID**				all dimensions and tolerances are in millimeters [feet / inches] alle Maß- und Toleranzangaben sind in mm [feet / inches]
	Datum / Date	Name		**Clearance**
Bearb.	25.02.2011	Mihelic		
Gepr.				
Norm				
Freigabe				
Rev. / Datum / Name	Urspr.: / Origin.:	SMA Solar Technology AG, Sonnenallee 1, 34266 Niestetal, Tel.: +49 561 9522-0	Z-Nr.: / D.-No.: / EDV-Nr.: / Name :	A2 / Blatt Page 1 / Bl. / o.P. 1

Erstellt mit SolidWorks

Terz-midle-frequency [kHz]	Soundpower-level L_{xpA} [dB_A]500kW	Soundpower-level L_{xpA} [dB_A]640kW	Soundpower-level L_{xpA} [dB_A]720kW	Soundpower-level L_{xpA} [dB_A]760kW	Soundpower level L_{xpA} [dB_A]800kW
0,05	63,30	55,30	57,70	67,00	56,50
0,063	60,80	53,10	56,80	63,20	54,00
0,08	63,90	56,30	56,50	59,50	55,20
0,1	64,10	66,20	65,00	66,50	68,10
0,125	65,70	64,50	60,60	65,20	62,00
0,16	72,30	65,80	65,50	63,20	66,40
0,2	67,30	64,60	66,80	64,90	67,80
0,25	66,10	76,20	77,50	70,80	72,40
0,315	78,40	79,80	77,70	82,20	75,10
0,4	73,70	73,90	73,90	72,80	66,70
0,5	77,80	78,70	77,70	77,40	74,70
0,63	78,90	78,90	74,60	77,40	77,00
0,8	70,60	72,50	74,10	70,60	72,00
1	72,20	71,00	70,00	68,90	67,90
1,25	72,40	72,00	71,50	70,80	71,80
1,6	67,30	68,30	76,70	68,60	68,50
2	69,30	66,30	66,50	67,20	65,30
2,5	65,10	66,80	64,60	64,80	63,90
3,15	62,60	64,30	65,00	63,20	61,00
4,0	53,50	54,20	54,70	52,30	53,80
5,0	51,30	49,50	50,50	51,20	49,80
6,3	68,90	72,60	73,50	73,50	69,70

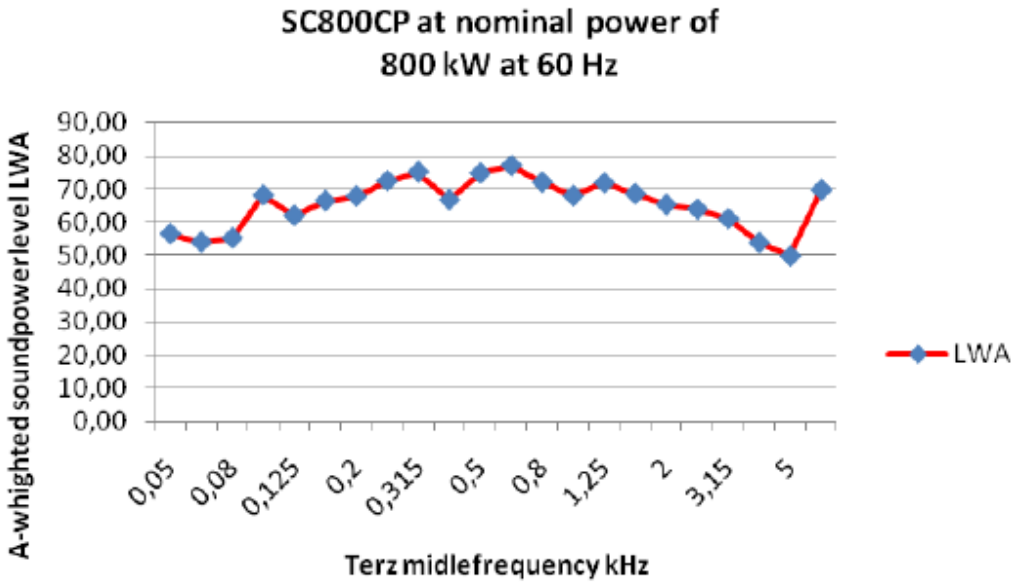
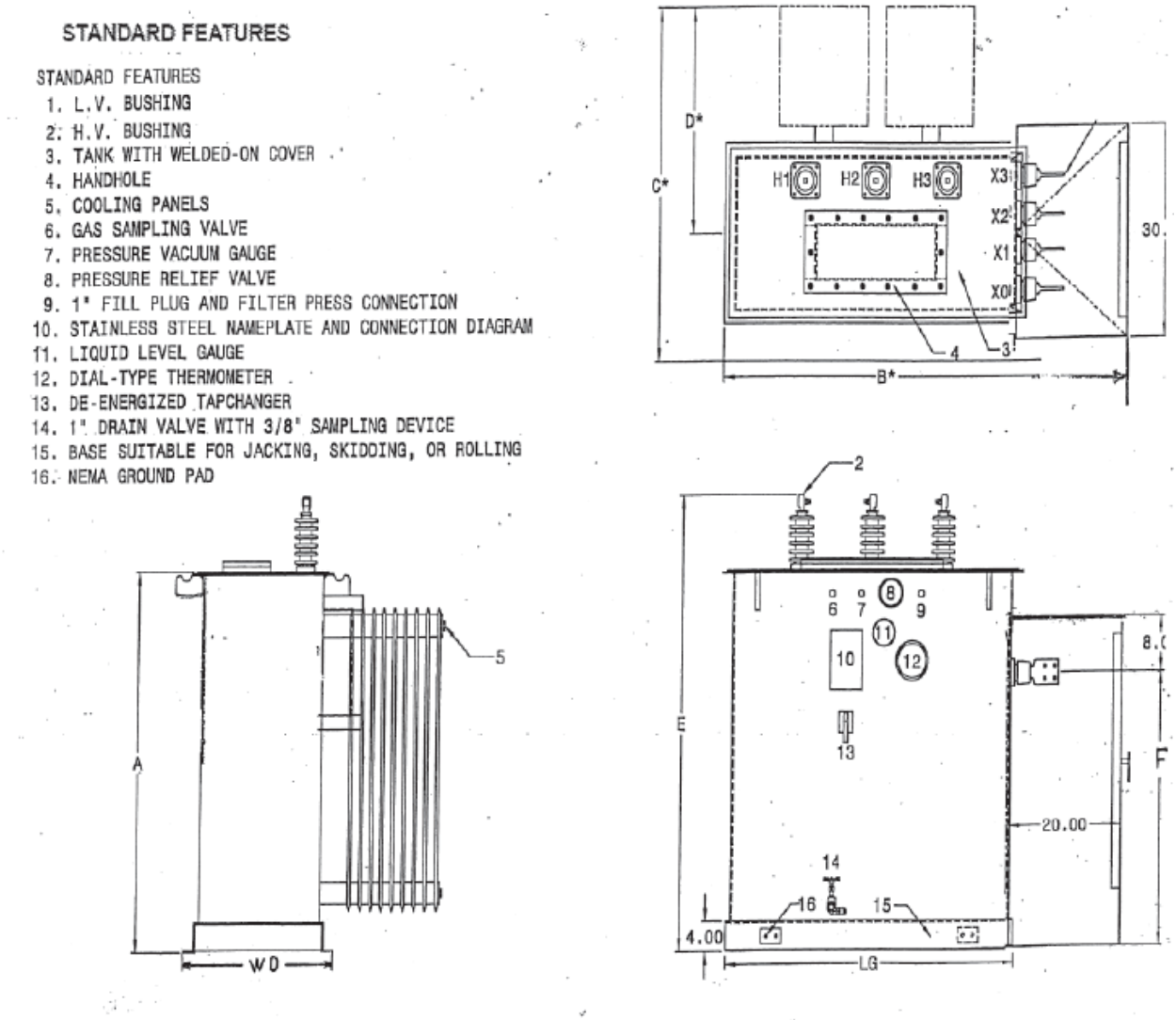


Figure B.1 SC800CP Inverter Sound Power Level as Provided by SMA. Note that the Header in the Table above Represents Various Inverter Models of CS###CP Series.



KVA	Fluid	Cond	HV BIL	LV BIL	WD	LG	A	B	C	D	E	F	Gal Liquid	Weight
10000	O	C	250	150	48	95	111	113	138	TBD	132	82	1530	37597

Figure B.2 44-kVA/10-MVA Substation Transformer Catalogue Dimensions (inches).

Estimated Frequency Spectra for Transformers

Transformer - 44kV/10MVA

From Handbook of Noise and Vibration Control (Crocker, 2007, page 1335-1336, Eq. 18 and Table 20)

Average LpA	68 dBA	Based on NEMA TR1-1993 (R2000), Table 0-2
Estimated surface area	35 m^2	Estimated based on similar transformer dimensions

Correction factors are in dB

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Notes
C1	-11.0	-5.0	-3.0	-8.0	-8.0	-14.0	-19.0	-24.0	-31.0	Outdoors, indoors in mechanical room over 140 m^3
C2	-11	-2	3	-2	-2	-11	-19	-24	-31	Indoors
C3	-11	-2	3	2	2	-4	-9	-14	-21	Serious Noise Problems

Sound Power Level calculated as Lw=Average LpA + 10*log(Estimated surface area) + C + 10

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Combined [dB]
C1 based [dB]	82.4	88.4	90.4	85.4	85.4	79.4	74.4	69.4	62.4	**94.5**
C2 based [dB]	82.4	91.4	96.4	91.4	91.4	82.4	74.4	69.4	62.4	**99.5**
C3 based [dB]	82.4	91.4	96.4	95.4	95.4	89.4	84.4	79.4	72.4	**101.5**

Resulting A-weighted sound power level

Freq. (Hz)	A-Weight	C1 based [dBA]	C2 based [dBA]	C2 based [dBA]
31	-39.4	43.0	52.0	57.0
63	-26.2	62.2	65.2	65.2
125	-16.1	74.3	80.3	80.3
250	-8.6	76.8	82.8	86.8
500	-3.2	82.2	88.2	92.2
1000	0	79.4	82.4	89.4
2000	1.2	75.6	75.6	85.6
4000	1	70.4	70.4	80.4
8000	-1.1	61.3	61.3	71.3
LwA [dBA]		**85.8**	**90.8**	**95.6**

Used in the study

Figure B.3 Sound Power Level Calculation for 44-kV/10-MVA Substation Transformer.

Sound Power Level Calculation for SMA Sunny Central 800CP, 100% LOAD

Third octave, as provided		
Freq #	Freq (Hz)	LwA (dBA)
1	25	
2	31.5	
3	40	
4	50	56.5
5	63	54.0
6	80	55.2
7	100	68.1
8	125	62.0
9	160	66.4
10	200	67.8
11	250	72.4
12	315	75.1
13	400	66.7
14	500	74.7
15	630	77.0
16	800	72.0
17	1000	67.9
18	1250	71.8
19	1600	68.5
20	2000	65.3
21	2500	63.9
22	3150	61.0
23	4000	53.8
24	5000	49.8
25	6300	69.7
26	8000	
27	10000	
	Total LwA	**83.3**

Full octave, as used in CADNA-A model			
Freq #	Freq (Hz)	LwA 1 inverter (dBA)	LwA 2 inverters (dBA)
	31.5		
5	63	60.1	63.1
8	125	70.9	73.9
11	250	77.5	80.5
14	500	79.3	82.3
17	1000	75.7	78.7
20	2000	71.1	74.1
23	4000	62.0	65.0
26	8000	69.7	72.7
	Total LwA	**83.3**	**86.3**

$$10\log\left(10^{\frac{56.5}{10}}+10^{\frac{54.0}{10}}+10^{\frac{55.2}{10}}\right)=60.1dBA$$

$$10\log\left(10^{\frac{60.1}{10}}+10^{\frac{60.1}{10}}\right)=63.1dBA$$

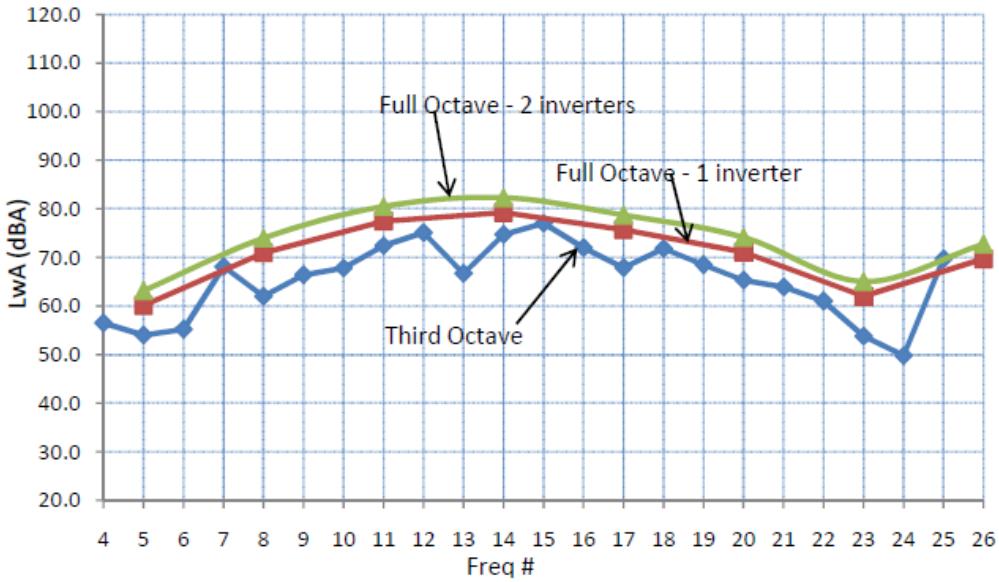


Figure B.4 Sound Power Level Calculation for SMA Sunny Central 800CP, 100% LOAD.

Estimated Frequency Spectra for Transformers

Transformer - 27.6kV/1.6MVA

From Handbook of Noise and Vibration Control (Crocker, 2007, page 1335-1336, Eq. 18 and Table 20)

Average LpA	61 dBA	Based on NEMA TR1-1993 (R2000), Table 0-2
Estimated surface area	14.872 m^2	Estimated based on client transformer drawings

Correction factors are in dB

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Notes
C1	-11.0	-5.0	-3.0	-8.0	-8.0	-14.0	-19.0	-24.0	-31.0	Outdoors, indoors in mechanical room over 140 m^3
C2	-11	-2	3	-2	-2	-11	-19	-24	-31	Indoors
C3	-11	-2	3	2	2	-4	-9	-14	-21	Serious Noise Problems

Sound Power Level calculated as Lw=Average LpA + 10*log(Estimated surface area) + C + 10

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Combined [dB]
C1 based [dB]	71.7	77.7	79.7	74.7	74.7	68.7	63.7	58.7	51.7	**83.8**
C2 based [dB]	71.7	80.7	85.7	80.7	80.7	71.7	63.7	58.7	51.7	**88.8**
C3 based [dB]	71.7	80.7	85.7	84.7	84.7	78.7	73.7	68.7	61.7	**90.8**

Resulting A-weighted sound power level

Freq. (Hz)	A-Weight	C1 based [dBA]	C2 based [dBA]	C2 based [dBA]
31	-39.4	32.3	41.3	46.3
63	-26.2	51.5	54.5	54.5
125	-16.1	63.6	69.6	69.6
250	-8.6	66.1	72.1	76.1
500	-3.2	71.5	77.5	81.5
1000	0	68.7	71.7	78.7
2000	1.2	64.9	64.9	74.9
4000	1	59.7	59.7	69.7
8000	-1.1	50.6	50.6	60.6
LwA [dBA]		**75.1**	**80.1**	**84.9**

Used in the study

Figure B.5 Sound Power Level Calculation for 27.6-kV/1.6-MVA Cluster Transformer.

Appendix C

Noise Maps from CADNA-A

394000 395000 396000 397000 398000 399000

4966000 4965000 4964000 4963000 4962000

NOONAN SIDERD
ALLANS MILL RD
MACKLER SIDERD
UPPER SCOTCH LINE
SCOTCH LINE
FERRIER RD
ARMOUR RD
STANLEY RD
GRANTS CK
PIKE LK 5 ROUTE
COUNTRY LANE
PIKE LK 1 ROUTE
STANLEYVILLE RD
NARROWS LOCK RD
POWERS RD

Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5
Cluster 6
Cluster 7
Sub

Legend

Cluster #
Inverter Cluster
SUB
Substation Transformer
#
Noise Receptor - Existing
#
Noise Receptor - Vacant
#
Representative Noise Receptor
Road
Parcel
Project Site
1000 m from Project Site
Waterbody
Wetland
Woodland

Sound Pressure Level (dBA)

40.0 - 41.0
41.1 - 44.0
44.1 - 47.0
47.1 - 49.0
49.1 - 52.0
> 52.1

Notes:
1. Produced by Hatch under licence from Ontario Ministry of Natural Resources, Copyright (c) Queens Printer 2011.
2. Spatial referencing UTM NAD 83.

0 125 250 500 Meters

NORTH

1:18,000

Figure C.1
Northland Power Solar
North Burgess L.P.
North Burgess Solar Project
Noise Contours at 4.5 m

HATCH™

Path: P:\NORTHLAND\333751\DATABASES\334844\GIS\NBurgess\North Burgess_Noise_C1_Contours_4_5m.mxd Date Saved: 12/19/2011 1:19:48 PM

396000 396250 396500 396750 397000 397250

4964000 4963750 4963500 4963250 4963000

Cluster 1 Cluster 2 Cluster 3 Cluster 4 Cluster 5 Cluster 6 Cluster 7

Sub

38 41 37 84 80 78 85 44 106 109 107 104 110 108 103 111 112 113 115 114 98 101

NARROWS LOCK RD

STANLEYVILLE RD

STANLEY RD

Legend

- Cluster # — Inverter Cluster
- SUB — Substation Transformer
- # — Noise Receptor - Existing
- # — Noise Receptor - Vacant
- # — Representative Noise Receptor
- Road
- Parcel
- Project Site
- 30 m from Noise Receptor
- Wetland
- Woodland

Sound Pressure Level (dBA)

40.0 - 41.0	41.1 - 44.0	44.1 - 47.0	47.1 - 49.0	49.1 - 52.0	> 52.1

Notes:
1. Produced by Hatch under licence from Ontario Ministry of Natural Resources, Copyright (c) Queens Printer 2011.
2. Spatial referencing UTM NAD 83.

0 50 100 200 Meters NORTH

1:5,000

Figure C.2
Northland Power Solar
North Burgess L.P.

North Burgess Solar Project
Noise Contours at 1.5 m

HATCH

Appendix D

CADNA-A Sample Calculations

Configuration	
Parameter	Value
General	
Country	(user defined)
Max. Error (dB)	0.00
Max. Search Radius (m)	3000.00
Min. Dist Src to Rcvr	0.00
Partition	
Raster Factor	0.50
Max. Length of Section (m)	1000.00
Min. Length of Section (m)	1.00
Min. Length of Section (%)	0.00
Proj. Line Sources	On
Proj. Area Sources	On
Ref. Time	
Reference Time Day (min)	960.00
Reference Time Night (min)	480.00
Daytime Penalty (dB)	0.00
Recr. Time Penalty (dB)	0.00
Night-time Penalty (dB)	0.00
DTM	
Standard Height (m)	0.00
Model of Terrain	Triangulation
Reflection	
max. Order of Reflection	1
Search Radius Src	100.00
Search Radius Rcvr	100.00
Max. Distance Source - Rcvr	1000.00 1000.00
Min. Distance Rvcr - Reflector	1.00 1.00
Min. Distance Source - Reflector	0.10
Industrial (ISO 9613)	
Lateral Diffraction	some Obj
Obst. within Area Src do not shield	On
Screening	Excl. Ground Att. over Barrier
	Dz with limit (20/25)
Barrier Coefficients C1,2,3	3.0 20.0 0.0
Temperature (°C)	10
rel. Humidity (%)	70
Ground Absorption G	0.70
Wind Speed for Dir. (m/s)	3.0
Roads (RLS-90)	
Strictly acc. to RLS-90	
Railways (Schall 03)	
Strictly acc. to Schall 03 / Schall-Transrapid	
Aircraft (???)	
Strictly acc. to AzB	

Receiver
Name: Existing
ID: 98.0
X: 396807.68
Y: 4962943.62
Z: 169.50

Point Source, ISO 9613, Name: "Inv1", ID: "Inv1"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396767.56	4963160.87	167.60	0	63	68.1	-88.0	0.0	0.0	57.9	0.0	-3.1	0.0	0.0	0.0	0.0	-0.0	13.3	-88.0
2	396767.56	4963160.87	167.60	0	125	78.9	-88.0	0.0	0.0	57.9	0.1	2.5	0.0	0.0	0.0	0.0	-0.0	18.4	-88.0
3	396767.56	4963160.87	167.60	0	250	85.5	-88.0	0.0	0.0	57.9	0.2	3.3	0.0	0.0	0.0	0.0	-0.0	24.1	-88.0
4	396767.56	4963160.87	167.60	0	500	87.3	-88.0	0.0	0.0	57.9	0.4	-0.5	0.0	0.0	0.0	0.0	-0.0	29.5	-88.0
5	396767.56	4963160.87	167.60	0	1000	83.7	-88.0	0.0	0.0	57.9	0.8	-0.9	0.0	0.0	0.0	0.0	-0.0	25.9	-88.0
6	396767.56	4963160.87	167.60	0	2000	79.1	-88.0	0.0	0.0	57.9	2.1	-0.9	0.0	0.0	0.0	0.0	-0.0	20.0	-88.0
7	396767.56	4963160.87	167.60	0	4000	70.0	-88.0	0.0	0.0	57.9	7.2	-0.9	0.0	0.0	0.0	0.0	-0.0	5.8	-88.0
8	396767.56	4963160.87	167.60	0	8000	77.7	-88.0	0.0	0.0	57.9	25.8	-0.9	0.0	0.0	0.0	0.0	-0.0	-5.1	-88.0

Point Source, ISO 9613, Name: "Inv2", ID: "Inv2"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	397010.14	4963359.87	167.38	0	63	68.1	-88.0	0.0	0.0	64.3	0.1	-4.6	0.0	0.0	0.0	0.0	-0.0	8.4	-88.0
2	397010.14	4963359.87	167.38	0	125	78.9	-88.0	0.0	0.0	64.3	0.2	3.0	0.0	0.0	0.0	0.0	-0.0	11.4	-88.0
3	397010.14	4963359.87	167.38	0	250	85.5	-88.0	0.0	0.0	64.3	0.5	2.9	0.0	0.0	0.0	0.0	-0.0	17.8	-88.0
4	397010.14	4963359.87	167.38	0	500	87.3	-88.0	0.0	0.0	64.3	0.9	-1.0	0.0	0.0	0.0	0.0	-0.0	23.1	-88.0
5	397010.14	4963359.87	167.38	0	1000	83.7	-88.0	0.0	0.0	64.3	1.7	-1.4	0.0	0.0	0.0	0.0	-0.0	19.1	-88.0
6	397010.14	4963359.87	167.38	0	2000	79.1	-88.0	0.0	0.0	64.3	4.5	-1.4	0.0	0.0	0.0	0.0	-0.0	11.7	-88.0
7	397010.14	4963359.87	167.38	0	4000	70.0	-88.0	0.0	0.0	64.3	15.2	-1.4	0.0	0.0	0.0	0.0	-0.0	-8.1	-88.0
8	397010.14	4963359.87	167.38	0	8000	77.7	-88.0	0.0	0.0	64.3	54.1	-1.4	0.0	0.0	0.0	0.0	-0.0	-39.3	-88.0

Point Source, ISO 9613, Name: "Inv3", ID: "Inv3"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396767.56	4963264.87	167.60	0	63	68.1	-88.0	0.0	0.0	61.2	0.0	-4.0	0.0	0.0	0.0	0.0	-0.0	10.9	-88.0
2	396767.56	4963264.87	167.60	0	125	78.9	-88.0	0.0	0.0	61.2	0.1	2.6	0.0	0.0	0.0	0.0	-0.0	15.0	-88.0
3	396767.56	4963264.87	167.60	0	250	85.5	-88.0	0.0	0.0	61.2	0.3	3.0	0.0	0.0	0.0	0.0	-0.0	20.9	-88.0
4	396767.56	4963264.87	167.60	0	500	87.3	-88.0	0.0	0.0	61.2	0.6	-0.8	0.0	0.0	0.0	0.0	-0.0	26.2	-88.0
5	396767.56	4963264.87	167.60	0	1000	83.7	-88.0	0.0	0.0	61.2	1.2	-1.2	0.0	0.0	0.0	0.0	-0.0	22.5	-88.0
6	396767.56	4963264.87	167.60	0	2000	79.1	-88.0	0.0	0.0	61.2	3.1	-1.2	0.0	0.0	0.0	0.0	-0.0	16.0	-88.0
7	396767.56	4963264.87	167.60	0	4000	70.0	-88.0	0.0	0.0	61.2	10.6	-1.2	0.0	0.0	0.0	0.0	-0.0	-0.6	-88.0
8	396767.56	4963264.87	167.60	0	8000	77.7	-88.0	0.0	0.0	61.2	37.8	-1.2	0.0	0.0	0.0	0.0	-0.0	-20.1	-88.0

Point Source, ISO 9613, Name: "Inv4", ID: "Inv4"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396791.76	4963432.87	163.74	0	63	68.1	-88.0	0.0	0.0	64.8	0.1	-4.7	0.0	0.0	0.0	0.0	-0.0	7.9	-88.0
2	396791.76	4963432.87	163.74	0	125	78.9	-88.0	0.0	0.0	64.8	0.2	3.1	0.0	0.0	0.0	0.0	-0.0	10.9	-88.0
3	396791.76	4963432.87	163.74	0	250	85.5	-88.0	0.0	0.0	64.8	0.5	2.8	0.0	0.0	0.0	0.0	-0.0	17.4	-88.0
4	396791.76	4963432.87	163.74	0	500	87.3	-88.0	0.0	0.0	64.8	0.9	-1.0	0.0	0.0	0.0	0.0	-0.0	22.5	-88.0
5	396791.76	4963432.87	163.74	0	1000	83.7	-88.0	0.0	0.0	64.8	1.8	-1.4	0.0	0.0	0.0	0.0	-0.0	18.5	-88.0
6	396791.76	4963432.87	163.74	0	2000	79.1	-88.0	0.0	0.0	64.8	4.7	-1.4	0.0	0.0	0.0	0.0	-0.0	11.0	-88.0
7	396791.76	4963432.87	163.74	0	4000	70.0	-88.0	0.0	0.0	64.8	16.0	-1.4	0.0	0.0	0.0	0.0	-0.0	-9.4	-88.0
8	396791.76	4963432.87	163.74	0	8000	77.7	-88.0	0.0	0.0	64.8	57.2	-1.4	0.0	0.0	0.0	0.0	-0.0	-42.9	-88.0

Point Source, ISO 9613, Name: "Inv5", ID: "Inv5"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396765.18	4963592.87	161.47	0	63	68.1	-88.0	0.0	0.0	67.3	0.1	-5.0	0.0	0.0	0.0	0.0	-0.0	5.8	-88.0
2	396765.18	4963592.87	161.47	0	125	78.9	-88.0	0.0	0.0	67.3	0.3	3.5	0.0	0.0	0.0	0.0	-0.0	7.8	-88.0
3	396765.18	4963592.87	161.47	0	250	85.5	-88.0	0.0	0.0	67.3	0.7	2.7	0.0	0.0	0.0	0.0	-0.0	14.8	-88.0
4	396765.18	4963592.87	161.47	0	500	87.3	-88.0	0.0	0.0	67.3	1.3	-1.1	0.0	0.0	0.0	0.0	-0.0	19.9	-88.0
5	396765.18	4963592.87	161.47	0	1000	83.7	-88.0	0.0	0.0	67.3	2.4	-1.5	0.0	0.0	0.0	0.0	-0.0	15.6	-88.0

Point Source, ISO 9613, Name: "Inv5", ID: "Inv5"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
6	396765.18	4963592.87	161.47	0	2000	79.1	-88.0	0.0	0.0	67.3	6.3	-1.5	0.0	0.0	0.0	0.0	-0.0	7.0	-88.0
7	396765.18	4963592.87	161.47	0	4000	70.0	-88.0	0.0	0.0	67.3	21.3	-1.5	0.0	0.0	0.0	0.0	-0.0	-17.1	-88.0
8	396765.18	4963592.87	161.47	0	8000	77.7	-88.0	0.0	0.0	67.3	76.0	-1.5	0.0	0.0	0.0	0.0	-0.0	-64.1	-88.0

Point Source, ISO 9613, Name: "Inv6", ID: "Inv6"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396646.48	4963802.57	158.52	0	63	68.1	-88.0	0.0	0.0	69.8	0.1	-5.3	0.0	0.0	0.0	0.0	-0.0	3.4	-88.0
2	396646.48	4963802.57	158.52	0	125	78.9	-88.0	0.0	0.0	69.8	0.4	4.0	0.0	0.0	0.0	0.0	-0.0	4.7	-88.0
3	396646.48	4963802.57	158.52	0	250	85.5	-88.0	0.0	0.0	69.8	0.9	2.7	0.0	0.0	0.0	0.0	-0.0	12.1	-88.0
4	396646.48	4963802.57	158.52	0	500	87.3	-88.0	0.0	0.0	69.8	1.7	-1.1	0.0	0.0	0.0	0.0	-0.0	16.9	-88.0
5	396646.48	4963802.57	158.52	0	1000	83.7	-88.0	0.0	0.0	69.8	3.2	-1.6	0.0	0.0	0.0	0.0	-0.0	12.3	-88.0
6	396646.48	4963802.57	158.52	0	2000	79.1	-88.0	0.0	0.0	69.8	8.5	-1.6	0.0	0.0	0.0	0.0	-0.0	2.4	-88.0
7	396646.48	4963802.57	158.52	0	4000	70.0	-88.0	0.0	0.0	69.8	28.6	-1.6	0.0	0.0	0.0	0.0	-0.0	-26.9	-88.0
8	396646.48	4963802.57	158.52	0	8000	77.7	-88.0	0.0	0.0	69.8	102.2	-1.6	0.0	0.0	0.0	0.0	-0.0	-92.7	-88.0

Point Source, ISO 9613, Name: "Inv7", ID: "Inv7"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396316.13	4963624.87	156.26	0	63	68.1	-88.0	0.0	0.0	69.5	0.1	-5.2	0.0	0.0	0.0	0.0	-0.0	3.8	-88.0
2	396316.13	4963624.87	156.26	0	125	78.9	-88.0	0.0	0.0	69.5	0.4	3.9	0.0	0.0	0.0	0.0	-0.0	5.1	-88.0
3	396316.13	4963624.87	156.26	0	250	85.5	-88.0	0.0	0.0	69.5	0.9	2.7	0.0	0.0	0.0	0.0	-0.0	12.5	-88.0
4	396316.13	4963624.87	156.26	0	500	87.3	-88.0	0.0	0.0	69.5	1.6	-1.1	0.0	0.0	0.0	0.0	-0.0	17.3	-88.0
5	396316.13	4963624.87	156.26	0	1000	83.7	-88.0	0.0	0.0	69.5	3.1	-1.6	0.0	0.0	0.0	0.0	-0.0	12.7	-88.0
6	396316.13	4963624.87	156.26	0	2000	79.1	-88.0	0.0	0.0	69.5	8.1	-1.6	0.0	0.0	0.0	0.0	-0.0	3.1	-88.0
7	396316.13	4963624.87	156.26	0	4000	70.0	-88.0	0.0	0.0	69.5	27.5	-1.6	0.0	0.0	0.0	0.0	-0.0	-25.4	-88.0
8	396316.13	4963624.87	156.26	0	8000	77.7	-88.0	0.0	0.0	69.5	98.2	-1.6	0.0	0.0	0.0	0.0	-0.0	-88.4	-88.0

Point Source, ISO 9613, Name: "Sub", ID: "Sub"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396675.23	4963865.84	159.76	0	32	48.0	48.0	0.0	0.0	70.4	0.0	-5.2	0.0	0.0	0.0	0.0	-0.0	-17.2	-17.2
2	396675.23	4963865.84	159.76	0	63	67.2	67.2	0.0	0.0	70.4	0.1	-5.2	0.0	0.0	0.0	0.0	-0.0	1.9	1.9
3	396675.23	4963865.84	159.76	0	125	79.3	79.3	0.0	0.0	70.4	0.4	3.9	0.0	0.0	0.0	0.0	-0.0	4.7	4.7
4	396675.23	4963865.84	159.76	0	250	81.8	81.8	0.0	0.0	70.4	1.0	1.4	0.0	0.0	0.0	0.0	-0.0	9.0	9.0
5	396675.23	4963865.84	159.76	0	500	87.2	87.2	0.0	0.0	70.4	1.8	-1.5	0.0	0.0	0.0	0.0	-0.0	16.6	16.6
6	396675.23	4963865.84	159.76	0	1000	84.4	84.4	0.0	0.0	70.4	3.4	-1.6	0.0	0.0	0.0	0.0	-0.0	12.2	12.2
7	396675.23	4963865.84	159.76	0	2000	80.6	80.6	0.0	0.0	70.4	9.0	-1.6	0.0	0.0	0.0	0.0	-0.0	2.8	2.8
8	396675.23	4963865.84	159.76	0	4000	75.4	75.4	0.0	0.0	70.4	30.5	-1.6	0.0	0.0	0.0	0.0	-0.0	-23.9	-23.9
9	396675.23	4963865.84	159.76	0	8000	66.3	66.3	0.0	0.0	70.4	108.9	-1.6	0.0	0.0	0.0	0.0	-0.0	-111.4	-111.4

Point Source, ISO 9613, Name: "Trans1", ID: "Trans1"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396773.06	4963160.37	167.58	0	32	37.3	37.3	0.0	0.0	57.8	0.0	-3.1	0.0	0.0	0.0	0.0	-0.0	-17.4	-17.4
2	396773.06	4963160.37	167.58	0	63	56.5	56.5	0.0	0.0	57.8	0.0	-3.1	0.0	0.0	0.0	0.0	-0.0	1.7	1.7
3	396773.06	4963160.37	167.58	0	125	68.6	68.6	0.0	0.0	57.8	0.1	2.5	0.0	0.0	0.0	0.0	-0.0	8.2	8.2
4	396773.06	4963160.37	167.58	0	250	71.1	71.1	0.0	0.0	57.8	0.2	3.3	0.0	0.0	0.0	0.0	-0.0	9.7	9.7
5	396773.06	4963160.37	167.58	0	500	76.5	76.5	0.0	0.0	57.8	0.4	-0.5	0.0	0.0	0.0	0.0	-0.0	18.7	18.7
6	396773.06	4963160.37	167.58	0	1000	73.7	73.7	0.0	0.0	57.8	0.8	-0.9	0.0	0.0	0.0	0.0	-0.0	16.0	16.0
7	396773.06	4963160.37	167.58	0	2000	69.9	69.9	0.0	0.0	57.8	2.1	-0.9	0.0	0.0	0.0	0.0	-0.0	10.9	10.9
8	396773.06	4963160.37	167.58	0	4000	64.7	64.7	0.0	0.0	57.8	7.2	-0.9	0.0	0.0	0.0	0.0	-0.0	0.6	0.6
9	396773.06	4963160.37	167.58	0	8000	55.6	55.6	0.0	0.0	57.8	25.7	-0.9	0.0	0.0	0.0	0.0	-0.0	-27.0	-27.0

Point Source, ISO 9613, Name: "Trans2", ID: "Trans2"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	397004.64	4963360.37	167.50	0	32	37.3	37.3	0.0	0.0	64.3	0.0	-4.6	0.0	0.0	0.0	0.0	-0.0	-22.4	-22.4
2	397004.64	4963360.37	167.50	0	63	56.5	56.5	0.0	0.0	64.3	0.1	-4.6	0.0	0.0	0.0	0.0	-0.0	-3.2	-3.2
3	397004.64	4963360.37	167.50	0	125	68.6	68.6	0.0	0.0	64.3	0.2	3.0	0.0	0.0	0.0	0.0	-0.0	1.2	1.2
4	397004.64	4963360.37	167.50	0	250	71.1	71.1	0.0	0.0	64.3	0.5	2.9	0.0	0.0	0.0	0.0	-0.0	3.4	3.4
5	397004.64	4963360.37	167.50	0	500	76.5	76.5	0.0	0.0	64.3	0.9	-0.9	0.0	0.0	0.0	0.0	-0.0	12.3	12.3
6	397004.64	4963360.37	167.50	0	1000	73.7	73.7	0.0	0.0	64.3	1.7	-1.4	0.0	0.0	0.0	0.0	-0.0	9.1	9.1

Point Source, ISO 9613, Name: "Trans2", ID: "Trans2"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
7	397004.64	4963360.37	167.50	0	2000	69.9	69.9	0.0	0.0	64.3	4.5	-1.4	0.0	0.0	0.0	0.0	-0.0	2.6	2.6
8	397004.64	4963360.37	167.50	0	4000	64.7	64.7	0.0	0.0	64.3	15.1	-1.4	0.0	0.0	0.0	0.0	-0.0	-13.3	-13.3
9	397004.64	4963360.37	167.50	0	8000	55.6	55.6	0.0	0.0	64.3	53.9	-1.4	0.0	0.0	0.0	0.0	-0.0	-61.2	-61.2

Point Source, ISO 9613, Name: "Trans3", ID: "Trans3"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396773.06	4963264.37	167.58	0	32	37.3	37.3	0.0	0.0	61.2	0.0	-4.0	0.0	0.0	0.0	0.0	-0.0	-19.9	-19.9
2	396773.06	4963264.37	167.58	0	63	56.5	56.5	0.0	0.0	61.2	0.0	-4.0	0.0	0.0	0.0	0.0	-0.0	-0.7	-0.7
3	396773.06	4963264.37	167.58	0	125	68.6	68.6	0.0	0.0	61.2	0.1	2.6	0.0	0.0	0.0	0.0	-0.0	4.7	4.7
4	396773.06	4963264.37	167.58	0	250	71.1	71.1	0.0	0.0	61.2	0.3	3.1	0.0	0.0	0.0	0.0	-0.0	6.5	6.5
5	396773.06	4963264.37	167.58	0	500	76.5	76.5	0.0	0.0	61.2	0.6	-0.8	0.0	0.0	0.0	0.0	-0.0	15.5	15.5
6	396773.06	4963264.37	167.58	0	1000	73.7	73.7	0.0	0.0	61.2	1.2	-1.2	0.0	0.0	0.0	0.0	-0.0	12.5	12.5
7	396773.06	4963264.37	167.58	0	2000	69.9	69.9	0.0	0.0	61.2	3.1	-1.2	0.0	0.0	0.0	0.0	-0.0	6.8	6.8
8	396773.06	4963264.37	167.58	0	4000	64.7	64.7	0.0	0.0	61.2	10.6	-1.2	0.0	0.0	0.0	0.0	-0.0	-5.8	-5.8
9	396773.06	4963264.37	167.58	0	8000	55.6	55.6	0.0	0.0	61.2	37.7	-1.2	0.0	0.0	0.0	0.0	-0.0	-42.1	-42.1

Point Source, ISO 9613, Name: "Trans4", ID: "Trans4"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396797.26	4963432.37	164.00	0	32	37.3	37.3	0.0	0.0	64.8	0.0	-4.7	0.0	0.0	0.0	0.0	-0.0	-22.8	-22.8
2	396797.26	4963432.37	164.00	0	63	56.5	56.5	0.0	0.0	64.8	0.1	-4.7	0.0	0.0	0.0	0.0	-0.0	-3.6	-3.6
3	396797.26	4963432.37	164.00	0	125	68.6	68.6	0.0	0.0	64.8	0.2	3.0	0.0	0.0	0.0	0.0	-0.0	0.6	0.6
4	396797.26	4963432.37	164.00	0	250	71.1	71.1	0.0	0.0	64.8	0.5	2.9	0.0	0.0	0.0	0.0	-0.0	2.9	2.9
5	396797.26	4963432.37	164.00	0	500	76.5	76.5	0.0	0.0	64.8	0.9	-1.0	0.0	0.0	0.0	0.0	-0.0	11.7	11.7
6	396797.26	4963432.37	164.00	0	1000	73.7	73.7	0.0	0.0	64.8	1.8	-1.4	0.0	0.0	0.0	0.0	-0.0	8.5	8.5
7	396797.26	4963432.37	164.00	0	2000	69.9	69.9	0.0	0.0	64.8	4.7	-1.4	0.0	0.0	0.0	0.0	-0.0	1.8	1.8
8	396797.26	4963432.37	164.00	0	4000	64.7	64.7	0.0	0.0	64.8	16.0	-1.4	0.0	0.0	0.0	0.0	-0.0	-14.7	-14.7
9	396797.26	4963432.37	164.00	0	8000	55.6	55.6	0.0	0.0	64.8	57.1	-1.4	0.0	0.0	0.0	0.0	-0.0	-64.9	-64.9

Point Source, ISO 9613, Name: "Trans5", ID: "Trans5"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396770.68	4963592.37	161.53	0	32	37.3	37.3	0.0	0.0	67.3	0.0	-5.0	0.0	0.0	0.0	0.0	-0.0	-25.0	-25.0
2	396770.68	4963592.37	161.53	0	63	56.5	56.5	0.0	0.0	67.3	0.1	-5.0	0.0	0.0	0.0	0.0	-0.0	-5.8	-5.8
3	396770.68	4963592.37	161.53	0	125	68.6	68.6	0.0	0.0	67.3	0.3	3.5	0.0	0.0	0.0	0.0	-0.0	-2.5	-2.5
4	396770.68	4963592.37	161.53	0	250	71.1	71.1	0.0	0.0	67.3	0.7	2.8	0.0	0.0	0.0	0.0	-0.0	0.4	0.4
5	396770.68	4963592.37	161.53	0	500	76.5	76.5	0.0	0.0	67.3	1.3	-1.1	0.0	0.0	0.0	0.0	-0.0	9.0	9.0
6	396770.68	4963592.37	161.53	0	1000	73.7	73.7	0.0	0.0	67.3	2.4	-1.5	0.0	0.0	0.0	0.0	-0.0	5.6	5.6
7	396770.68	4963592.37	161.53	0	2000	69.9	69.9	0.0	0.0	67.3	6.3	-1.5	0.0	0.0	0.0	0.0	-0.0	-2.1	-2.1
8	396770.68	4963592.37	161.53	0	4000	64.7	64.7	0.0	0.0	67.3	21.3	-1.5	0.0	0.0	0.0	0.0	-0.0	-22.4	-22.4
9	396770.68	4963592.37	161.53	0	8000	55.6	55.6	0.0	0.0	67.3	76.0	-1.5	0.0	0.0	0.0	0.0	-0.0	-86.1	-86.1

Point Source, ISO 9613, Name: "Trans6", ID: "Trans6"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396646.98	4963808.07	158.50	0	32	37.3	37.3	0.0	0.0	69.9	0.0	-5.3	0.0	0.0	0.0	0.0	-0.0	-27.3	-27.3
2	396646.98	4963808.07	158.50	0	63	56.5	56.5	0.0	0.0	69.9	0.1	-5.3	0.0	0.0	0.0	0.0	-0.0	-8.2	-8.2
3	396646.98	4963808.07	158.50	0	125	68.6	68.6	0.0	0.0	69.9	0.4	4.0	0.0	0.0	0.0	0.0	-0.0	-5.6	-5.6
4	396646.98	4963808.07	158.50	0	250	71.1	71.1	0.0	0.0	69.9	0.9	2.7	0.0	0.0	0.0	0.0	-0.0	-2.4	-2.4
5	396646.98	4963808.07	158.50	0	500	76.5	76.5	0.0	0.0	69.9	1.7	-1.1	0.0	0.0	0.0	0.0	-0.0	6.0	6.0
6	396646.98	4963808.07	158.50	0	1000	73.7	73.7	0.0	0.0	69.9	3.2	-1.6	0.0	0.0	0.0	0.0	-0.0	2.2	2.2
7	396646.98	4963808.07	158.50	0	2000	69.9	69.9	0.0	0.0	69.9	8.5	-1.6	0.0	0.0	0.0	0.0	-0.0	-6.9	-6.9
8	396646.98	4963808.07	158.50	0	4000	64.7	64.7	0.0	0.0	69.9	28.8	-1.6	0.0	0.0	0.0	0.0	-0.0	-32.4	-32.4
9	396646.98	4963808.07	158.50	0	8000	55.6	55.6	0.0	0.0	69.9	102.8	-1.6	0.0	0.0	0.0	0.0	-0.0	-115.5	-115.5

Point Source, ISO 9613, Name: "Trans7", ID: "Trans7"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	396321.63	4963624.37	156.49	0	32	37.3	37.3	0.0	0.0	69.5	0.0	-5.2	0.0	0.0	0.0	0.0	-0.0	-26.9	-26.9
2	396321.63	4963624.37	156.49	0	63	56.5	56.5	0.0	0.0	69.5	0.1	-5.2	0.0	0.0	0.0	0.0	-0.0	-7.8	-7.8
3	396321.63	4963624.37	156.49	0	125	68.6	68.6	0.0	0.0	69.5	0.3	3.9	0.0	0.0	0.0	0.0	-0.0	-5.1	-5.1
4	396321.63	4963624.37	156.49	0	250	71.1	71.1	0.0	0.0	69.5	0.9	2.7	0.0	0.0	0.0	0.0	-0.0	-1.9	-1.9

Point Source, ISO 9613, Name: "Trans7", ID: "Trans7"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
5	396321.63	4963624.37	156.49	0	500	76.5	76.5	0.0	0.0	69.5	1.6	-1.1	0.0	0.0	0.0	0.0	-0.0	6.5	6.5
6	396321.63	4963624.37	156.49	0	1000	73.7	73.7	0.0	0.0	69.5	3.1	-1.6	0.0	0.0	0.0	0.0	-0.0	2.8	2.8
7	396321.63	4963624.37	156.49	0	2000	69.9	69.9	0.0	0.0	69.5	8.1	-1.6	0.0	0.0	0.0	0.0	-0.0	-6.1	-6.1
8	396321.63	4963624.37	156.49	0	4000	64.7	64.7	0.0	0.0	69.5	27.4	-1.6	0.0	0.0	0.0	0.0	-0.0	-30.6	-30.6
9	396321.63	4963624.37	156.49	0	8000	55.6	55.6	0.0	0.0	69.5	97.8	-1.6	0.0	0.0	0.0	0.0	-0.0	-110.1	-110.1