

Appendix 7.4.8 Predicted Noise Levels at Noise Sensitive Receivers from Operation of APUs

The Worst Operation Mode (Year 2030)

The prediction method set out in ISO-9613 was used to calculate the A-weighted equivalent continuous noise level ($L_{Aeq,30 \text{ mins}}$ (dBA)) for the worst 30 mins. periods during day & evening and night time periods (same as the ones for the aircraft taxiing operations) at NSRs for Year 2030 due to the operation of APUs. **Tables 1a & b** show the unmitigated ground noise levels associated with the operation of APUs (in $L_{Aeq, 30 \text{ mins}}$) under the worst 30 mins. period during day & evening and night time periods, respectively, at the representative NSRs, which are detailed in the **Appendix 7.4.8**.

Table 1a: Planned Ground Noise Levels in Year 2030 (Unmitigated)

Time Period	*Predicted $L_{Aeq, 30 \text{ mins}}$ at NSRs (dBA)														
	TC-1	TC-2	TC-3	TC-4	TC-5	TC-6	TC-7	TC-11	TC-16	TC-46	TS-1	TS-2	SLW -1	SLW -2	SLW -3
Day & Evening 1700-1730	29	28	28	28	29	29	28	29	29	28	32	32	32	30	28
*Noise Criteria (dBA)	60	60	65	60	60	60	60	60	60	60	64	60	65	65	63
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Night 2330-2400	31	31	30	31	34	33	29	30	30	31	38	38	35	32	30
*Noise Criteria (dBA)	50	50	55	50	50	50	50	50	50	50	55	50	55	55	55
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Remarks:

- 1). Oversea studies on APU noise were reviewed and reference was made to the London Manston Aircraft Noise Assessment and Mitigation Report. The worst reference noise level of 65 dBA at a distance of 152 m (i.e. SWL = 117 dBA) for the APU of Large Pass./Freights (B747) (Source: www.m-a-g.fsnet.co.uk) is assumed for all APUs. In order to further validate the assumptions, analysis of available noise data on powered mechanical equipment was conducted accordingly. For the large passenger aircraft/ freighter of B747 which has one APU that consists of a gas turbine driving two electric generators and an air compressor, the SWLs of generators and air compressor for the APU can be similarly estimated in accordance with Tables D.7 & F.1 of BS 5228-1: 2009 and GW-TM, respectively. By considering the doubling of energy for two generators and also the noise from the concurrent operation of the air compressor, the total SWL of APU can be reasonably estimated to be not more than 117 dB(A). Therefore, it is considered that the SWL of 117 dB(A) for operating APU adopted in the analysis is a conservative estimate.
- 2). Equivalent stationary locations for each APU have been adopted with the total operation time of 1 min. (before the aircraft reaching the gate) / 5 mins. (after the aircraft leaving the gate) throughout the 30 mins. period under the runway utilization mode of arrival / departure, respectively.
- 3). An atmospheric correction (assumed at 500 Hz, 23.6°C, RH 68.3%) has been accounted for in accordance with ISO-9613 "Acoustics - Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere".
- 4). Correction for scaling up to the busiest day (based on the busiest dates profile in Year 2011) for peak ground noise assessment with +0.5 dBA has been adopted. Detailed can be referred to the **Appendix 7.4.4**.
- 5). (*) denotes the planned fixed noise criteria or the predicted ground noise levels associated with the operation of APUs for 07L-25R (North) only.

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Table 1b: Cumulative Ground Noise Levels in Year 2030 (Unmitigated)

Time Period	Predicted $L_{Aeq, 30 \text{ mins}}$ at NSRs (dBA)														
	TC-1	TC-2	TC-3	TC-4	TC-5	TC-6	TC-7	TC-11	TC-16	TC-46	TS-1	TS-2	SLW -1	SLW -2	SLW -3
Day & Evening 1700-1730	40	39	39	39	41	41	40	40	40	39	46	45	49	44	42
Noise Criteria (dBA)	65	65	70	65	65	65	65	65	65	65	70	65	70	70	70
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Night 2330-2400	41	40	40	41	43	43	39	39	40	40	49	48	44	41	39
Noise Criteria (dBA)	55	55	60	55	55	55	55	55	55	55	60	55	60	60	60
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Remarks:

- 1). Oversea studies on APU noise were reviewed and reference was made to the London Manston Aircraft Noise Assessment and Mitigation Report. The worst reference noise level of 65 dBA at a distance of 152 m (i.e. SWL = 117 dBA) for the APU of Large Pass./Freights (B747) (Source: www.m-a-g.fsnet.co.uk) is assumed for all APUs. In order to further validate the assumptions, analysis of available noise data on powered mechanical equipment was conducted accordingly. For the large passenger aircraft/ freighter of B747 which has one APU that consists of a gas turbine driving two electric generators and an air compressor, the SWLs of generators and air compressor for the APU can be similarly estimated in accordance with Tables D.7 & F.1 of BS 5228-1: 2009 and GW-TM, respectively. By considering the doubling of energy for two generators and also the noise from the concurrent operation of the air compressor, the total SWL of APU can be reasonably estimated to be not more than 117 dB(A). Therefore, it is considered that the SWL of 117 dB(A) for operating APU adopted in the analysis is a conservative estimate.
- 2). Equivalent stationary locations for each APU have been adopted with the total operation time of 1 min. (before the aircraft reaching the gate) / 5 mins. (after the aircraft leaving the gate) throughout the 30 mins. period under the runway utilization mode of arrival / departure, respectively.
- 3). An atmospheric correction (assumed at 500 Hz, 23.6°C, RH 68.3%) has been accounted for in accordance with ISO-9613 "Acoustics - Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere".
- 4). Correction for scaling up to the busiest day (based on the busiest dates profile in Year 2011) for peak ground noise assessment with +0.5 dBA has been adopted. Detailed can be referred to the **Appendix 7.4.4**.

The Interim Phase Operation Mode (Year 2021)

Tables 2a & b show the unmitigated ground noise levels associated with the operation of APUs (in $L_{Aeq, 30 \text{ mins}}$) under the worst 30 mins. period during day & evening and night time periods, respectively, at the representative NSRs for Year 2021, which are detailed in the **Appendix 7.4.8**.

Table 2a: Planned Ground Noise Levels in Year 2021 (Unmitigated)

Time Period	*Predicted $L_{Aeq, 30 \text{ mins}}$ at NSRs (dBA)														
	TC-1	TC-2	TC-3	TC-4	TC-5	TC-6	TC-7	TC-11	TC-16	TC-46	TS-1	TS-2	SLW -1	SLW -2	SLW -3
Day & Evening 1400-1430	31	30	29	29	31	31	30	30	30	29	36	36	37	33	31
*Noise Criteria (dBA)	60	60	65	60	60	60	60	60	60	60	64	60	65	65	63
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Night 2300-2330	31	30	30	30	32	32	30	30	30	30	37	37	39	35	34
*Noise Criteria (dBA)	50	50	55	50	50	50	50	50	50	50	55	50	55	55	55
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Remarks:

- 1). Oversea studies on APU noise were reviewed and reference was made to the London Manston Aircraft Noise Assessment and Mitigation Report. The worst reference noise level of 65 dBA at a distance of 152 m (i.e. SWL = 117 dBA) for the APU of Large Pass./Freights (B747) (Source: www.m-a-g.fsnet.co.uk) is assumed for all APUs. In order to further validate the assumptions, analysis of available noise data on powered mechanical equipment was conducted accordingly. For the large passenger aircraft/ freighter of B747 which has one APU that consists of a gas turbine driving two electric generators and an air compressor, the SWLs of generators and air compressor for the APU can be similarly estimated in accordance with Tables D.7 & F.1 of BS 5228-1: 2009 and GW-TM, respectively. By considering the doubling of energy for two generators and also the noise from the concurrent operation of the air compressor, the total SWL of APU can be reasonably estimated to be not more than 117 dB(A). Therefore, it is considered that the SWL of 117 dB(A) for operating APU adopted in the analysis is a conservative estimate.
- 2). Equivalent stationary locations for each APU have been adopted with the total operation time of 1 min. (before the aircraft reaching the gate) / 5 mins. (after the aircraft leaving the gate) throughout the 30 mins. period under the runway utilization mode of arrival / departure, respectively.
- 3). An atmospheric correction (assumed at 500 Hz, 23.6°C, RH 68.3%) has been accounted for in accordance with ISO-9613 "Acoustics - Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere".
- 4). Correction for scaling up to the busiest day (based on the busiest dates profile in Year 2011) for peak ground noise assessment with +0.5 dBA has been adopted. Detailed can be referred to the **Appendix 7.4.4**.
- 5). (*) denotes the planned fixed noise criteria or the predicted ground noise levels associated with the operation of APUs for 07L-25R (North) only.

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Table 2b: Cumulative Ground Noise Levels in Year 2021 (Unmitigated)

Time Period	Predicted $L_{Aeq, 30 \text{ mins}}$ at NSRs (dBA)														
	TC-1	TC-2	TC-3	TC-4	TC-5	TC-6	TC-7	TC-11	TC-16	TC-46	TS-1	TS-2	SLW -1	SLW -2	SLW -3
Day & Evening 1400-1430	41	40	40	41	42	42	40	40	40	40	48	47	50	46	43
Noise Criteria (dBA)	65	65	70	65	65	65	65	65	65	65	70	65	70	70	70
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Night 2300-2330	40	39	38	39	41	41	38	38	39	39	46	46	49	45	42
Noise Criteria (dBA)	55	55	60	55	55	55	55	55	55	55	60	55	60	60	60
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Remarks:

- 1). Oversea studies on APU noise were reviewed and reference was made to the London Manston Aircraft Noise Assessment and Mitigation Report. The worst reference noise level of 65 dBA at a distance of 152 m (i.e. SWL = 117 dBA) for the APU of Large Pass./Freights (B747) (Source: www.m-a-g.fsnet.co.uk) is assumed for all APUs. In order to further validate the assumptions, analysis of available noise data on powered mechanical equipment was conducted accordingly. For the large passenger aircraft/ freighter of B747 which has one APU that consists of a gas turbine driving two electric generators and an air compressor, the SWLs of generators and air compressor for the APU can be similarly estimated in accordance with Tables D.7 & F.1 of BS 5228-1: 2009 and GW-TM, respectively. By considering the doubling of energy for two generators and also the noise from the concurrent operation of the air compressor, the total SWL of APU can be reasonably estimated to be not more than 117 dB(A). Therefore, it is considered that the SWL of 117 dB(A) for operating APU adopted in the analysis is a conservative estimate.
- 2). Equivalent stationary locations for each APU have been adopted with the total operation time of 1 min. (before the aircraft reaching the gate) / 5 mins. (after the aircraft leaving the gate) throughout the 30 mins. period under the runway utilization mode of arrival / departure, respectively.
- 3). An atmospheric correction (assumed at 500 Hz, 23.6°C, RH 68.3%) has been accounted for in accordance with ISO-9613 "Acoustics - Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere".
- 4). Correction for scaling up to the busiest day (based on the busiest dates profile in Year 2011) for peak ground noise assessment with +0.5 dBA has been adopted. Detailed can be referred to the **Appendix 7.4.4**.

Full Operation Mode (Year 2032)

Tables 3a & b show the unmitigated ground noise levels associated with the operation of APUs (in $L_{Aeq, 30 \text{ mins}}$) under the worst 30 mins. period during day & evening and night time periods, respectively, at the representative NSRs for Year 2032, which are detailed in the **Appendix 7.4.8**.

Table 3a: Planned Ground Noise Levels in Year 2032 (Unmitigated)

Time Period	*Predicted $L_{Aeq, 30 \text{ mins}}$ at NSRs (dBA)														
	TC-1	TC-2	TC-3	TC-4	TC-5	TC-6	TC-7	TC-11	TC-16	TC-46	TS-1	TS-2	SLW -1	SLW -2	SLW -3
Day & Evening 1700-1730	33	32	31	31	32	32	33	33	33	31	34	33	30	27	26
*Noise Criteria (dBA)	60	60	65	60	60	60	60	60	60	60	64	60	65	65	63
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Night 2330-2400	32	40	31	31	33	33	31	31	31	31	38	37	35	32	30
*Noise Criteria (dBA)	50	50	55	50	50	50	50	50	50	50	55	50	55	55	55
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Remarks:

- 1). Oversea studies on APU noise were reviewed and reference was made to the London Manston Aircraft Noise Assessment and Mitigation Report. The worst reference noise level of 65 dBA at a distance of 152 m (i.e. SWL = 117 dBA) for the APU of Large Pass./Freights (B747) (Source: www.m-a-g.fsnet.co.uk) is assumed for all APUs. In order to further validate the assumptions, analysis of available noise data on powered mechanical equipment was conducted accordingly. For the large passenger aircraft/ freighter of B747 which has one APU that consists of a gas turbine driving two electric generators and an air compressor, the SWLs of generators and air compressor for the APU can be similarly estimated in accordance with Tables D.7 & F.1 of BS 5228-1: 2009 and GW-TM, respectively. By considering the doubling of energy for two generators and also the noise from the concurrent operation of the air compressor, the total SWL of APU can be reasonably estimated to be not more than 117 dB(A). Therefore, it is considered that the SWL of 117 dB(A) for operating APU adopted in the analysis is a conservative estimate.
- 2). Equivalent stationary locations for each APU have been adopted with the total operation time of 1 min. (before the aircraft reaching the gate) / 5 mins. (after the aircraft leaving the gate) throughout the 30 mins. period under the runway utilization mode of arrival / departure, respectively.
- 3). An atmospheric correction (assumed at 500 Hz, 23.6°C, RH 68.3%) has been accounted for in accordance with ISO-9613 "Acoustics - Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere".
- 4). Correction for scaling up to the busiest day (based on the busiest dates profile in Year 2011) for peak ground noise assessment with +0.5 dBA has been adopted. Detailed can be referred to the **Appendix 7.4.4**.
- 5). (*) denotes the planned fixed noise criteria or the predicted ground noise levels associated with the operation of APUs for 07L-25R (North) only.

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Table 3b: Cumulative Ground Noise Levels in Year 2032 (Unmitigated)

Time Period	Predicted $L_{Aeq, 30 \text{ mins}}$ at NSRs (dBA)														
	TC-1	TC-2	TC-3	TC-4	TC-5	TC-6	TC-7	TC-11	TC-16	TC-46	TS-1	TS-2	SLW -1	SLW -2	SLW -3
Day & Evening 1700-1730	42	40	40	39	41	40	41	41	41	39	43	43	42	39	37
Noise Criteria (dBA)	65	65	70	65	65	65	65	65	65	65	70	65	70	70	70
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Night 2330-2400	41	40	40	40	42	42	39	40	40	40	46	46	43	40	39
Noise Criteria (dBA)	55	55	60	55	55	55	55	55	55	55	60	55	60	60	60
Exceedance of Noise Criteria?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mitigation Measure required?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Remarks:

- 1). Oversea studies on APU noise were reviewed and reference was made to the London Manston Aircraft Noise Assessment and Mitigation Report. The worst reference noise level of 65 dBA at a distance of 152 m (i.e. SWL = 117 dBA) for the APU of Large Pass./Freights (B747) (Source: www.m-a-g.fsnet.co.uk) is assumed for all APUs. In order to further validate the assumptions, analysis of available noise data on powered mechanical equipment was conducted accordingly. For the large passenger aircraft/ freighter of B747 which has one APU that consists of a gas turbine driving two electric generators and an air compressor, the SWLs of generators and air compressor for the APU can be similarly estimated in accordance with Tables D.7 & F.1 of BS 5228-1: 2009 and GW-TM, respectively. By considering the doubling of energy for two generators and also the noise from the concurrent operation of the air compressor, the total SWL of APU can be reasonably estimated to be not more than 117 dB(A). Therefore, it is considered that the SWL of 117 dB(A) for operating APU adopted in the analysis is a conservative estimate.
- 2). Equivalent stationary locations for each APU have been adopted with the total operation time of 1 min. (before the aircraft reaching the gate) / 5 mins. (after the aircraft leaving the gate) throughout the 30 mins. period under the runway utilization mode of arrival / departure, respectively.
- 3). An atmospheric correction (assumed at 500 Hz, 23.6°C, RH 68.3%) has been accounted for in accordance with ISO-9613 "Acoustics - Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere".
- 4). Correction for scaling up to the busiest day (based on the busiest dates profile in Year 2011) for peak ground noise assessment with +0.5 dBA has been adopted. Detailed can be referred to the **Appendix 7.4.4**.