2026/06/15 2026/080/SUPDT-R/41

All KCASR Stockholders and Users

Subject.: ***Notice of Proposed Amendment's (NPA) No. 2026-13 to Kuwait Civil Aviation Safety Regulations KCASR 16 – ENVIRONMENTAL PROTECTIONVOLUME – I Rev 04.***

Dear Sir,

Purpose:

The purpose of this NPA is to announce to the KCASR users the intention of the Civil Aviation Authority to amend ***KCASR 16 – ENVIRONMENTAL PROTECTIONVOLUME – I*** (issue 4) to comply with ICAO standers and recommended practices up to amendment (15).

Action Required:

All users of KCASR are required to refer to the CAA/ASD website (https://kcasr.dgca.gov.kw) for reviewing the NPA and mail or email (safety@dgca.gov.kw) their comments by 24/Sep/2026 using the attached NPA Response Sheet Forms No. 1500 or using NPA comments & feedback form on the website. If we do not receive your response by this date, it will be assumed that you do not have any comments on the proposal.

If required, the CAA/Aviation Safety Department personnel are available to answer your questions on the interpretation and intended implementation of the proposed amendments.

This is for your information and distribution to the concerned parties.

Yours Sincerely,

President of Civil Aviation

Abdullah F. Alrajhi
Acting / Deputy Director General
for Aviation Safety, Air Transport & Aviation Security

CC: Director General of Civil Aviation.
Dy. Dir. Gen. Kuwait. Intel. Airport Affairs.
Dy. Dir. Gen. for Air Navigation Services Affairs.
Safety Management Coordination Center (SMCC).
Head of Technical Office.
Civil Aviation Security Department.
Aviation Safety Director.
Air Transport Director.
Legal Department

NPA RESPONSE FORM

NPA 2026-13

Please add your comments on the proposal by ticking [✓] the appropriate box below.

Any additional constructive comments, suggested amendments or alternative action will be welcome and may be provided on this response sheet or by separate correspondence.

☐ No comments on the proposal.

☐ Comments on the proposal. (Please provide explanatory comment).

Name:	Organization:
Address/Contact No:	
E-Mail:	
Signature:	Date:

Notes on the presentation of the Amendment
Notice Of Proposed Amendment
(NPA)

The text of the amendment is arranged to show deleted text in Red Color and with a line through it, new text to be inserted is in Blue color as shown below:

~~Text to be deleted is in Red and shown with a line through it.~~	**Text to be deleted**
New text to be inserted is in Blue Color.	**New text to be inserted**
~~Text to be deleted is in Red and shown with a line through it~~, followed by the replacement text which is in Blue Color.	**New text to replace existing text**
. . . Indicates that remaining text is unchanged in front or following the reflected amendment.	**Text is unchanged**

Notice Of Safety Regulation Amendment
(NPA, NSRA and Revisions)

Side bar indicates that text is changed or added.

Kuwait Civil Aviation Safety Regulations

KCASR 16 – ENVIRONMENTAL PROTECTION

VOLUME – I

Amendment Record

Amendment No	Date of Issue	Remarks
1	Jun. 2018	Part Rename
2	Aug. 2020	Based on NPA 2020-15 Updated to ICAO Annex 16 – Vol I (Amendment 13)
3	Jun. 2023	Updated to ICAO Annex 16 – Vol I (Amendment 14)
4	Nov. 2026	Updated to ICAO Annex 16 – Vol I (Amendment 15)

Control of this Document

DC.1 Introduction

DC.1.1 Pursuant to Law No 85 of the Year 2025 and Law No (30) of the year 1960 and subsequent Ministerial Decisions No (3) of the year 1986, No (18) of the year 1990, and No (18) of the year 1996, based upon that Law, the President of the Kuwait Directorate General of Civil Aviation is empowered to adopt and amend Kuwait Civil Aviation Safety Regulations. In accordance herewith, the following Regulation is hereby established for compliance by all persons concerned. This regulation shall be known as KCASR 16, Volume I – Environmental Protection and any reference to this title shall mean referring to these regulations governing the basic requirements to be met for civil aviation in the State of Kuwait.

DC.2 Authority for this Requirement

DC.2.1 This KCASR 16, Volume I – Environmental Protection is issued on the authority of the President of the Kuwait Directorate General of Civil Aviation.

DC.3 Applicability

DC.3.1 This KCASR 16, Volume I – Environmental Protection is applicable to the aviation industry of State of Kuwait.

DC.4 Scope

DC.4.1 KCASR 16, Volume I – Environmental Protection contains the basic regulations to be met for civil aviation in State of Kuwait, and shows compliance with ICAO Annexes. The regulations are separated into the following civil aviation safety regulations with cross references where applicable.

KCASR 0 – Basic Regulation

KCASR 1 – Personnel Licensing

KCASR 2 – Rules of the Air

KCASR 3 – Meteorological Service for International Air Navigation

KCASR 4 – Aeronautical Charts

KCASR 5 – Units of Measurement

KCASR 6 – Operation of Aircraft

KCASR 7 – Aircraft Registration and Cancellation

KCASR 8 – Airworthiness of Aircraft and Continuous Airworthiness

KCASR 9 – Facilitation

KCASR 10 – Aeronautical Telecommunications

KCASR 11 – Air Traffic Services

KCASR 12 – Search and Rescue

KCASR 13 – Aircraft Accident and Incident Investigation

KCASR 14 – Volume I - Aerodromes

KCASR 14 – Volume II – Aerodromes – Heliports

KCASR 14 – Volume III – Gropund Handling Operations (GHO)

KCASR 15 – Aeronautical Information Services

KCASR 16 – Environmental Protection

KCASR 18 – Dangerous Goods

KCASR 17 – Aviation Security

KCASR 19 – Safety Management

KCASR 22 – Unmanned Aircraft Systems

KCASR 23 – Light Sport Aircraft

KCASR 25 – Special Aviation Regulations

KCASR 26 – Enforcement and Sanctions

KCASR 27 – Charges and Fees

KCASR 28 – Instrument Flight Procedure Design Requirements

PART I. DEFINITIONS, NOMENCLATURE: SYMBOLS AND UNITS

Aeroplane. A power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight.

Aircraft. Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

Associated aircraft systems. Those aircraft systems drawing electrical/pneumatic power from an auxiliary power unit during ground operations.

Auxiliary power-unit (APU). A self-contained power-unit on an aircraft providing electrical/pneumatic power to aircraft systems during ground operations.

Bypass ratio. The ratio of the air mass flow through the bypass ducts of a gas turbine engine to the air mass flow through the combustion chambers calculated at maximum thrust when the engine is stationary in an international standard atmosphere at sea level.

Derived version of an aircraft. An aircraft which incorporates changes in type design which may adversely affect its noise characteristics as follows:
1. For aeroplanes certificated according to Chapters 3, 4, 14, 15 or 16 – an increase of more than 0.10 EPNdB in any one of the noise certification levels, unless the cumulative effect of changes in type design are tracked by an approved procedure, in which case a cumulative increase in the noise level in any one of the noise certification levels of more than 0.30 EPNdB or the margin of compliance, whichever is smaller.

2. For aeroplanes certificated according to Chapters 6 or 10 – an increase of more than 0.10 dB(A) in the noise certification level, unless the cumulative effect of changes in type design is tracked by an approved procedure, in which case a cumulative increase in the noise certification level of more than 0.30 dB(A) or the margin of compliance, whichever is smaller.

3. For helicopters – an increase of more than 0.30 EPNdB in any one of the noise certification levels for helicopters certificated according to Chapter 8, and 0.30 dB(A) in the noise certification level for helicopters certificated according to Chapter 11.

4. For tilt-rotors – an increase of more than 0.30 EPNdB in any one of the take-off, approach or overflight in VTOL/conversion mode noise certification levels.

~~***Derived version of a helicopter.*** A helicopter which, from the point of view of airworthiness, is similar to the noise-certificated prototype but incorporates changes in type design which may affect its noise characteristics adversely.~~

~~***Note 1.*** *A helicopter that is based on an existing prototype but which is considered by the certificating authority to be a new type design for airworthiness purposes is considered as a derived version for noise purposes if the noise source characteristics are judged by the certificating authority to be the same as the prototype.*~~

~~***Note 2.*** *"Adversely" refers to an increase of more than 0.30 EPNdB in any one of the noise certification levels for helicopters certificated according to Chapter 8 and 0.30 dB(A) in the certification level for helicopters certificated*~~

~~*according to Chapter 11.*~~

~~***Derived version of an aeroplane.*** An aeroplane which, from the point of view of airworthiness, is similar to the noise-certificated prototype but incorporates changes in type design which may affect its noise characteristics adversely.~~

~~***Note 1.*** *Where the certificating authority finds that the proposed change in design, configuration, power or mass is so extensive that a substantially new investigation of compliance with the applicable airworthiness regulations is required, the aeroplane is generally considered to be a new type design rather than a derived version.*~~

~~***Note 2.*** *"Adversely" refers to an increase of more than 0.10 dB in any one of the noise certification levels unless the cumulative effects of changes in type design are tracked by an approved procedure in which case "adversely" refers to a cumulative increase in the noise level in any one of the noise certification levels of more than 0.30 dB or the margin of compliance, whichever is smaller.*~~

External equipment (helicopter). Any instrument, mechanism, part, apparatus, appurtenance, or accessory that is attached to or extends from the helicopter exterior but is not used nor is intended to be used for operating or controlling a helicopter in flight and is not part of an airframe or engine.

Helicopter. A heavier-than-air aircraft supported in flight chiefly by the reactions of the air on one or more power-driven rotors on substantially vertical axes.

Human performance. Human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations.

***Powered-lift*.** A heavier-than-air aircraft capable of vertical take-off, vertical landing, and low-speed flight, which depends principally on engine-driven lift devices or engine thrust for the lift during these flight regimes and on non-rotating aerofoil(s) for lift during horizontal flight.

Recertification. Certification of an aircraft with or without a revision to its certification noise levels, to a Standard different to that to which it was originally certificated.

Self-sustaining powered sailplane. A powered aeroplane with available engine power which allows it to maintain level flight but not to take off under its own power.

***State of Design*.** The State having jurisdiction over the organization responsible for the type design.

State of Registry. The State on whose register the aircraft is entered.

Subsonic aeroplane. An aeroplane incapable of sustaining level flight at speeds exceeding flight Mach number of 1.

***Supersonic aeroplane*.** An aeroplane capable of sustaining level flight at speeds exceeding flight Mach number of 1.

***Tilt-rotor*.** A powered-lift capable of vertical take-off, vertical landing, and sustained low-speed

μ	-	Engine noise performance parameter. For jet aeroplanes, typically the normalized low pressure fan speed, normalized engine thrust, or engine pressure ratio used in the calculation of the source noise adjustment.

PART II. AIRCRAFT NOISE CERTIFICATION

CHAPTER 1. ADMINISTRATION

1.1 The provisions of 1.2 to 1.6 should apply to all aircraft included in the classifications defined for noise certification purposes in Chapters 2, 3, 4, 5, 6, 8, 10, 11, 12, 13 ~~and~~, 14, 15 and 16 of this part where such aircraft are engaged in international air navigation.

1.2 Noise certification should be granted or validated by the State of Registry of an aircraft on the basis of satisfactory evidence that the aircraft complies with requirements that are at least equal to the applicable Standards specified in this Part.

1.3 If noise recertification is requested, it should be granted or validated by the State of Registry of an aircraft on the basis of satisfactory evidence that the aircraft complies with requirements that are at least equal to the applicable Standards specified in this Part. The date used by a certificating authority to determine the recertification basis should be the date of acceptance of the first application for recertification.

1.4 The documents attesting noise certification should be approved by the State of Registry and should be required by that State to be carried on the aircraft.

Note *- See part 6, Part I, 6.13, concerning the translation into English of documents attesting noise certification.*

1.5 The documents attesting noise certification for an aircraft should provide at least the following information:

Item 1 Name of State.

Item 2 Title of the noise document. Item 3. Number of the document.

Item 4 Nationality or common mark and registration marks. Item 5. Manufacturer and manufacturer's designation of aircraft. Item 6. Aircraft serial number.

Item 7 Engine manufacturer, type and model.

Item 8 Propeller type and model for propeller-driven aeroplanes. Item 9. Maximum take-off mass in kilograms.

Item 10 Maximum landing mass, in kilograms, for certificates issued under Chapters 2,

3, 4, 5, 12 ~~,and~~ 14, 15 and 16 of this part.

Item 11. The chapter and section of this part according to which the aircraft was certificated.

Item 12 Additional modifications incorporated for the purpose of compliance with the applicable noise certification Standards.

Item 13 The lateral/full-power noise level in the corresponding unit for documents issued under Chapters 2, 3, 4, 5, ~~12~~ 12~~,and~~ 14, 15 and 16 of this part.

Item 14 The approach noise level in the corresponding unit for documents issued under Chapters 2, 3, 4, 5, 8, 12, 13, ~~and~~ 14, 15 and 16 of this part.

Item 15. The flyover noise level in the corresponding unit for documents issued under Chapters 2, 3, 4, 5, 12, ~~and~~ 14, 15 and 16 of this part.

Item 16. The overflight noise level in the corresponding unit for documents issued under Chapters 6, 8, 11 and 13 of this part.

Item 17. The take-off noise level in the corresponding unit for documents issued under Chapters 8, 10 and 13 of this part.

Item 18. Statement of compliance, including a reference to part 16, Volume I.

Item 19. Date of issuance of the noise certification document.

Item 20. Signature of the officer issuing it.

1.6 Item headings on the noise certification documents should be uniformly numbered in Arabic numerals, as indicated in 1.5, so that on any noise certification document the number will, under any arrangement, refer to the same item heading, except where the information in Items 1 through 6 and Items 18 through 20 is given in the certificate of airworthiness, in which case the numbering system of the certificate of airworthiness according to Part 8 should prevail.

1.7 An administrative system for implementation of noise certification documentation should be developed by the State of Registry.

Note- *See Attachment G for guidance on the format and structure of noise certification documentation.*

1.8 The state of Kuwait should recognize as valid a noise certification granted by another Contracting State provided that the requirements under which such certification was granted are at least equal to the applicable Standards specified in this Part.

1.9 The state of Kuwait should suspend or revoke the noise certification of an aircraft on its

c) time-limited engine and/or nacelle changes, where the change in type design specifies that the aeroplane may not be operated for a period of more than 90 days unless compliance with the provisions of part 16, Volume I, is shown for that change in type design. This applies only to changes resulting from a required maintenance action.

4.2 Noise measurements

4.2.1 Noise evaluation measure

The noise evaluation measure should be the effective perceived noise level in EPNdB as described in Appendix 2.

4.3 ~~Reference noise~~ Noise measurement points

4.3.1 Reference noise measurement points

~~4.3.1~~ An aeroplane, when tested in accordance with these Standards, should not exceed the maximum noise level specified in 4.4 of the noise measured at the points specified in Chapter 3, 3.3.1 a), b) and c).

4.3.2 Test noise measurement points

The provisions of Chapter 3, 3.3.2, relating to test noise measurement points should apply.

4.4 Maximum noise levels

4.4.1 The maximum permitted noise levels are defined in Chapter 3, 3.4.1.1, 3.4.1.2 and 3.4.1.3, and should not be exceeded at any of the measurement points.

4.4.1.1 The sum of the differences at all three measurement points between the maximum noise levels and the maximum permitted noise levels specified in Chapter 3, 3.4.1.1, 3.4.1.2 and 3.4.1.3, should not be less than 10 EPNdB.

4.4.1.2 The sum of the differences at any two measurement points between the maximum noise levels and the corresponding maximum permitted noise levels specified in Chapter 3, 3.4.1.1, 3.4.1.2 and 3.4.1.3, should not be less than EPNdB.

Note-See Attachment A for equations for the calculation of maximum permitted noise levels as a function of take-off mass.

4.5 Noise certification reference procedures

The noise certification reference procedures should be as specified in Chapter 3, 3.6.

4.6 Test procedures

The test procedures should be as specified in Chapter 3, 3.7.

4.7 Recertification

For aeroplanes specified in 4.1.1 ~~c~~d), recertification should be granted on the basis that the evidence used to determine compliance with Chapter 4 is as satisfactory as the evidence associated with aeroplanes specified in 4.1.1 a), b) and ~~b~~c).

10.2 Noise evaluation measure

The noise evaluation measure should be the maximum A-weighted noise level (L_{Amax}) as defined in Appendix 6.

10.3 Reference noise measurement points

10.3.1 An aeroplane, when tested in accordance with these Standards, should not exceed the noise level specified in 10.4 at the take-off reference noise measurement point.

10.3.2 The take-off reference noise measurement point shall be the point on the extended center line of the runway at a distance of 2500 m from the start of take-off roll.

10.4 Maximum noise levels

The maximum noise levels determined in accordance with the noise evaluation method of Appendix 6 should not exceed the following:

a) for aeroplanes specified in 10.1.2, ~~and~~ , 10.1.4 and 10.1.6 c, a 76 dB(A) constant limit up to an aeroplane mass of 600 kg varying linearly from that point with the logarithm of aeroplane mass until at 1400 kg the limit of 88 dB(A) is reached after which the limit is constant up to 8618 kg; and

b) for aeroplanes specified in ~~10.1.4~~10.1.6 a) and b), a 70 dB(A) constant limit up to an aeroplane mass of 570 kg increasing linearly from that point with the logarithm of aeroplane mass until at 1500 kg the limit of 85 dB(A) is reached after which the limit is constant up to 8618 kg.

***Note** -See Attachment A for equations for the calculation of maximum permitted noise levels as a function of take-off mass.*

10.5 Noise certification reference procedures

10.5.1 General conditions

10.5.1.1 The calculations of reference procedures and flight paths should be approved by the certificating authority.

10.5.1.2 Except in conditions specified in 10.5.1.3, the take-off reference procedure should be that defined in 10.5.2.

10.5.1.3 When it is shown by the applicant that the design characteristics of the aeroplane would prevent flights being conducted in accordance with 10.5.2, the reference procedures should:

a) depart from the reference procedures defined only to the extent demanded by those design characteristics which make compliance with the procedures impossible; and

b) be approved by the certificating authority.

10.5.1.4 The reference procedures should be calculated under the following atmospheric

CHAPTER 12. SUPERSONIC AEROPLANES — Application for Type Certificate submitted before 1 January 2029~~Blank.~~

12.1 Supersonic aeroplanes — Application for Type Certificate submitted before 1 January 1975

12.1.1 The Standards of Chapter 2 of this Part, with the exception of the maximum noise levels specified in 2.4, shall be applicable to all supersonic aeroplanes, including their derived versions, for which the application for the Type Certificate was submitted before 1 January 1975, and for which a certificate of airworthiness for the individual aeroplane was first issued after 26 November 1981.

12.1.2 The maximum noise levels of those aeroplanes covered by 12.1.1, when determined in accordance with the noise evaluation method of Appendix 1, shall not exceed the measured noise levels of the first certificated aeroplane of the type.

12.2 Supersonic aeroplanes — Application for Type Certificate submitted on or after 1 January 1975 and before 1 January 2029

Note.— *Standards and Recommended Practices for these aeroplanes have not been developed. However, the maximum noise levels of the Part that would be applicable to subsonic jet aeroplanes may be used as a guideline. Acceptable levels of sonic boom have not been established and compliance with subsonic noise Standards may not be presumed to permit supersonic flight.*

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CHAPTER 14.

1- SUBSONIC JET AEROPLANES AND PROPELLER-DRIVEN AEROPLANES WITH MAXIMUM CERTIFICATED TAKE-OFF MASS 55 000 kg AND OVER — Application for Type Certificate submitted on or after 31 December 2017 and before 1 January 2029

2- SUBSONIC JET AEROPLANES WITH MAXIMUM CERTIFICATED TAKE-OFF MASS LESS THAN 55 000 kg — Application for Type Certificate submitted on or after 31 December 2020 and before 1 January 2029

3- PROPELLER-DRIVEN AEROPLANES WITH MAXIMUM CERTIFICATED TAKE-OFF MASS OVER 8 618 kg AND LESS THAN 55 000 kg — Application for Type Certificate submitted on or after 31 December 2020 and before 1 January 2029

14.1 Applicability

Note.- *See also Chapter 1, 1.10, 1.11, 1.12 and 1.13.*

14.1.1 The Standards of this chapter should, with the exception of those aeroplanes which require a runway[1] length of 610 m or less at maximum certificated mass for airworthiness or propeller-driven aeroplanes specifically designed and used for agricultural or firefighting purposes, be applicable to:

a) all subsonic jet aeroplanes and propeller-driven aeroplanes, including their derived versions, with a maximum certificated take-off mass of 55000 kg and over for which the application for a Type Certificate was submitted on or after 31 December 2017and before 1 January 2029;

b) all subsonic jet aeroplanes, including their derived versions, with a maximum certificated take-off mass of less than 55000 kg for which the application for a Type Certificate was submitted on or after 31 December 2020and before 1 January 2029;

c) all propeller-driven aeroplanes, including their derived versions, with a maximum certificated take-off mass of over 8 618 kg and less than 55000 kg for which the application for a Type Certificate was submitted on or after 31 December 2020 and before 1 January 2029; and

d) all subsonic jet aeroplanes and all propeller-driven aeroplanes certificated originally as satisfying Part 16, Volume I, Chapter 3, Chapter 4 or Chapter 5, for which recertification to Chapter 14 is requested.

Note- *Guidance material on applications for recertification is provided in the* Environmental Technical Manual *(Doc 9501), Volume I* — Procedures for Noise Certification of Aircraft.

14.1.2 Notwithstanding 14.1.1, it may be recognized by a Contracting State that the following

situations for jet aeroplanes and propeller-driven aeroplanes over 8618 kg maximum certificated take-off mass on its registry do not require demonstration of compliance with the provisions of the Standards of part 16, Volume

1. With no stopway or clearway.

a) gear down flight with one or more retractable landing gear down during the entire flight;

b) spare engine and nacelle carriage external to the skin of the aeroplane (and return of the pylon or other external mount); and

c) time-limited engine and/or nacelle changes, where the change in type design specifies that the aeroplane may not be operated for a period of more than 90 days unless compliance with the provisions of Part 16, Volume I, is shown for that change in type design. This applies only to changes resulting from a required maintenance action.

14.2 Noise measurements

14.2.1 Noise evaluation measure

The noise evaluation measure should be the effective perceived noise level in EPNdB as described in Appendix 2.

14.3 ~~Reference noise~~ Noise measurement points

14.3.1 Reference noise measurement points

~~14.3.1~~ An aeroplane, when tested in accordance with these Standards, should not exceed the maximum noise level specified in 14.4 of the noise measured at the points specified in Chapter 3, 3.3.1 a), b) and c).

14.3.2 Test noise measurement points

The provisions of Chapter 3, 3.3.2, relating to test noise measurement points should apply.

14.4 Maximum noise levels

14.4.1 The maximum noise levels, when determined in accordance with the noise evaluation method of Appendix 2, should not exceed the following:

14.4.1.1 *At the lateral full-power reference noise measurement point* 103 EPNdB for aeroplanes with maximum certificated take-off mass, at which the noise certification is requested, of 400000 kg and over, decreasing linearly with the logarithm of the mass down to 94

14.6 Test procedures

The test procedures should be as specified in Chapter 3, 3.7.

14.7 Recertification

For aeroplanes specified in 14.1.1 d), recertification should be granted on the basis that the evidence used to determine compliance with Chapter 14 is as satisfactory as the evidence associated with aeroplanes specified in 14.1.1 a), b) and c).

CHAPTER 15. SUPERSONIC AEROPLANES — Application for Type Certificate submitted on or after 1 January 2029

15.1 Applicability

Note.— See also Chapter 1, 1.10, 1.11, 1.12 and 1.13.

15.1.1 The Standards of this chapter shall be applicable to all supersonic aeroplanes, including their derived versions, for which the application for a Type Certificate was submitted on or after 1 January 2029.

15.1.2 Notwithstanding 15.1.1, it may be recognized by a Contracting State that supersonic aeroplanes on its registry do not require demonstration of compliance with the provisions of the Standards of Annex 16, Volume I for time-limited engine and/or nacelle changes, where the change in type design specifies that the aeroplane may not be operated for a period of more than 90 days unless compliance with the provisions of Annex 16, Volume I, is shown for that change in type design. This applies only to changes resulting from a required maintenance action.

15.2 Noise measurements

15.2.1 Noise evaluation measure

The noise evaluation measure shall be the effective perceived noise level in EPNdB as described in Appendix 2.

15.3 Noise measurement points

15.3.1 Reference noise measurement points

An aeroplane, when tested in accordance with these Standards, shall not exceed the maximum noise levels specified in 15.4 at the following reference noise measurement points:

a) lateral full-power reference noise measurement point: the point on a line parallel to and 450 m from the runway centre line, where the noise level is a maximum during take-off;

b) flyover reference noise measurement point: the point on the extended centre line of the runway at a distance of 6.5 km from the start of roll; and

c) approach reference noise measurement point: the point on the ground, on the extended centre line of the runway, 2 000 m from the threshold. On level ground this corresponds to a

position 120 m (394 ft) vertically below the 3° descent path originating from a point 300 m beyond the threshold.

15.3.2 Test noise measurement points

15.3.2.1 If the test noise measurement points are not located at the reference noise measurement points, any corrections for the difference in position shall be made in the same manner as the corrections for the differences between test and reference flight paths.

15.3.2.2 Sufficient lateral test noise measurement points shall be used to demonstrate to the certificating authority that the maximum noise level on the appropriate lateral line has been clearly determined. Simultaneous measurements shall be made at one test noise measurement point at a symmetrical position on the other side of the runway.

15.4 Maximum noise levels

15.4.1 The maximum permitted noise levels, when determined in accordance with the noise evaluation method of Appendix 2, shall not exceed the following:

15.4.1.1 At the lateral full-power reference noise measurement point

103 EPNdB for aeroplanes with maximum certificated take-off mass, at which the noise certification is requested, of 400 000 kg and over, decreasing linearly with the logarithm of the mass down to 94 EPNdB at 35 000 kg, after which the limit is constant to 8 618 kg, from where it decreases linearly with the logarithm of the mass down to 88.6 EPNdB at 2 000 kg, after which the limit is constant.

15.4.1.2 At flyover reference noise measurement point

a) Aeroplanes with two engines or less

101 EPNdB for aeroplanes with maximum certificated take-off mass, at which the noise certification is requested, of 385 000 kg and over, decreasing linearly with the logarithm of the mass at the rate of 4 EPNdB per halving of mass down to 89 EPNdB, after which the limit is constant to 8 618 kg, from where it decreases linearly with the logarithm of the mass at a rate of 4 EPNdB per halving of mass down to 2 000 kg, after which the limit is constant.

b) Aeroplanes with three engines

As a) but with 104 EPNdB for aeroplanes with maximum certificated take-off mass of 385 000 kg and over.

c) Aeroplanes with four engines or more

As a) but with 106 EPNdB for aeroplanes with maximum certificated take-off mass of 385 000 kg and over.

15.4.1.3 At approach reference noise measurement point

105 EPNdB for aeroplanes with maximum certificated take-off mass, at which the noise certification is requested, of 280 000 kg and over, decreasing linearly with the logarithm of the mass down to 98 EPNdB at 35 000 kg, after which the limit is constant to 8 618 kg, from where it decreases linearly with the logarithm of the mass down to 93.1 EPNdB at 2 000 kg, after which the limit is constant.

15.4.1.4 The sum of the differences at all three measurement points between the maximum noise levels and the maximum permitted noise levels specified in 15.4.1.1, 15.4.1.2 and 15.4.1.3 shall not be less than 17 EPNdB.

15.4.1.5 The maximum noise level at each of the three measurement points shall not be less than 1 EPNdB below the corresponding maximum permitted noise level specified in 15.4.1.1, 15.4.1.2 and 15.4.1.3.

Note.— *See Attachment A for equations for the calculation of maximum permitted noise levels as a function of take-off mass.*

15.5 Noise certification reference procedures

15.5.1 General conditions

15.5.1.1 The reference procedures shall comply with the appropriate airworthiness requirements.

15.5.1.2 The calculations of reference procedures and flight paths shall be approved by the certificating authority.

15.5.1.3 Except in conditions specified in 15.5.1.4, the reference procedures shall be those defined in 15.5.2.

15.5.1.4 When it is shown by the applicant that the design characteristics of the aeroplane would prevent flight being conducted in accordance with 15.5.2, the reference procedures shall:

a) depart from the reference procedures defined in 15.5.2 only to the extent demanded by those design characteristics which make compliance with the procedures impossible; and

b) be approved by the certificating authority.

15.5.1.5 The reference procedures shall be calculated under the following reference atmospheric conditions:

a) atmospheric pressure at sea level of 1 013.25 hPa, decreasing with altitude at a rate defined by the ICAO Standard Atmosphere;

b) ambient air temperature at sea level of 25°C, decreasing with altitude at a rate defined by the ICAO Standard Atmosphere (i.e. 0.65°C per 100 m);

c) constant relative humidity of 70 per cent;

d) zero wind;

e) for the purpose of defining the reference take-off profiles for both take-off and lateral noise measurements, the runway gradient is zero; and

f) the reference atmosphere in terms of temperature and relative humidity is considered to be homogeneous (i.e. ambient temperature 25°C and relative humidity 70 per cent) for the purpose of calculating:

1) the reference sound attenuation rate due to atmospheric absorption; and

2) the reference speed of sound used in the calculation of the reference sound propagation geometry.

Note 1.— *Details for calculating the variation of reference atmospheric pressure with altitude are given in the section of the Environmental Technical Manual (Doc 9501), Volume I — Procedures for the Noise Certification of Aircraft, concerning the ICAO Standard Atmosphere.*

Note 2.— *The characteristics of the ICAO Standard Atmosphere are provided in the Manual of the ICAO Standard Atmosphere (extended to 80 kilometres (262 500 feet)) (Doc 7488/3).*

15.5.2 Noise certification reference procedures

15.5.2.1 Take-off reference procedure

The take-off reference flight path shall be calculated as follows:

a) average engine take-off thrust shall be used from the start of take-off to the point where at least the following height above runway level is reached:

1) aeroplanes with two engines or less — 300 m (984 ft);

2) aeroplanes with three engines — 260 m (853 ft); and

3) aeroplanes with four engines or more — 210 m (689 ft);

b) upon reaching the height specified in a) above, the thrust shall not be reduced below that required to maintain:

1) a climb gradient of 4 per cent; or

2) in the case of multi-engined aeroplanes, level flight with one engine inoperative;

whichever thrust is greater;

c) for the purpose of determining the lateral full-power noise level, the reference flight path shall be calculated on the basis of using full take-off power throughout with no thrust reduction;

d) the speed shall be the all-engines operating take-off climb speed selected by the applicant for use in normal operations, which shall be at least V2 +28 km/h (V2 + 15 kt) but not greater than V2 + 65 km/h (V2 + 35 kt) and which shall be attained as soon as practicable after lift-off and be maintained throughout the take-off certification test. The increment applied to V2 shall be the same for all reference masses of an aeroplane model unless a difference in increment is substantiated based on performance characteristics of the aeroplane;

e) a constant take-off configuration selected by the applicant shall be maintained throughout the take-off reference procedure except that the landing gear may be retracted. Configuration shall be interpreted as meaning the conditions of the systems and centre of gravity position and shall include the position of any lift augmentation devices used, whether the APU is operating, and whether air bleeds and power off-takes are operating;

f) the mass of the aeroplane at the brake release shall be the maximum take-off mass at which the noise certification is requested;

g) the average engine shall be defined by the average of all the certification compliant engines used during the aeroplane flight tests up to and during certification when operated to the limitations and procedures given in the flight manual. This will establish a technical standard including the relationship of thrust to control parameters (e.g. N1 or EPR). Noise measurements made during certification tests shall be corrected to this standard; and

h) take-off thrust used shall be the maximum available for normal operations as scheduled in the performance section of the aeroplane flight manual for the reference atmospheric conditions given in 15.5.1.5.

15.5.2.2 Approach reference procedure

The approach reference flight path shall be calculated as follows:

a) the aeroplane shall be stabilized and following a 3° glide path;

b) a steady approach speed of VREF + 19 km/h (VREF + 10 kt), with thrust or power stabilized, shall be maintained over the measurement point;

Note.— *In airworthiness terms VREF is defined as the "reference landing speed". Under this definition reference landing speed means "the speed of the aeroplane, in a specified landing configuration, at the point where it descends through the landing screen height in the determination of the landing distance for manual landings".*

c) the constant approach configuration as used in the airworthiness certification tests, but with the landing gear down, shall be maintained throughout the approach reference procedure;

d) the mass of the aeroplane at touchdown shall be the maximum landing mass permitted in the approach configuration defined in 15.5.2.2 c) at which noise certification is requested; and

e) the most critical (that which produces the highest noise level) configuration with normal deployment of aerodynamic control surfaces including lift and drag producing devices, at the mass at which certification is requested shall be used. This configuration includes all those items listed in 5.2.5 of Appendix 2 that will contribute to the noisiest continuous state at the maximum landing mass in normal operation.

15.6 Test procedures

15.6.1 The test procedures shall be acceptable to the airworthiness and noise certificating authority of the State issuing the certificate.

15.6.2 The test procedures and noise measurements shall be conducted and processed in an approved manner to yield the noise evaluation measure designated as effective perceived noise level, EPNL, in units of EPNdB, as described in Appendix 2.

15.6.3 Acoustic data shall be adjusted by the methods outlined in Appendix 2 to the reference conditions specified in this chapter. Adjustments for speed and thrust shall be made as described in Section 8 of Appendix 2.

15.6.4 If the mass during the test is different from the mass at which the noise certification is requested, the necessary EPNL adjustment shall not exceed 2 EPNdB for take-offs and 1 EPNdB for approaches. Data approved by the certificating authority shall be used to determine the variation of EPNL with mass for both take-off and approach test conditions. Similarly, the necessary EPNL adjustment for variations in approach flight path from the reference flight path shall not exceed 2 EPNdB.

15.6.5 For the approach conditions the test procedures shall be accepted if the aeroplane follows a steady glide path angle of 3° ± 0.5°.

15.6.6 If equivalent test procedures different from the reference procedures are used, the test procedures and all methods for adjusting the results to the reference procedures shall be approved by the certificating authority. The amounts of the adjustments shall not exceed 16 EPNdB on take-off and 8 EPNdB on approach, and if the adjustments are more than 8 EPNdB and 4 EPNdB, respectively, the resulting numbers shall be more than 2 EPNdB below the noise limits specified in 15.4.

Note.— *Guidance material on the use of equivalent procedures is provided in the Environmental Technical Manual (Doc 9501), Volume I — Procedures for the Noise Certification of Aircraft.*

15.6.7 For take-off, lateral, and approach conditions, the variation in instantaneous indicated airspeed of the aeroplane must be maintained within ±3 per cent of the average airspeed between the 10 dB-down points. This shall be determined by reference to the pilot's airspeed indicator. However, when the instantaneous indicated airspeed varies from the average

airspeed over the 10 dB-down points by more than ±5.5 km/h (±3 kt), and this is judged by the certificating authority representative on the flight deck to be due to atmospheric turbulence, then the flight so affected shall be rejected for noise certification purposes.

CHAPTER 16.

1.— SUBSONIC JET AEROPLANES — Application for Type Certificate submitted on or after 1 January 2029

2.— PROPELLER-DRIVEN AEROPLANES WITH MAXIMUM CERTIFICATED TAKE-OFF MASS OVER 8 618 kg — Application for Type Certificate submitted on or after 1 January 2029

16.1 Applicability

Note.— *See also Chapter 1, 1.10, 1.11, 1.12 and 1.13.*

16.1.1 The Standards of this chapter shall, with the exception of those aeroplanes which require a runway[1] length of 610 m or less at maximum certificated mass for airworthiness or propeller-driven aeroplanes specifically designed and used for agricultural or firefighting purposes, be applicable to:

a) all subsonic jet aeroplanes, including their derived versions, for which the application for a Type Certificate was submitted on or after 1 January 2029;

b) all propeller-driven aeroplanes, including their derived versions, with a maximum certificated take-off mass over 8 618 kg for which the application for a Type Certificate was submitted on or after 1 January 2029; and

c) all subsonic jet aeroplanes and all propeller-driven aeroplanes certificated originally as satisfying Annex 16, Volume I, Chapter 3, Chapter 4, Chapter 5 or Chapter 14, for which recertification to Chapter 16 is requested.

Note.— *Guidance material on applications for recertification is provided in the Environmental Technical Manual (Doc 9501), Volume I — Procedures for Noise Certification of Aircraft.*

16.1.2 Notwithstanding 16.1.1, it may be recognized by a Contracting State that the following situations for jet aeroplanes and propeller-driven aeroplanes over 8 618 kg maximum certificated take-off mass on its registry do not require demonstration of compliance with the provisions of the Standards of Annex 16, Volume I:

a) gear down flight with one or more retractable landing gear down during the entire flight;

b) spare engine and nacelle carriage external to the skin of the aeroplane (and return of the pylon or other external mount); and

c) time-limited engine and/or nacelle changes, where the change in type design specifies that the aeroplane may not be operated for a period of more than 90 days unless compliance with the

provisions of Annex 16, Volume I, is shown for that change in type design. This applies only to changes resulting from a required maintenance action.

16.2 Noise measurements

16.2.1 The noise evaluation measure shall be the effective perceived noise level in EPNdB as described in Appendix 2.

16.3 Noise measurement points

16.3.1 Reference noise measurement points

An aeroplane, when tested in accordance with these Standards, shall not exceed the maximum noise level specified in 16.4 of the noise measured at the points specified in Chapter 3, 3.3.1 a), b) and c).

16.3.2 Test noise measurement points

The provisions of Chapter 3, 3.3.2, relating to test noise measurement points shall apply.

16.4 Maximum noise levels

16.4.1 The maximum noise levels, when determined in accordance with the noise evaluation method of Appendix 2, shall not exceed the following:

16.4.1.1 At the lateral full-power reference noise measurement point

103 EPNdB for aeroplanes with maximum certificated take-off mass, at which the noise certification is requested, of 400 000 kg and over, decreasing linearly with the logarithm of the mass down to 94 EPNdB at 35 000 kg, after which the limit is constant to 8 618 kg, where it decreases linearly with the logarithm of the mass down to 88.6 EPNdB at 2 000 kg, after which the limit is constant.

16.4.1.2 At the flyover reference noise measurement point

a) Aeroplanes with two engines or less

101 EPNdB for aeroplanes with maximum certificated take-off mass, at which the noise certification is requested, of 385 000 kg and over, decreasing linearly with the logarithm of the mass at the rate of 4 EPNdB per halving of mass down to 89 EPNdB, after which the limit is constant to 8 618 kg, where it decreases linearly with the logarithm of the mass at a rate of 4 EPNdB per halving of mass down to 2 000 kg, after which the limit is constant.

b) Aeroplanes with three engines

As a) but with 104 EPNdB for aeroplanes with maximum certificated take-off mass of 385 000 kg and over.

c) Aeroplanes with four engines or more

As a) but with 106 EPNdB for aeroplanes with maximum certificated take-off mass of 385 000 kg and over.

16.4.1.3 At the approach reference noise measurement point

105 EPNdB for aeroplanes with maximum certificated take-off mass, at which the noise certification is requested, of 280 000 kg and over, decreasing linearly with the logarithm of the mass down to 98 EPNdB at 35 000 kg, after which the limit is constant to 8 618 kg, where it decreases linearly with the logarithm of the mass down to 93.1 EPNdB at 2 000 kg, after which the limit is constant.

16.4.1.4 The difference between the maximum noise level at the lateral full-power reference measurement point and the corresponding maximum noise level specified in 16.4.1.1 shall not be less than 1 EPNdB.

16.4.1.5 The difference between the maximum noise level at the flyover reference measurement point and the corresponding maximum noise level specified in 16.4.1.2 shall not be less than 2 EPNdB.

16.4.1.6 The difference between the maximum noise level at the approach reference measurement point and the corresponding maximum noise level specified in 16.4.1.3 shall not be less than 2 EPNdB for aeroplanes with maximum certificated take-off mass of 47 106 kg and over, decreasing linearly with the logarithm of the mass down to 1 EPNdB for aeroplanes with maximum certificated take-off mass of 35 000 kg and less.

16.4.1.7 The sum of the differences between the maximum noise levels at the lateral full-power and flyover reference measurement points and the corresponding maximum noise levels specified in 16.4.1.1 and 16.4.1.2 shall not be less than 5 EPNdB.

16.4.1.8 The sum of the differences between the maximum noise levels at all three reference measurement points and the corresponding maximum noise levels specified in 16.4.1.1, 16.4.1.2 and 16.4.1.3 shall not be less than:

a) Aeroplanes with two engines or less

23 EPNdB for aeroplanes with maximum certificated take-off mass, at which the noise certification is requested, of 73 070 kg and over, decreasing linearly with the logarithm of the mass down to 20.3 EPNdB at 48 125 kg, decreasing linearly with the logarithm of the mass down to 20.2 EPNdB at 41 645 kg, decreasing linearly with the logarithm of the mass down to 19 EPNdB at 35 000 kg, after which the sum of the differences is constant.

b) Aeroplanes with three engines or more

23 EPNdB for aeroplanes with maximum certificated take-off mass, at which the noise certification is requested, of 81 779 kg and over, decreasing linearly with the logarithm of the mass down to 19 EPNdB at 35 000 kg, after which the sum of the differences is constant.

Note.— *See Attachment A for equations for the calculation of maximum permitted noise levels as a function of take-off mass.*

16.5 Noise certification reference procedures

The noise certification reference procedures shall be as specified in Chapter 3, 3.6.

16.6 Test procedures

The test procedures shall be as specified in Chapter 3, 3.7.

16.7 Recertification

For aeroplanes specified in 16.1.1 c), recertification shall be granted on the basis that the evidence used to determine compliance with Chapter 16 is as satisfactory as the evidence associated with aeroplanes specified in 16.1.1 a) and b).

APPENDIX 2. EVALUATION METHOD FOR NOISE CERTIFICATION

1. SUBSONIC JET AEROPLANES — Application for

Type Certificate submitted on or after 6 October 1977

2. PROPELLER-DRIVEN AEROPLANES OVER 8 618 kg —

Application for Type Certificate submitted on or after 1 January 1985

3. HELICOPTERS

4. TILT-ROTORS

5. SUPERSONIC AEROPLANES — Application for Type Certificate submitted on or after 1 January 2029

***Note**. See Part II, Chapters 3, 4, 8, 13 ~~and~~, 14, 15 and 16.*

1. INTRODUCTION

***Note 1**—This noise evaluation method includes:*

a) noise certification test and measurement conditions;

b) measurement of aeroplane and helicopter noise received on the ground;

c) calculation of effective perceived noise level from measured noise data; and

d) reporting of data to the certificating authority and correcting measured data.

***Note 2**- The instructions and procedures given in the method are clearly delineated to ensure uniformity during compliance tests, and to permit comparison between tests of various types of aircraft conducted in various geographical locations.*

***Note 3**.- A complete list of symbols and units, the mathematical formulation of perceived noisiness, a procedure for determining atmospheric attenuation of sound, and detailed procedures for correcting noise levels from non-reference to reference conditions are included in Sections 4, 7 and 8 of this appendix.*

2. NOISE CERTIFICATION TEST AND MEASUREMENT CONDITIONS

2.1 General

This section prescribes the conditions under which noise certification tests should be conducted and the measurement procedures that should be used.

7. SOUND ATTENUATION IN AIR

7.1 The atmospheric attenuation of sound should be determined by the following equations:

$$\alpha(i) = 10^{[2.05 \log (f_o/1\,000) + 1.1394 \times \sout{10^{-3}\theta T} 10^{-3} \times T - 1.916984]} + \eta(\delta) \times 10^{[\log (f_o) + 8.42994 \times \sout{10^{-3}\theta T} 10^{-3} \times T - 2.755624]}$$

$$\delta = \sqrt{\frac{1010}{f_o}}\, 10^{(\log RH - 1.328924 + 3.179768 \times 10^{-2} \times T)} \times 10^{(-2.173716 \times 10^{-4} \times T^2 + 1.7496 \times 10^{-6} \times T^3)}$$

$$\alpha(i) = 10^{[2.05 \log (f_o/1\,000) + 1.1394 \times 10^{-3} \sout{\theta} T - 1.916984]} + \eta(\delta) \times 10^{[\log (f_o) + 8.42994 \times 10^{-3} \sout{\theta} T - 2.755624]}$$

$$\delta = \sqrt{\frac{1010}{f_o}}\, 10^{(\log RH - 1.328924 + 3.179768 \times 10^{-2} \times T)} \times 10^{(-2.173716 \times 10^{-4} \times T^2 + 1.7496 \times 10^{-6} \times T^3)}$$

where:

* Gear up, speed of at least V_2 + 19 km/h (V_2 + 10 kt), take-off thrust.

** Gear up, speed of at least V_2 + 19 km/h (V_2 + 10 kt), after cutback.

η(δ) is given by Table A2-4 and f_o by Table A2-5;

α(*i*) being the attenuation coefficient in dB/100 m;

θ being the temperature in °C; and

H being the relative humidity expressed as a percentage.

8.2.3 For aeroplanes, either the simplified method, described in 8.3, or the integrated method, described in 8.4, should be used for the lateral, flyover or approach conditions. The integrated method should be used when:

a) for flyover, the absolute value of the difference between the value of $EPNL_r$, when calculated according to the simplified method described in 8.3, and the measured value of EPNL calculated according to the procedure described in 4.1.3 is greater than 8 EPNdB;

b) for approach, the absolute value of the difference between the value of $EPNL_r$, when calculated according to the simplified method described in 8.3, and the measured value of EPNL calculated according to the procedure described in 4.1.3 is greater than 4 EPNdB; or

c) for flyover or approach, the value of $EPNL_r$, when calculated according to the simplified method described in 8.3, is greater than the maximum noise levels prescribed in 3.4 of Part II, Chapter 3, less 1 EPNdB.

Note.- *Part II, Chapter 3, 3.7.6, and Chapter 15, 15.6.6, regardless of the method used for adjustment ~~specifies~~ specify limitations regarding the validity of test data based upon both the extent to which* $EPNL_r$ *differs from* EPNL*, and also the proximity of the final* $EPNL_r$ *values to the maximum permitted noise levels~~, regardless of the method used for adjustment~~.*

8.3 Simplified method of adjustment

8.3.1 General

8.3.1.1 The simplified adjustment method shall consist of the determination and application of adjustments to the EPNL calculated from the measured data for the differences between measured and reference conditions at the moment of PNLTM. The adjustment terms are:

a) Δ_1 — adjustment for differences in the PNLTM spectrum under test and reference conditions (see 8.3.2);

b) Δ_{Peak} — adjustment for when the PNLT for a secondary peak, identified in the calculation of EPNL from measured data and adjusted to reference conditions, is greater than the PNLT for the adjusted PNLTM spectrum (see 8.3.3);

c) Δ_2 — adjustment for the difference in noise duration, taking into account the differences between test and reference aircraft speed and position relative to the microphone (see 8.3.4); and

d) Δ_3 — adjustment for differences in source noise generating mechanisms (see 8.3.5).

where:

V_G is the test ground speed (horizontal component of the test airspeed); and

V_{Gr} is the reference ground speed (horizontal component of the reference airspeed).

Note.- *The factors, –7.5 and 10, have been determined empirically from a representative sample population of certificated aeroplanes and helicopters. The factors account for the effects of changes in noise duration on* EPNL *due to distance and speed, respectively.*

8.3.4.3 Δ_2 should be added algebraically to the EPNL calculated from measured data as described in 8.3.6.

8.3.5 Source noise adjustments

8.3.5.1 The source noise adjustment should be applied to take account of differences in test and reference source noise generating mechanisms. For this purpose the effect on aircraft propulsion source noise of differences between the acoustically significant propulsion operating parameters actually realized in the certification flight tests and those calculated or specified for the reference conditions of Chapter 3, 3.6.1.5 and Chapter 15, 15.5.1.5, is determined. Such operating parameters may include for jet aeroplanes, the engine control parameter μ (typically normalized low pressure fan speed, normalized engine thrust or engine pressure ratio), for propeller-driven aeroplanes both shaft horsepower and propeller helical tip Mach number and for helicopters, during overflight only, advancing rotor blade tip Mach number. The adjustment should be determined from manufacturer's data approved by the certificating authority.

8.3.5.2 For aeroplanes, the adjustment term Δ_3 should normally be determined from sensitivity curve(s) of EPNL versus the propulsion operating parameter(s) referred to in 8.3.5.1. It is obtained by subtracting the EPNL value corresponding to the measured value of the correlating parameter from the EPNL value corresponding to the reference value of the correlating parameter. The adjustment term Δ_3 should be added algebraically to the EPNL value calculated from the measured data (see 8.3.6).

Note*-Representative data for jet aeroplanes are illustrated in Figure A2-12 which shows a curve of* EPNL *versus the engine control parameter* μ*. The* EPNL *data is adjusted to all other relevant reference conditions (aeroplane mass, speed, height and air temperature) and, at each value of* μ*, for the difference in noise between the installed engine and the flight manual standard of engine.*

measured" data. Separate curves of PNLTM~~R~~ versus advancing blade tip Mach number, or another agreed noise correlating parameter, may be derived for each of the three certification microphone locations, centre line, left sideline and right sideline, defined relative to the direction of flight of each test run. If it is not possible during noise measurement tests to attain the reference value of advancing blade tip Mach number or the agreed reference noise correlating parameter, then an extrapolation of the sensitivity curve is permitted, provided the data cover an adequate range of values, agreed by the certificating authority, of the noise correlating parameter.

8.3.5.6 When using advancing blade tip Mach number is used, it shall be computed using true airspeed, on-board outside air temperature (OAT), and rotor speed.

8.3.5.7 For helicopters, the adjustment term Δ_3, obtained according to 8.3.5.5, should be added algebraically to the EPNL value calculated from the measured data as described in 8.3.6.

8.3.6 Application of adjustment terms for simplified method

When the simplified adjustment method is used, the EPNL for reference conditions, $EPNL_r$, shall be determined by adding the adjustment terms identified in 8.3.2 through 8.3.5 to the EPNL calculated for measurement conditions as follows:

$$EPNL_r = EPNL + \Delta_1 + \Delta_{Peak} + \Delta_2 + \Delta_3$$

8.3.7 Lateral noise asymmetry

For the determination of the lateral noise level for jet aeroplanes, asymmetry (see Chapter 3, 3.3.2.2) should be accounted for as follows:

a) if a symmetrical measurement point is opposite the point where the highest noise level is obtained, the certification noise level should be the (arithmetical) mean of the noise levels measured at these two points (see Figure A2-13 a));

b) if not, it should be assumed that the variation of noise with the height of the aeroplane is the same on both sides (i.e. there is a constant difference of noise versus height on the two sides (see Figure A2-13 b)). The certification noise level should then be the maximum value of the mean between these lines.

$$\triangle_3 = K_3 \log (P_R/P_T)$$

Where ~~P and~~ P_R and P are the ~~test~~ reference and ~~reference~~test engine powers respectively obtained from the manifold pressure/torque gauges and engine rpm. The value of K_3 should be determined from approved data from the test aeroplane. In the absence of flight test data and at the discretion of the certificating authority a value of $K_3 = 17$ may be used. The reference power P_R should be that obtained at the reference height ~~pressure and~~ temperature and pressure assuming temperature and pressure ~~an ISA temperature~~ lapse rate with height defined by the ICAO Standard Atmosphere.

6. REPORTING OF DATA TO THE CERTIFICATING AUTHORITY AND VALIDITY OF RESULTS

6.1 Data reporting

6.1.1 Measured and corrected sound pressure levels obtained with equipment conforming to the specifications described in Section 4 of this appendix should be reported.

6.1.2 The type of equipment used for measurement and analysis of all acoustic aeroplane performance and meteorological data should be reported.

6.1.3 The following atmospheric environmental data, measured immediately before, after, or during each test at the observation points prescribed in Section 2 of this appendix should be reported:

a) air temperature and relative humidity;

b) wind speeds and wind directions; and

c) atmospheric pressure.

6.1.4 Comments on local topography, ground cover and events that might interfere with sound recordings should be reported.

6.1.5 The following aeroplane information should be reported:

a) type, model and serial numbers of aeroplane, engine(s) and propeller(s);

b) any modifications or non-standard equipment likely to affect the noise characteristics of the aeroplane;

c) maximum certificated take-off mass;

d) for each overflight, airspeed and air temperature at the flyover altitude determined by properly calibrated instruments;

e) for each overflight, engine performance as manifold pressure or power, propeller speed in revolutions per minute and other relevant parameters determined by properly calibrated instruments;

f) aeroplane height above the measurement point; and

g) corresponding manufacturer's data for the reference conditions relevant to 6.1.5 d), e) and f).

6.2 Validity of results

6.2.1 The measuring point should be overflown at least six times. The test results should produce an average noise level (L_{Amax}) value and its 90 per cent confidence limits, the noise level being the arithmetic average of the corrected acoustical measurements for all valid test runs over the measuring point.

6.2.2 The samples should be large enough to establish statistically a 90 per cent confidence limit not exceeding ±1.5 dB(A). No test results should be omitted from the averaging process, unless otherwise specified by the certificating authority.

ATTACHMENTS TO PART 16, VOLUME I

ATTACHMENT A. EQUATIONS FOR THE CALCULATION OF MAXIMUM PERMITTED NOISE LEVELS AS A FUNCTION OF TAKE-OFF MASS

~~**Note.—**~~**Note. —** *See Part II, 2.4.1, 2.4.2, 3.4.1, 4.4.1, 5.4, 6.3, 8.4.1, 8.4.2, 10.4, 11.4.1, 11.4.2, 13.4.1, ~~and~~ 14.4.1, 15.4.1 and 16.4.1.*

1. CONDITIONS DESCRIBED IN CHAPTER 2, 2.4.1

M = Maximum take-off mass in 1000 kg	0	34	272
Lateral noise level (EPNdB)	102	91.83 + 6.64 log M	108
Approach noise level (EPNdB)	102	91.83 + 6.64 log M	108
Flyover noise level (EPNdB)	93	67.56 + 16.61 log M	108

2. CONDITIONS DESCRIBED IN CHAPTER 2, 2.4.2

M = Maximum take-off mass in 1 000 kg		0	34	35	48.3	66.72	133.45	280	325	400
Lateral noise level (EPNdB) All aeroplanes		97		83.87 + 8.51 log M						106
Approach noise level (EPNdB) All aeroplanes		101		89.03 + 7.75 log M				108		
Flyover noise levels (EPNdB)	2 engines	93				70.62 + 13.29 log M				104
	3 engines	93		67.56 + 16.61 log M			73.62 + 13.29 log M			107
	4 engines	93		67.56 + 16.61 log M				74.62 + 13.29 log M		108

3. CONDITIONS DESCRIBED IN CHAPTER 3, 3.4.1

M = Maximum take-off mass in 1 000 kg		0	20.2	28.6	35	48.1	280	385	400
Lateral full-power noise level (EPNdB) All aeroplanes		94			80.87 + 8.51 log M				103
Approach noise level (EPNdB) All aeroplanes		98			86.03 + 7.75 log M			105	
Flyover noise levels (EPNdB)	2 engines or less	89				66.65 + 13.29 log M			101
	3 engines	89			69.65 + 13.29 log M				104
	4 engines or more	89			71.65 + 13.29 log M				106

4. CONDITIONS DESCRIBED IN CHAPTER 4, 4.4

Each of the following conditions should apply:

$EPNL_L \leq LIMIT_L$; $EPNL_A \leq LIMIT_A$; and $EPNL_F \leq LIMIT_F$;

$[(LIMIT_L - EPNL_L) + (LIMIT_A - EPNL_A) + (LIMIT_F - EPNL_F)] \geq 10$

$[(LIMIT_L - EPNL_L) + (LIMIT_A - EPNL_A)] \geq 2$; $[(LIMIT_L - EPNL_L) + (LIMIT_F - EPNL_F)] \geq 2$; and

$[(LIMIT_A - EPNL_A) + (LIMIT_F - EPNL_F)] \geq 2$

where

$EPNL_L$, $EPNL_A$ and $EPNL_F$ are, respectively, the noise levels at the lateral, approach and flyover reference noise measurement points when determined, to one decimal place, in accordance with the noise evaluation method of Appendix 2; and

$LIMIT_L$, $LIMIT_A$ and $LIMIT_F$ are, respectively, the maximum permitted noise levels at the lateral, approach and flyover reference noise measurement points determined, to one decimal place, in accordance with the equations for the conditions described in Chapter 3, 3.4.1 (Condition 3).

5 CONDITIONS DESCRIBED IN CHAPTER 5, 5.4

M = Maximum take-off mass in 1000 kg	5.7	34.0	358.9	384.7
Lateral noise level (EPNdB)	96	85.83 + 6.64 log M		103
Approach noise level (EPNdB)	98	87.83 + 6.64 log M		105
Flyover noise level (EPNdB)	89	63.56 + 16.61 log M	106	

6. CONDITIONS DESCRIBED IN CHAPTER 6, 6.3

M = Maximum take-off mass in 1000 kg	0	0.6	1.5	8.618
Noise level in dB(A)	68	60 + 13.33 M		80

7. CONDITIONS DESCRIBED IN CHAPTER 8, 8.4.1, AND CHAPTER 13, 13.4

M = Maximum take-off mass in 1000 kg	0	0.788	80.0
Take-off noise level (EPNdB)	89	90.03 + 9.97 log M	109
Approach noise level (EPNdB)	90	91.03 + 9.97 log M	110
Overflight noise level (EPNdB)	88	89.03 + 9.97 log M	108

8. CONDITIONS DESCRIBED IN CHAPTER 8, 8.4.2

M = Maximum take-off mass in 1000 kg	0	0.788	80.0
Take-off noise level (EPNdB)	86	87.03 + 9.97 log M	106
Approach noise level (EPNdB)	89	90.03 + 9.97 log M	109
Overflight noise level (EPNdB)	84	85.03 + 9.97 log M	104

9. CONDITIONS DESCRIBED IN CHAPTER 10, 10.4 A) AND 10.4 B)

10.4 a):

M = Maximum take-off mass in 1000 kg	0	0.6	1.4	8.618
Noise level in dB(A)	76	83.23 + 32.67 log M		88

10.4 b):

M = Maximum take-off mass in 1000 kg	0	0.57	1.5	8.618
Noise level in dB(A)	70	78.71 + 35.70 log M		85

10. CONDITIONS DESCRIBED IN CHAPTER 11, 11.4.1

M = Maximum take-off

mass in 1000 kg	0	1.417	3.175
Noise level in dB(A)	82	80.49 + 9.97 log M	

11. CONDITIONS DESCRIBED IN CHAPTER 11, 11.4.2

M = Maximum take-off

mass in 1000 kg	0	1.417	3.175
Noise level in dB(A)	82	80.49 + 9.97 log M	

12. CONDITIONS DESCRIBED IN CHAPTERS 14, 14.4.1 AND 15, 15.4.1

M = Maximum take-off mass in 1 000 kg		0	2	8.618	20.234	28.615	35	48.125	280	385	400
Lateral full-power noise level (EPNdB) All aeroplanes		88.6	86.03754 + 8.512295 log M		94		80.86511 + 8.50668 log M			103	
Approach noise level (EPNdB) All aeroplanes		93.1	90.77481 + 7.72412 log M		98		86.03167 + 7.75117 log M		105		
Flyover noise levels (EPNdB)	2 engines or less	80.6	76.57059 + 13.28771 log M		89		66.64514 + 13.28771 log M			101	
	3 engines				89		69.64514 + 13.28771 log M			104	
	4 engines or more				89		71.64514 + 13.28771 log M			106	

***Note**. The slope of the limit lines in the lower and higher weight regions are essentially the same. The observed minor differences between the coefficients of the equations defining the slopes of the lateral and approach lines are a consequence of the limits in Chapter 14, Sections 14.4.1.1 and 14.4.1.3, and Chapter 15, Sections 15.4.1.1 and 15.4.1.3, being defined with fixed end-points. For all practical purposes the minor differences between the coefficients are considered to be insignificant.*

Each of the following conditions apply:

$(LIMIT_L - EPNL_L) \geq 1$; $(LIMIT_A - EPNL_A) \geq 1$; and $(LIMIT_F - EPNL_F) \geq 1$;
$[(LIMIT_L - EPNL_L) + (LIMIT_A - EPNL_A) + (LIMIT_F - EPNL_F)] \geq 17$

where
$EPNL_L$, $EPNL_A$ and $EPNL_F$ are respectively the noise levels at the lateral, approach and flyover reference noise measurement points when determined, to one decimal place, in accordance with the noise evaluation method of Appendix 2; and

LIMITL, LIMITA, and LIMITF are respectively the maximum permitted noise levels at the lateral, approach and flyover reference noise measurement points determined, to one decimal place, in accordance with the equations for the conditions described in Chapter 14, 14.4.1 and Chapter 15, 15.4.1.

13. CONDITIONS DESCRIBED IN CHAPTER 16, 16.4.1.1 TO 16.4.1.3

M = Maximum take-off mass in 1 000 kg		0	2	8.618	20.234	28.615	35	48.125	280	385	400
$LIMIT_L$ EPNdB, All aeroplanes		88.6	86.03754 + 8.512295 log M		94			80.86511 + 8.50668 log M			103
$LIMIT_A$ EPNdB, All aeroplanes		93.1	90.77481 + 7.72412 log M		98			86.03167 + 7.75117 log M		105	
$LIMIT_F$ EPNdB	2 engines or less				89			66.64514 + 13.28771 log M			101
	3 engines	80.6	76.57059 + 13.28771 log M		89			69.64514 + 13.28771 log M			104
	4 engines or more				89			71.64514 + 13.28771 log M			106

where
$LIMIT_L$, $LIMIT_A$ and $LIMIT_F$ are respectively the maximum noise levels at the lateral, approach and flyover reference noise measurement points determined, to one decimal place, in accordance with the equations for the conditions described in Chapter 16, 16.4.1.1, 16.4.1.2 and 16.4.1.3.

Note. — The slope of the limit lines in the lower and higher weight regions are essentially the same. The observed minor differences between the coefficients of the equations defining the slopes of the lateral and approach lines are a consequence of the limits in Chapter 16, Sections 16.4.1.1 and 16.4.1.3, being defined with fixed end-points. For all practical purposes the minor differences between the coefficients are considered to be insignificant.

14. CONDITIONS DESCRIBED IN CHAPTER 16, 16.4.1.4 TO 16.4.1.8

where
$EPNL_L$, $EPNL_A$ and $EPNL_F$ are respectively the noise levels at the lateral, approach and flyover reference noise measurement points when determined, to one decimal place, in accordance with the noise evaluation method of Appendix 2; and

$LIMIT_L$, $LIMIT_A$, and $LIMIT_F$ are respectively the maximum noise levels at the lateral, approach and flyover reference noise measurement points determined, to one decimal place, in accordance with the equations for the conditions described in Chapter 16, 16.4.1.1, 16.4.1.2 and 16.4.1.3.

15. CHARTS OF CONDITIONS DESCRIBED IN CHAPTER 3, 3.4, CHAPTER 4, 4.4, 1.1 CHAPTER 14, 14.4.1 AND CHAPTER 16, 16.4.1

Note. — The maximum permitted noise levels displayed in the charts of this section include the conditions at individual reference noise measurement points or combinations of those in Chapter 4, 4.4.1.1, 4.4.1.2, Chapter 14, 14.4.1.4, 14.4.1.5 and Chapter 16, 16.4.1.4 to 16.4.1.8, but do not include the trade-offs in Chapter 3, 3.5.

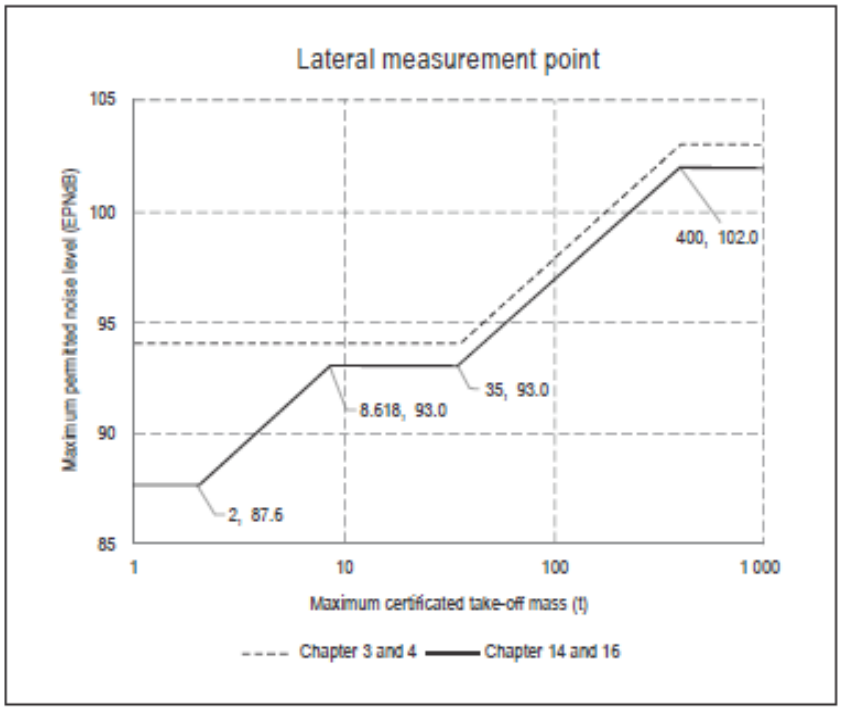


Figure Att. A-1. Lateral measurement point

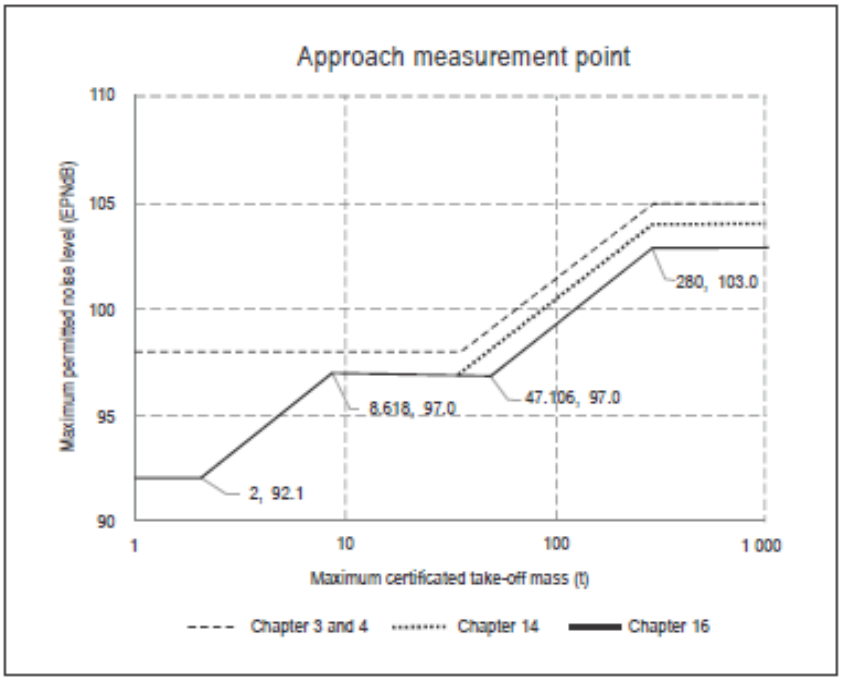


Figure Att. A-2. Approach measurement point

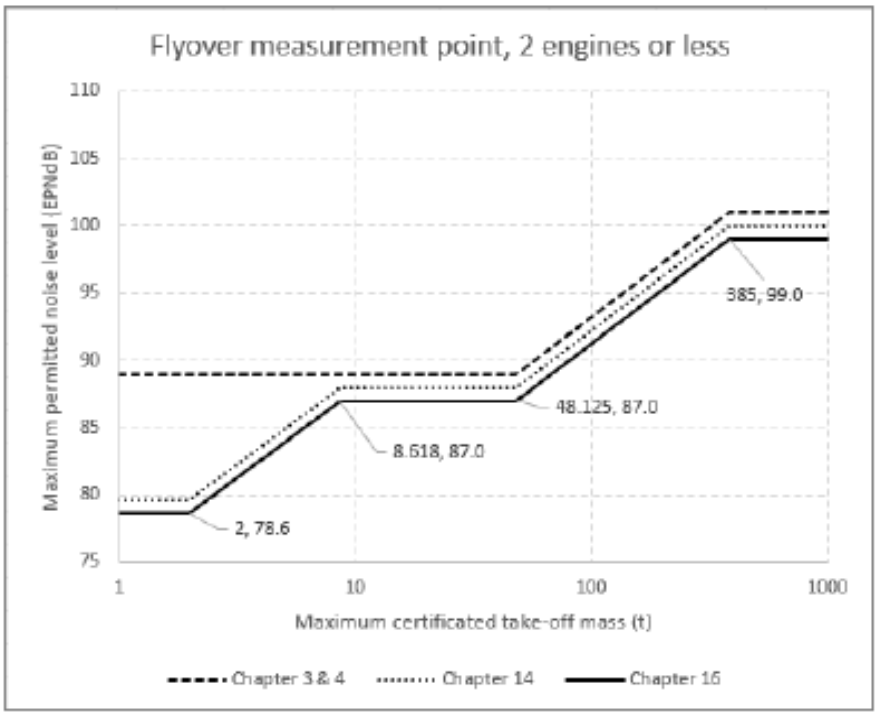


Figure Att. A-3. Flyover measurement point, two engines or less

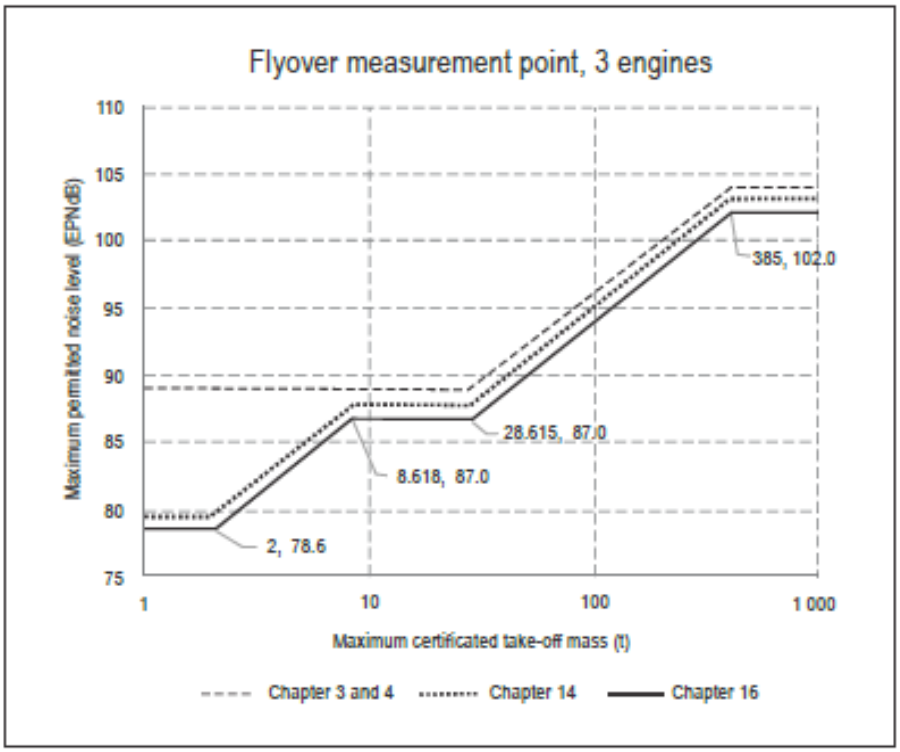


Figure Att. A-4. Flyover measurement point, three engines

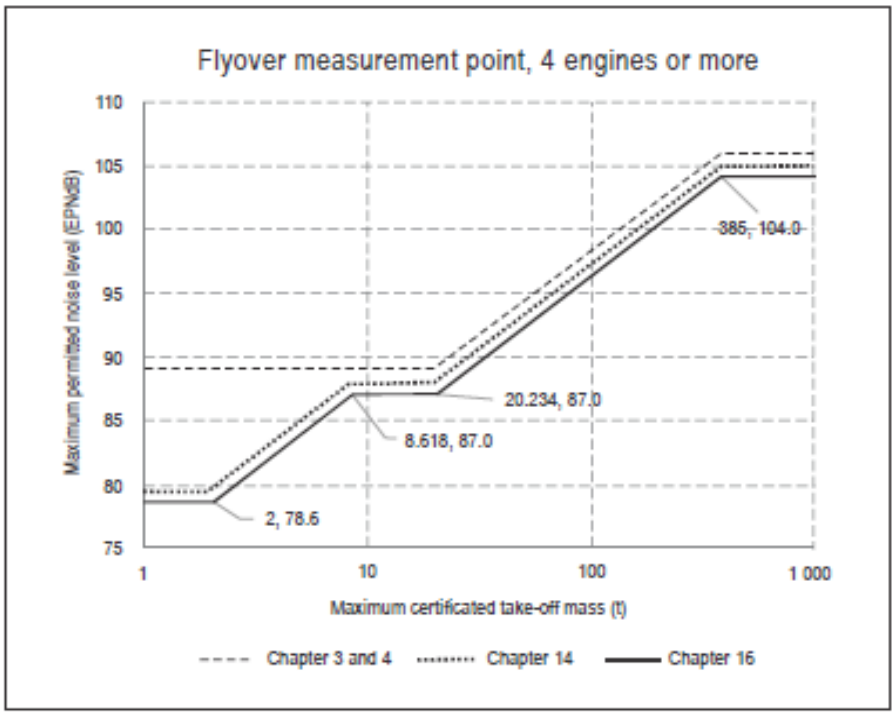


Figure Att. A-5. Flyover measurement point, four engines or more

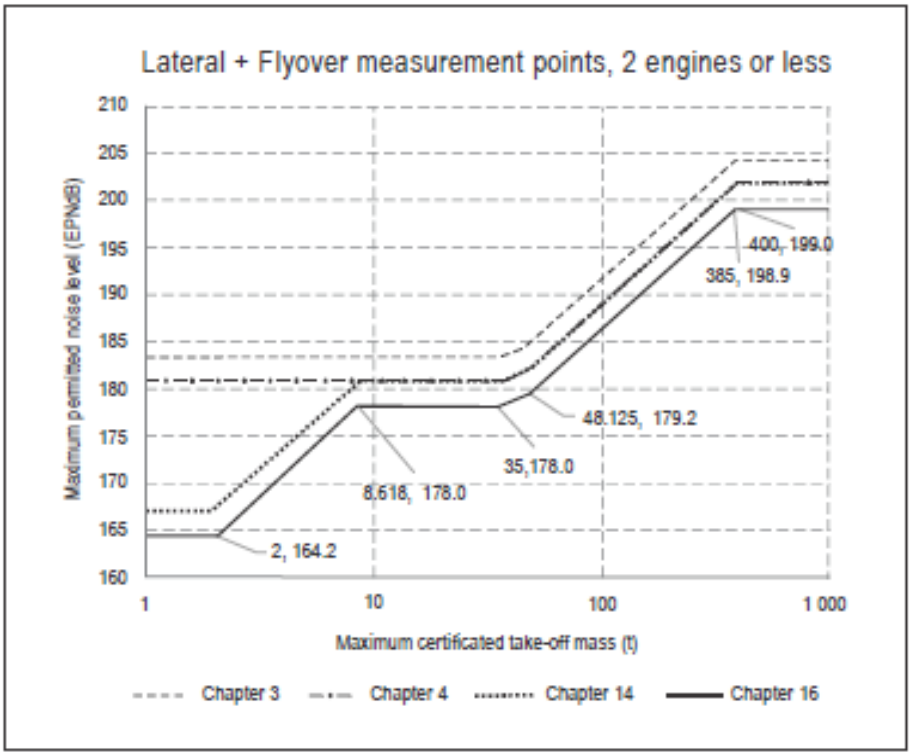


Figure Att. A-6. Lateral + flyover measurement points, two engines or less

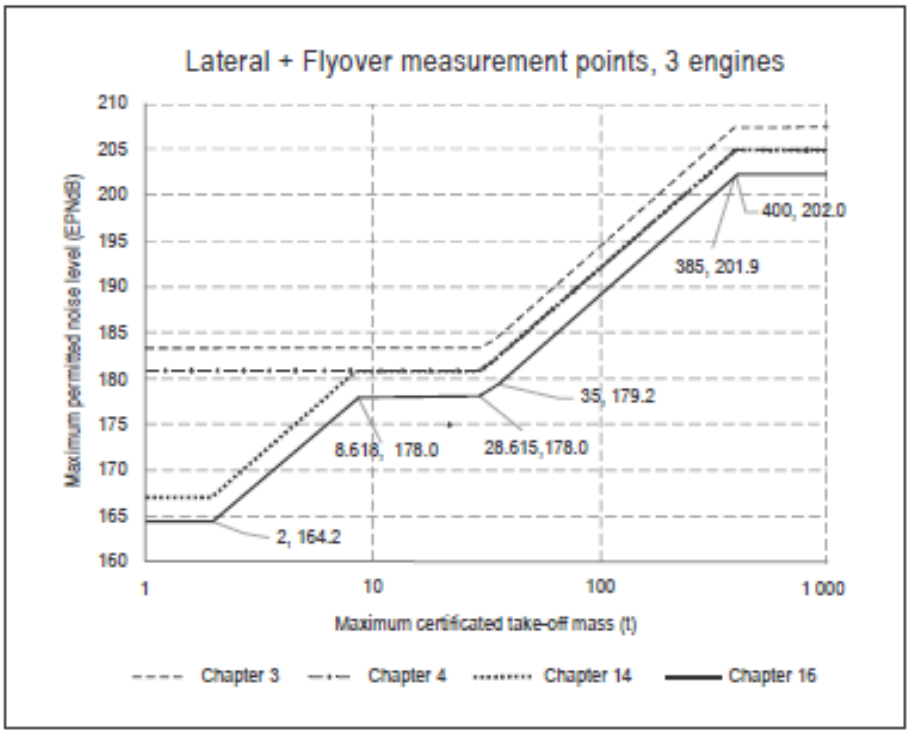


Figure Att. A-7. Lateral + flyover measurement points, three engines

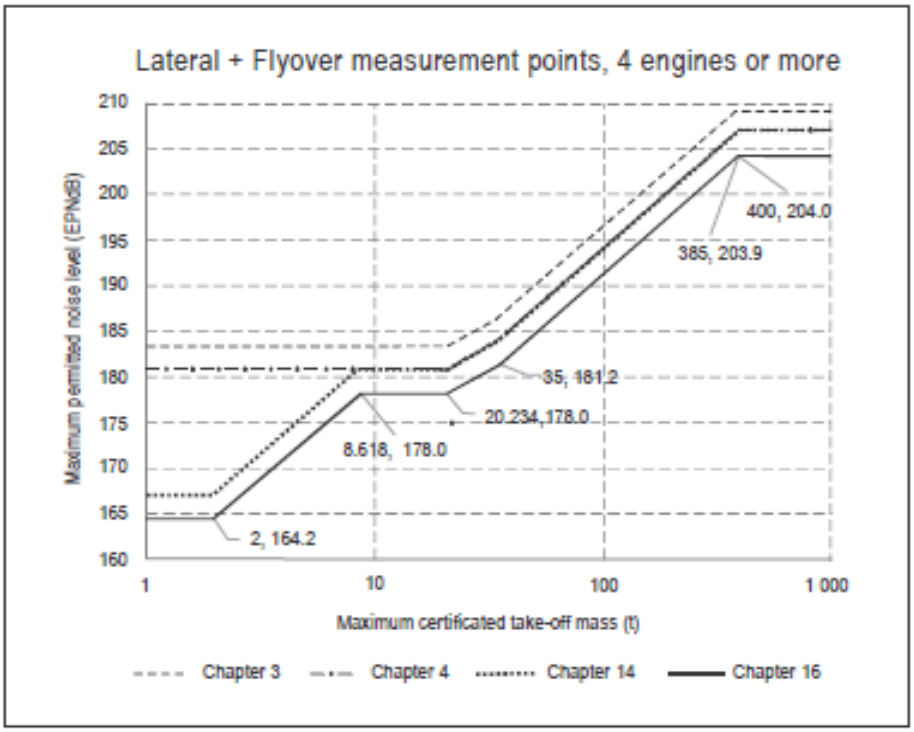


Figure Att. A-8. Lateral + flyover measurement points, four engines or more

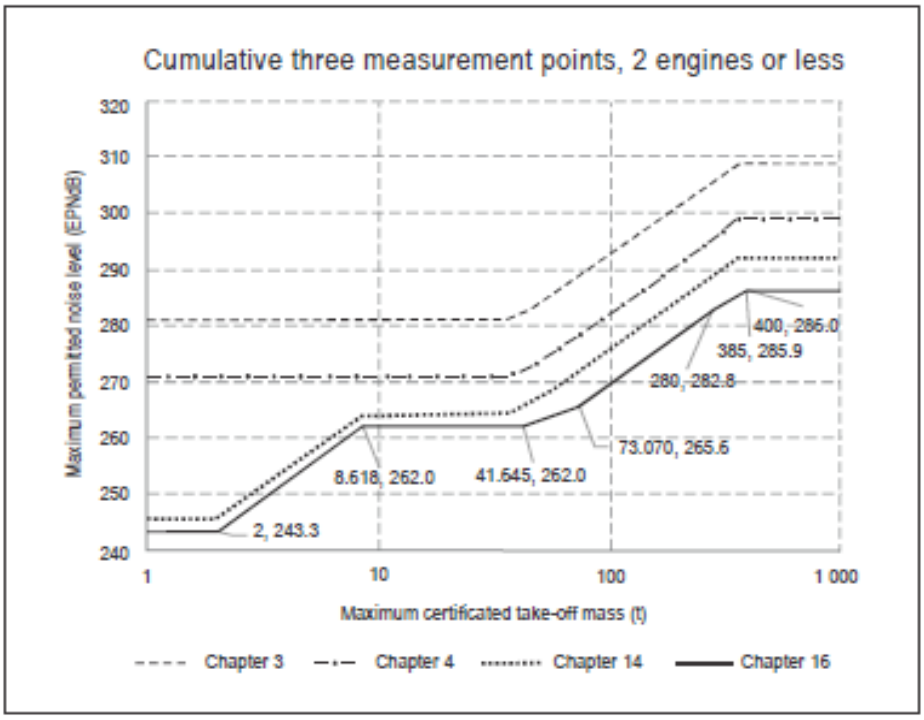


Figure Att. A-9. Cumulative three measurement points, two engines or less

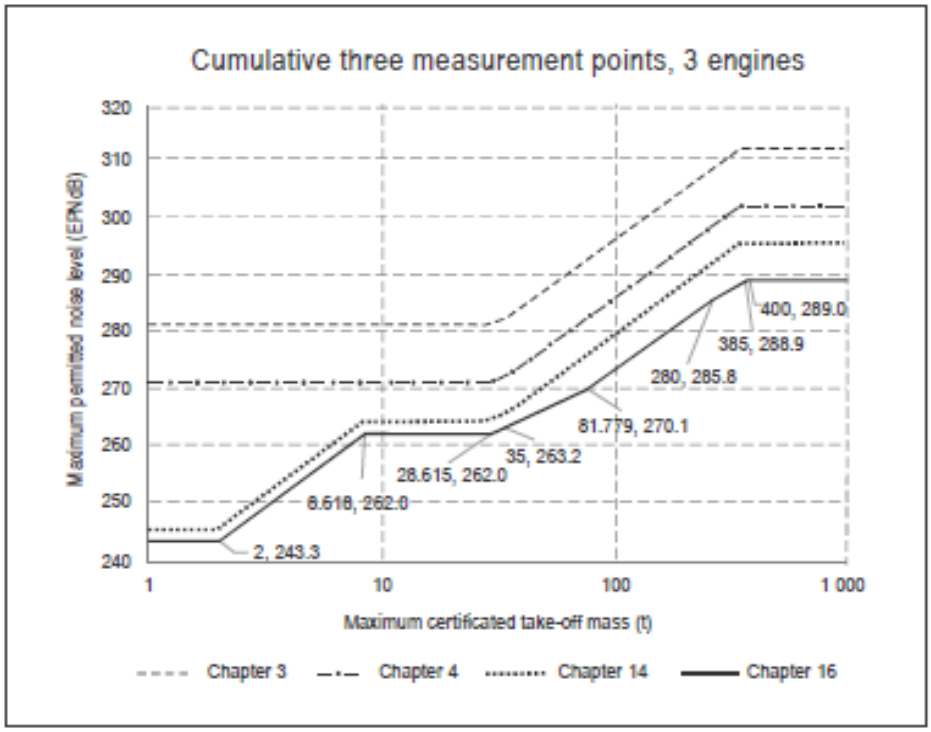


Figure Att. A-10. Cumulative three measurement points, three engines

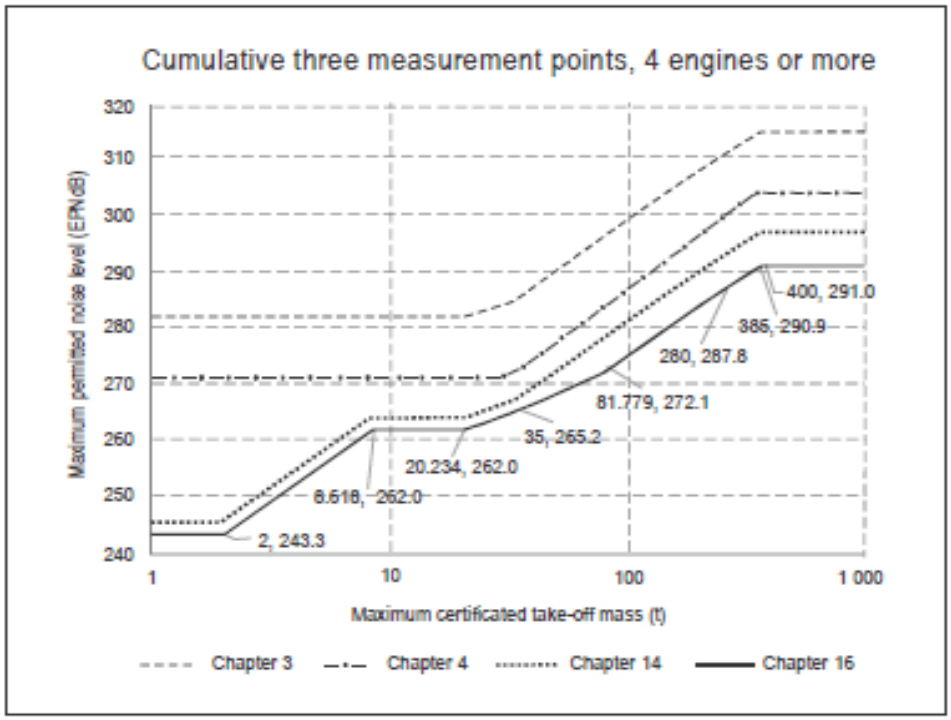


Figure Att. A-11. Cumulative three measurement points, four engines or more

The nationality or common mark and registration marks issued by the State of Registry in accordance with Part 7. This item should correspond with the information on the certificate of registration and the certificate of airworthiness.

2.1.6 *Item 5. Manufacturer and manufacturer's designation of aircraft*

The type and model of the subject aircraft. This item should correspond with the information on the certificate of registration and the certificate of airworthiness.

2.1.7 *Item 6. Aircraft serial number*

The aircraft serial number as given by the manufacturer of the aircraft. This item should correspond with the information on the certificate of registration and the certificate of airworthiness.

2.1.8 *Item 7. Engine manufacturer, type and model*

The designation of the installed engine(s) for identification and verification of the aircraft configuration. It should contain the type and model of the subject engine(s) . The designation should be in accordance with the type certificate or supplemental type certificate for the subject engine(s).

2.1.9 *Item 8. Propeller type and model for propeller-driven aeroplanes*

The designation of the installed propeller(s) for identification and verification of the aircraft configuration. It should contain the type and model of the subject propeller(s). The designation should be in accordance with the type certificate or supplemental type certificate for the subject propeller(s). This item is included only in the noise certification documentation for propeller-driven aeroplanes.

2.1.10 *Item 9. Maximum take-off mass and unit*

The maximum take-off mass, in kilograms, associated with the certificated noise levels of the aircraft. The unit (kg) should be specified explicitly in order to avoid misunderstanding. If the primary unit of mass of the State of Design of the aircraft is different from kilograms, the conversion factor used should be in accordance with Part 5.

2.1.11 *Item 10. Maximum landing mass and unit for certificates issued under Chapters 2, 3, 4, 5, 12 ~~and~~, 14, 15 and 16*

The maximum landing mass, in kilograms, associated with the certificated noise levels of the aircraft. The unit (kg) should be specified explicitly in order to avoid misunderstanding. If the primary unit of mass of the State of Design of the aircraft is

different from kilograms, the conversion factor used should be in accordance with Part 5. This item is included only in the noise certification documentation for documents issued under Chapters 2, 3, 4, 5, 12 ~~and~~, 14, 15 and 16.

2.1.12 *Item 11. The chapter and section of Part 16, Volume I, according to which the aircraft is certificated*

The chapter of Part 16, Volume I, to which the subject aircraft is noise certificated. For Chapters 2, 8, 10 and 11, the section specifying the noise limits should also be included.

2.1.13 *Item 12. Additional modifications incorporated for the purpose of compliance with the applicable noise certification Standards*

This item should contain, as a minimum, all additional modifications to the basic aircraft as defined by Items 5, 7 and 8 that are essential in order to meet the requirements of the chapter of Part 16, Volume I, to which the aircraft is noise certificated as given under Item 11. Other modifications that are not essential to meet the stated chapter but are needed to attain the certificated noise levels as given may also be included at the discretion of the certificating authority. The additional modifications should be given using unambiguous references, such as supplemental type certificate (STC) numbers, unique part numbers or type/model designators given by the manufacturer of the modification.

2.1.14 *Item 13. The lateral/full-power noise level in the corresponding unit for documents issued under Chapters 2, 3, 4, 5, 12 ~~and~~, 14, 15 and 16*

The lateral/full-power noise level as defined in the relevant chapter. It should specify the unit (e.g. EPNdB) of the noise level, and the noise level should be stated to the nearest tenth of a dB. This item is included only in the noise certification documentation for aircraft certificated to Chapters 2, 3, 4, 5, 12 ~~and~~, 14, 15 and 16 .

2.1.15 *Item 14. The approach noise level in the corresponding unit for documents issued under Chapters 2, 3, 4, 5, 8, 12, 13 ~~and~~, 14, 15 and 16*

The approach noise level as defined in the relevant chapter. It should specify the unit (e.g. EPNdB) of the noise level, and the noise level should be stated to the nearest tenth of a dB. This item is included only in the noise certification documentation for aircraft certificated to Chapters 2, 3, 4, 5, 8, 12, 13 ~~and~~, 14, 15 and 16 .

2.1.16 *Item 15. The flyover noise level in the corresponding unit for documents issued under Chapters 2, 3, 4, 5, 12 ~~and~~, 14, 15 and 16*

The flyover noise level as defined in the relevant chapter. It should specify the unit (e.g. EPNdB) of the noise level, and the noise level should be stated to the nearest tenth of a dB. This item is included only in the noise certification documentation for aircraft

certificated to Chapters 2, 3, 4, 5, 12 ~~and~~, 14, 15 and 16.

2.1.17 *Item 16. The overflight noise level in the corresponding unit for documents issued under Chapters 6, 8, 11 and 13*

The overflight noise level as defined in the relevant chapter. It should specify the unit (e.g. EPNdB or dB(A)) of the noise level, and the noise level should be stated to the nearest tenth of a dB. This item is included only in the noise certification documentation for aircraft certificated to Chapters 6, 8, 11 and 13.

Note.- For tilt-rotors certificated according to Chapter 13 only the overflight noise level established in VTOL/conversion mode needs to be stated.

2.1.18 *Item 17. The take-off noise level in the corresponding unit for documents issued under Chapters 8, 10 and 13*

The take-off noise level as defined in the relevant chapter. It should specify the unit (e.g. EPNdB or dB(A)) of the noise level, and the noise level should be stated to the nearest tenth of a dB. This item is included only in the noise certification documentation for aircraft certificated to Chapters 8, 10 and 13.

2.1.19 *Item 18. Statement of compliance, including reference to Part 16, Volume I*

A statement that the subject aircraft complies with the applicable noise requirements. Reference should be made to Part 16, Volume I. In addition to this, reference may be made to national noise requirements.

2.1.20 Item 19. Date of issuance of the noise certification document

The date on which the noise certification document was issued.

2.1.21 Item 20. Signature of the officer issuing it

The signature of the officer issuing the noise certification document. Other items may be added such as a seal or a stamp.

2.2 Additional information

2.2.1 States may decide to add additional information to the noise certification documentation at their own discretion. Caution should be exercised to ensure that the information provided will not be confused with the official noise certification levels. In particular, noise levels taken under conditions other than the noise certification conditions should be clearly marked as supplementary information. The additional information should be placed in a “remarks” box or in separate boxes. These boxes should *not* be numbered in order to avoid non-standardized numbering and to allow for future modifications to the numbering system. The box or boxes should contain an