



CIVIL AVIATION REQUIREMENTS

SECTION 6 – DESIGN STANDARDS AND TYPE CERTIFICATION SERIES ‘C’ PART II

AIRCRAFT NOISE CERTIFICATION – STANDARDS AND PROCEDURES

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Director General of Civil Aviation
OFFICE OF THE DIRECTOR GENERAL OF CIVIL AVIATION
TECHNICAL CENTRE, OPP. SAFDARJUNG AIRPORT, NEW DELHI

RECORD OF REVISION

This CAR has been issued to formulate regulations towards aircraft noise certification based on International Civil Aviation Organization's International Standards and Recommended Practices (SARPs) as contained in Annex-16, Environmental Protection, Volume-I "Aircraft Noise". The CAR was initially developed and issued on 7th February, 2011. Thereafter, the CAR has undergone revisions due to the recommendations made by the Committee on Aviation Environmental Protection (CAEP) in their subsequent meetings. The Record of Revisions to the aforesaid CAR is as follows:

Sl. No.	Issue Number	Revision Number	Date	Remarks
1.	Issue - I	Revision - 0	7 February 2011	Initial issue of CAR to adopt noise standards as contained in Annex-16, Volume-I including Amendment 9.
2.	Issue - I	Revision - 1	October 2011	Revisions due to Amendment 10.
3.	Issue - I	Revision - 2	October 2014	Revisions due to Amendment 11.
4.	Issue - II	Revision - 0	5 October 2017	Revisions due to Amendment 12.

INTRODUCTION

Rule 49 of the Aircraft Rules, 1937 stipulates requirements for a Type Certificate (TC) in respect of a new type of aeronautical products such as aircraft, engine and propeller or change in type design in case of its derived version, designed and manufactured in India. The Type Certificate Data Sheet (TCDS), which forms the part of the Type Certificate, contains the applicable certification basis in respect of that aircraft as mentioned in CAR 21.17 and environmental protection requirements as mentioned in CAR 21.18. With the objective of demonstrating compliance with the above mentioned requirements, CAR, Section-6, Series-C, Part-II has been developed based on the International Standards and Recommended Practices (SARPs) contained in ICAO Annex-16, Volume-I.

This CAR is issued under the provisions of Rule 133A of the Aircraft Rules, 1937, for information, guidance and compliance by all such organizations who intend to design and develop aeronautical products including Auxiliary Power Unit (APU) in India for which a Type Certificate is to be issued by DGCA under the provisions mentioned in CAR 21 and apply for issuance of Certificate of Airworthiness thereafter for operations or intend to import an aircraft for operations in India.

The requirements contained in this CAR are in-line with the requirements as mentioned in ICAO Annex 16, Volume I incorporating all changes due to its amendments thereon including amendment no. 12 dated May, 2017. It prescribes applicability, evaluation measures, measurement points, maximum noise levels, trade-offs and test procedures along with relevant calculations for different category of aircraft depending upon their maximum certificated take-off mass, number of engines and date of applicability for a type certificate application submitted to DGCA, for demonstrating compliance for issue of noise certificate in respect of the type aircraft.

This CAR Issue II supersedes earlier issued CAR, Issue-I, Revision-3 October, 2014.

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SUBPART – A: General Certification Requirements

1. APPLICABILITY:

The provision of this CAR shall apply to the following:

- 1.1 All aircraft (i.e., propeller driven aeroplanes, subsonic jet aeroplanes, helicopters, installed auxiliary power units and associated aircraft systems during ground operations) that is designed, developed and manufactured in India for operation at subsonic speed after 1st June, 2011.
- 1.2 All aircraft imported in India by type acceptance or validated, for civil operations, shall meet the required design standards and environmental protection requirements in accordance with the provisions contained in CAR 21.16(A) and CAR 21.18 respectively.
- 1.3 For aircraft designed, developed and manufactured in India, noise certificate shall be part of the type certification process and same shall be satisfactorily demonstrated by the manufacturer/TC Holder on the basis of compliance with applicable requirements contained in CAR 21, Subpart-I and the noise standards as per the current ICAO Annex-16, Volume-I and its latest amendments thereafter.

2. GENERAL REQUIREMENTS:

- 2.1 All civil aircraft, operating in India, shall have a valid Noise Certificate on board in accordance with the provisions contained in CAR, Section-2, Series-F, Part-III and CAR 21, Subpart-I.
- 2.2 Noise certification shall be granted or validated by DGCA for an aircraft on the basis of satisfactory evidence that the aircraft complies with requirements that are equal to the applicable standards specified in this CAR.
- 2.3 If noise recertification is requested, it shall be granted or validated by DGCA for an aircraft on the basis of satisfactory evidence that the aircraft complies with requirements that are equal to the applicable standards specified in this CAR. Date to determine the recertification basis shall be the date of acceptance of the application for recertification by DGCA.
- 2.4 The noise certificate issued by DGCA shall be required to be carried on the aircraft.
- 2.5 The documents with respect to noise certification for an aircraft shall provide at least the following information:

- Item 1. Aircraft Registration Mark,
- Item 2. Aircraft Manufacturer,
- Item 3. Aircraft Model,
- Item 4. Aircraft Serial Number,
- Item 5. Date of Manufacture,
- Item 6. Flight Manual Reference,
- Item 7. Maximum Take-off Mass,
- Item 8. Maximum Landing Mass,
- Item 9. Engine Manufacturer,
- Item 10. Engine Model, Type and Serial Number,
- Item 11. Propeller Type, Model and Serial Number,
- Item 12. Noise Certification Standards,
- Item 13. Additional modifications incorporated, if any, for the purpose of compliance with the applicable noise certification standards.
- Item 14. Lateral/full-power noise level,
- Item 15. Approach noise level,
- Item 16. Flyover noise level,
- Item 17. Over flight noise level,
- Item 18. Take-off noise level,
- Item 19. Statement of compliance including reference to Annex 16, Vol. I,
- Item 20. Date of issuance of the noise certification document.

2.6 Item listed on the noise certification documents shall be uniformly numbered as indicated in paragraph 2.5 above.

2.7 DGCA shall recognize noise certificate issued/granted by Civil Aviation Authority of other contracting state provided that the requirements under which such certification was granted, are equal to the applicable standards as specified in this CAR.

2.8 DGCA shall suspend or revoke the noise certification of an aircraft on its register, if the aircraft ceases to comply with the applicable noise standards. DGCA shall not remove the suspension of a noise certification or grant a new noise certification unless the aircraft is found, on reassessment, to comply with the applicable noise standards.

2.9 This CAR shall also apply for which the applicant has submitted an application to DGCA for the following purpose:

- a) A Type Certificate in the case of a new type, or
- b) Approval of a change in type design in the case of a derived version.

- 2.10 Unless otherwise specified in this CAR, the date in determining the applicability of the standards shall be the date on which the application for the Type Certificate was submitted to DGCA.
- 2.11 For derived versions where the provisions governing the applicability of the standards of this CAR refer to “the application for the certification of the change in type design”, the date to be used in determining the applicability of the standards in this CAR shall be the date the application for the change in type design was submitted to the Contracting State that first certified the change in type design.
- 2.12 An application shall be effective for the period specified in the designation of the airworthiness regulations appropriate to the aircraft type, except in special cases where DGCA accepts an extension of this period. When this period of effectivity is exceeded, the date to be used in determining the applicability of the standards in this CAR shall be the date of issue of the Type Certificate or approval of the change in type design.

SUBPART – B: Chapter 2 Aeroplane - Subsonic Jet Aeroplanes – Application for Type Certificate submitted before 6 October 1977.

NOT APPLICABLE.

SUBPART – C: Chapter 3 Aeroplane - Subsonic Jet Aeroplanes – Application for Type Certificate submitted on or after 6 October 1977 and before 1 January 2006 and Propeller-driven Aeroplanes over 8618 kg – Application for Type Certificate submitted on or after 1 January 1985 and before 1 January 2006.

NOT APPLICABLE.

SUBPART – D: Chapter 4 Aeroplane - 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 1 January 2006 and before 31 December 2017, and Subsonic jet aeroplanes with maximum certificated take-off mass less than 55,000 kg – Application for Type Certificate submitted on or after 1 January 2006 and before 31 December 2020 and 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 1 January 2006 and before 31 December 2020.

1. APPLICABILITY:

- 1.1 The standards of this chapter shall, with the exception of those aeroplanes which require a runway (with no stopway or clearway) length of 610 m or less at maximum certificated mass for airworthiness or propeller-driven aeroplanes specifically designed and used for agricultural or fire fighting 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 55,000 kg and over for which the application for a Type Certificate was submitted on or after 1 January 2006 and before 31 December 2017,
 - b) All subsonic jet aeroplanes, including their derived versions, with a maximum certificated take-off mass less than 55,000 kg for which the application for a Type Certificate was submitted on or after 1 January 2006 and before 31 December 2020,
 - c) All propeller-driven aeroplanes, including their derived versions, with a maximum certificated take-off mass of over 8,618 kg and less than 55,000 kg, for which the application for a Type Certificate was submitted on or after 1 January 2006 and before 31 December 2020, and
 - d) All subsonic jet aeroplanes and all propeller-driven aeroplanes certificated originally as Annex-16, Volume-1, Chapter-3 or Chapter-5, for which recertification to Chapter-4 is now requested.
- 1.2 The following situations for jet aeroplanes and propeller-driven aeroplanes over 8,618 kg maximum certificated take-off mass, however, do not require demonstration of compliance with the provisions of the standards of this CAR:

- 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 this CAR, is shown for that change in type design. This applies only to changes resulting from a required maintenance action.

2. Noise Measurements:

- 2.1 **Noise evaluation measure:** The noise evaluation measure shall be the effective perceived noise level in EPNdB as described in Appendix-2 of ICAO, Annex-16, Volume-I.

3. Noise measurement points:

- 3.1 **Reference Noise Measurement Points:** An aeroplane, when tested in accordance with these standards, shall not exceed the noise level specified at paragraph 4 at the following points:

- a) **Lateral full-power reference noise measurement point:**

- 1) **For jet-powered aeroplanes:** 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,
- 2) **For propeller-driven aeroplanes:** the point on the extended centre line of the runway 650 m vertically below the climb-out flight path at full take-off power, as defined in paragraph 5.

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

- c) **Approach reference noise measurement point:** the point on the ground, on the extended centre line of the runway, 2000 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.

- 3.2 **Test Noise Measurement Points:** 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.

3.3 Sufficient lateral test noise measurement points shall be considered to demonstrate that the maximum noise level on the appropriate lateral line has been clearly determined.

4. Maximum Noise Levels:

4.1 The maximum noise levels, when determined in accordance with the noise evaluation method as contained in Appendix-2 of ICAO Annex-16, Volume-I, shall not exceed the following:

4.2 **At Lateral Full-power Reference Noise Measurement Point:** 103 EPNdB for aeroplanes with maximum certificated take-off mass of 4,00,000 kg and over and decreasing linearly with the logarithm of the mass down to 94 EPNdB at 35,000 kg, after which the limit remains constant.

4.3 **At Flyover Reference Noise Measurement Point:**

a) **Aeroplanes with two engines or Less:** 101 EPNdB for aeroplanes with maximum certificated take-off mass of 3,85,000 kg and over and decreasing linearly with the logarithm of the aeroplane mass at the rate of 4 EPNdB per halving of mass down to 89 EPNdB, after which the limit is constant.

b) **Aeroplanes with three engines:** As at paragraph (a) above but with 104 EPNdB for aeroplanes with maximum certificated take-off mass of 3,85,000 kg and over.

c) **Aeroplanes with four engines or more:** As at paragraph (a) above but with 106 EPNdB for aeroplanes with maximum certificated take-off mass of 3,85,000 kg and over.

4.4 **At Approach Reference Noise Measurement Point:** 105 EPNdB for aeroplanes with maximum certificated take-off mass of 2,80,000 kg or over and decreasing linearly with the logarithm of the mass down to 98 EPNdB at 35,000 kg, after which the limit remains constant.

4.5 The maximum permitted noise levels as defined at paragraphs 4.2, 4.3 and 4.4, shall not be exceeded at any of the measurement points.

4.6 The sum of the differences at all three measurement points between the maximum noise levels and the maximum permitted noise levels as defined at paragraphs 4.2, 4.3 and 4.4, shall not be less than 10 EPNdB.

4.7 The sum of the differences at any two measurement points between the maximum noise levels and the corresponding maximum permitted noise levels as defined at paragraphs 4.2, 4.3 and 4.4, shall not be less than 2 EPNdB.

5. Noise certification reference procedures:

- 5.1 For the demonstration of maximum noise levels, the reference procedures shall comply with the appropriate airworthiness requirements and shall be acceptable to DGCA. The calculations of reference procedures and flight paths shall be approved by DGCA.
- 5.2 The applicant shall follow the take-off and approach reference procedures as specified by DGCA.
- 5.3 The reference procedures shall be calculated under the reference atmospheric conditions as specified by DGCA.

6. Test Procedures:

- 6.1 The test procedures adopted by the applicant shall be acceptable to DGCA.
- 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 of ICAO Annex-16, Volume-I.
- 6.3 Acoustic data shall be adjusted by the methods outlined in Appendix-2 of ICAO Annex-16, Volume-I to the reference conditions as specified at paragraph 5.3 above. Adjustments for speed and thrust shall be made as described in Section 8 of Appendix-2 of ICAO Annex-16, Volume-I.
- 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 DGCA 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.
- 6.5 For the approach conditions the test procedures shall be accepted if the aeroplane follows a steady glide path angle of $3^\circ \pm 0.5^\circ$.
- 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 DGCA. 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 paragraph 4 above.

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 witnessed by DGCA representative on the flight deck to be due to atmospheric turbulence, then the flight so affected shall be rejected for noise certification purposes.

7. Recertification:

7.1 For aeroplanes specified in paragraph 1.1 (c), recertification shall be granted on the basis that the evidence used to determine compliance with this subpart is as satisfactory as the evidence associated with aeroplanes specified in paragraphs 1.1 (a) and (b).

SUBPART – E: Chapter 5 Aeroplane - Propeller-driven Aeroplanes over 8,618 kg – Application for Type Certificate submitted before 1 January 1985.

NOT APPLICABLE.

SUBPART – F: Chapter 6 Aeroplane - Propeller-driven Aeroplanes not exceeding 8,618 kg – Application for Type Certificate submitted before 17 November 1988.

NOT APPLICABLE.

**SUBPART – G: Chapter 7 Aeroplane - Propeller-driven STOL
Aeroplanes.**

NOT APPLICABLE.

SUBPART – H: Chapter 8 - Helicopters.

1. APPLICABILITY:

- 1.1 The standards of this chapter shall be applicable to all helicopters except those specifically designed and used for agricultural, fire fighting or external load-carrying purposes.
- 1.2 For all helicopters, including their derived versions, for which the application for the Type Certificate was submitted on or after 21 March 2002, the maximum noise levels as mentioned at paragraph 8.4.2 shall apply.
- 1.3 Certification of helicopters which are capable of carrying external loads or external equipment shall be made without such loads or equipment fitted.

Note – Helicopters which comply with the standards with internal loads may be excepted when carrying external loads or external equipment, if such operations are conducted at a gross mass or with other operating parameters which are in excess of those certificated for airworthiness with internal loads.

- 1.4 An applicant under 1.1 may alternatively elect to show compliance with Subpart K (Chapter 11 Aeroplane) of this CAR, instead of these standards if the helicopter has a maximum certificated take-off mass of 3,175 kg or less.

2. Noise Measurements:

- 2.1 **Noise evaluation measure:** The noise evaluation measure shall be the effective perceived noise level in EPNdB as described in Appendix-2 of ICAO, Annex-16, Volume-I.

3. Noise measurement points:

- 3.1 A helicopter, when tested in accordance with these standards, shall not exceed the noise levels specified in paragraph 4 at the following points:

3.2 Take-off reference noise measurement points:

- 1) A flight path reference point located on the ground vertically below the flight path defined in the take-off reference procedure and 500 m horizontally in the direction of flight from the point at which transition to climbing flight is initiated in the reference procedure,

- 2) Two other points on the ground symmetrically disposed at 150 m on both sides of the flight path defined in the take-off reference procedure and lying on a line through the flight path reference point.

3.3 Over flight reference noise measurement points:

- 1) A flight path reference point located on the ground 150 m (492 ft) vertically below the flight path defined in the over flight reference procedure,
- 2) Two other points on the ground symmetrically disposed at 150 m on both sides of the flight path defined in the over flight reference procedure and lying on a line through the flight path reference point.

3.4 Approach reference noise measurement points:

- 1) A flight path reference point located on the ground 120 m (394 ft) vertically below the flight path defined in the approach reference procedure. On level ground, this corresponds to a position 1140 m from the intersection of the 6.0° approach path with the ground plane,
- 2) Two other points on the ground symmetrically disposed at 150 m on both sides of the flight path defined in the approach reference procedure and lying on a line through the flight path reference point.

Note –Guidelines for Obtaining Helicopter Noise Data for Land-use Planning Purposes that defines acceptable supplemental land-use planning (LUP) data procedures are given at Attachment-H of ICAO Aneex-16, Volume-I.

4. Maximum Noise Levels:

- 4.1 The maximum noise levels, when determined in accordance with the noise evaluation method as contained in Appendix-2 of ICAO Annex-16, Volume-I, shall not exceed the following:
- 4.2 **For take-off:** 106 EPNdB for helicopters with maximum certificated take-off mass, at which the noise certification is requested, of 80,000 kg and over and decreasing linearly with the logarithm of the helicopter mass at a rate of 3 EPNdB per halving of mass down to 86 EPNdB after which the limit is constant.
- 4.3 **For over flight:** 104 EPNdB for helicopters with maximum certificated take-off mass, at which the noise certification is requested, of 80,000 kg and over and decreasing linearly with the logarithm of the helicopter mass at a rate of 3 EPNdB per halving of mass down to 84 EPNdB after which the limit is constant.

- 4.4 **For approach:** 109 EPNdB for helicopters with maximum certificated take-off mass, at which the noise certification is requested, of 80,000 kg and over and decreasing linearly with the logarithm of the helicopter mass at a rate of 3 EPNdB per halving of mass down to 89 EPNdB after which the limit is constant.

5. Trade-off:

- 5.1 If the noise level limits are exceeded at one or two measurement points:
- a) The sum of excesses shall not be greater than 4 EPNdB,
 - b) Any excess at any single point shall not be greater than 3 EPNdB, and
 - c) Any excess shall be offset by corresponding reductions at the other point or points.

6. Noise certification reference procedures:

- 6.1 For the demonstration of maximum noise levels, the reference procedures shall comply with the appropriate airworthiness requirements and shall be acceptable to DGCA.
- 6.2 The applicant shall follow the take-off, over flight and approach reference procedures as specified by DGCA.
- 6.3 The reference procedures shall be calculated under the reference atmospheric conditions as specified by DGCA.

7. Test Procedures:

- 7.1 The test procedures adopted by the applicant shall be acceptable to DGCA.
- 7.2 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 of ICAO Annex-16, Volume-I.
- 7.3 Test conditions and procedures shall be closely similar to reference conditions and procedures or the acoustic data shall be adjusted, by the methods outlined in Appendix-2 of ICAO Annex-16, Volume-I, to the reference conditions and procedures specified in this subpart.
- 7.4 Adjustments for differences between test and reference flight procedures shall not exceed:

a) **For take-off:** 4.0 EPNdB, of which the arithmetic sum of $\Delta 1$ and the term $-7.5 \log (QK/QrKr)$ from $\Delta 2$ shall not intotal exceed 2.0 EPNdB,

b) **For over flight or approach:** 2.0 EPNdB.

7.5 During the test, the average rotor rpm shall not vary from the normal maximum operating rpm by more than ± 1.0 per cent during the 10 dB-down period.

7.6 The helicopter airspeed shall not vary from the reference airspeed appropriate to the flight demonstration by more than ± 9 km/h (± 5 kt) throughout the 10 dB-down period.

SUBPART – I: Chapter 9 - Installed Auxiliary Power Units (APU) and associated Aircraft Systems during Ground Operations.

1. APPLICABILITY:

- 1.1 As standards and recommended practices for Auxiliary Power Units have not fully developed yet by ICAO, however, guidelines provided in Attachment C of ICAO, Annex-16, Volume-I may be used for noise certification of installed Auxiliary Power Units (APU) and associated aircraft systems in:
- a) All aircraft for which the application for a Type Certificate was submitted to DGCA, on or after 6 October 1977, and
 - b) Aircraft of existing type design for which the application for a change of type design involving the basic APU installation was submitted to DGCA, on or after 6 October 1977.

SUBPART – J: Chapter 10 Aeroplane - Propeller-driven Aeroplanes not exceeding 8,618 kg – Application for Type Certificate or Certification of derived version submitted on or after 17 November 1988.

1. APPLICABILITY:

- 1.1 The standards of this chapter shall be applicable to all propeller-driven aeroplanes with a certificated take-off mass not exceeding 8,618 kg, except those aeroplanes specifically designed and used for aerobatic, agricultural or fire-fighting purposes and self-sustaining powered sailplanes.
- 1.2 For aeroplanes for which the application for the Type Certificate was submitted on or after 17 November 1988, except for those aeroplanes specified in 1.4 below, the maximum noise levels of 4.1 (a) shall apply.
- 1.3 For derived versions for which the application for certification of the change in type design was submitted on or after 17 November 1988, except for those derived versions specified in 1.4 below, the maximum noise levels of 4.1 (a) shall apply.
- 1.4 For single-engined aeroplanes, except float planes and amphibians:
 - a) The maximum noise levels of 4 (b) shall apply to those aeroplanes, including their derived versions, for which the application for the Type Certificate was submitted on or after 4 November 1999,
 - b) The maximum noise levels of 4 (b) shall apply to those derived versions of aeroplanes for which the application for the Type Certificate was submitted before 4 November 1999 and for which the application for certification of the change in type design was submitted on or after 4 November 1999.

2. Noise evaluation measure

- 2.1 The noise evaluation measure shall be the maximum A-weighted noise level (L_{ASmax}) as defined in Appendix-6 of ICAO Annex-16, Volume-I.

3. Reference Noise Measurement Points:

- 3.1 An aeroplane, when tested in accordance with these standards, shall not exceed the noise level specified in paragraph 4 below at the take-off reference noise measurement point.

3.2 The take-off reference noise measurement point is the point on the extended centre line of the runway at a distance of 2500 m from the start of take-off roll.

4. Maximum noise levels:

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

a) For aeroplanes specified in 1.2 and 1.3, 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 1,400 kg the limit of 88 dB(A) is reached after which the limit is constant up to 8,618 kg, and

b) For aeroplanes specified in 1.4, 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 1,500 kg the limit of 85 dB(A) is reached after which the limit is constant up to 8,618 kg.

5. Noise certification reference procedures:

5.1 For the demonstration of maximum noise levels, the reference procedures shall comply with the appropriate airworthiness requirements and shall be acceptable to DGCA.

5.2 The applicant shall follow the take-off reference procedures as prescribed by DGCA.

5.3 The reference procedures shall be calculated under the reference atmospheric conditions as specified by DGCA.

6. Test Procedures:

6.1 The test procedures adopted by applicant shall be acceptable to DGCA.

6.2 The test procedures and noise measurements shall be conducted and processed in an approved manner to yield the noise evaluation measure in units of L_{ASmax} as described in Appendix-6 of ICAO Annex-16, Volume-I.

6.3 Acoustic data shall be adjusted by the methods outlined in Appendix 6 of ICAO Annex-16, Volume-I to the reference conditions specified in this subpart.

6.4 If equivalent test procedures are used, the test procedures and all methods for correcting the results to the reference procedures shall be approved by DGCA.

**SUBPART – K: Chapter 11 - Helicopters not exceeding 3,175 kg
Maximum Certificated Take-off mass.**

1. APPLICABILITY:

- 1.1 The standards of this subpart shall be applicable to all helicopters having a maximum certificated take-off mass not exceeding 3,175 kg, except those specifically designed and used for agricultural, fire-fighting or external load-carrying purposes.
- 1.2 For all helicopters, including their derived versions, for which the application for the Type Certificate was submitted on or after 21 March 2002, the maximum noise levels of 4.1 shall apply.
- 1.3 Certification of helicopters which are capable of carrying external loads or external equipment shall be made without such loads or equipment fitted.
- 1.4 Alternatively, an applicant may also chose to show compliance with standards as mentioned in Subpart H instead of complying with the standards mentioned in this subpart.

Note - Helicopters which comply with the standards with internal loads may be excepted when carrying external loads or external equipment, if such operations are conducted at a gross mass or with other operating parameters which are in excess of those certificated for airworthiness with internal loads.

2. Noise evaluation measure

- 2.1 The noise evaluation measure shall be the sound exposure level (SEL) as described in Appendix-4 of ICAO Annex-16, Volume-I.

3. Reference Noise Measurement Points:

- 3.1 A helicopter, when tested in accordance with these standards, shall not exceed the noise levels specified at paragraph 4 below at a flight path reference point located on the ground 150 m (492 ft) vertically below the flight path defined in the over flight reference procedure.

Note –Guidelines for Obtaining Helicopter Noise Data for Land-use Planning Purposes that defines acceptable supplemental land-use planning (LUP) data procedures are given at Attachment-H of ICAO Aneex-16, Volume-I.

4. Maximum noise levels:

- 4.1 The maximum noise levels determined in accordance with the noise evaluation method of Appendix-4 of ICAO Annex-16, Volume-I shall not exceed 82 decibels SEL for helicopters with maximum certificated take-off mass, at which the noise certification is requested, of up to 1,417 kg and increasing linearly with the logarithm of the helicopter mass at a rate of 3 decibels per doubling of mass thereafter.

5. Noise certification reference procedures:

- 5.1 For the demonstration of maximum noise levels, the reference procedures shall comply with the appropriate airworthiness requirements and shall be acceptable to DGCA.
- 5.2 The applicant shall follow the overflight reference procedures as prescribed by DGCA.
- 5.3 The reference procedures shall be calculated under the reference atmospheric conditions as specified by DGCA.

6. Test Procedures:

- 6.1 The test procedures adopted by the applicant shall be acceptable to DGCA.
- 6.2 The test procedure and noise measurements shall be conducted and processed in an approved manner to yield the noise evaluation measure designated as sound exposure level (SEL), in A-weighted decibels, as described in Appendix-4 of ICAO Annex-16, Volume-I.
- 6.3 Test conditions and procedures shall be closely similar to reference conditions and procedures or the acoustic data shall be adjusted, by the methods outlined in Appendix-4 of ICAO Annex-16, Volume-I, to the reference conditions and procedures specified in this Subpart.
- 6.4 During the test, flights shall be made in equal numbers with tailwind and headwind components.
- 6.5 Adjustments for differences between test and reference flight procedures shall not exceed 2.0 dB(A).
- 6.6 During the test, the average rotor rpm shall not vary from the normal maximum operating rpm by more than ± 1.0 per cent during the 10 dB-down period.

- 6.7 The helicopter airspeed shall not vary from the reference airspeed appropriate to the flight demonstration as described in Appendix-4 of ICAO Annex-16, Volume-I by more than ± 5.5 km/h (± 3 kt) throughout the 10 dB-down period.
- 6.8 The helicopter shall fly within $\pm 10^\circ$ from the vertical above the reference track through the reference noise measurement position.
- 6.9 Tests shall be conducted at a helicopter mass not less than 90 per cent of the relevant maximum certificated mass and may be conducted at a mass not exceeding 105 per cent of the relevant maximum certificated mass.

SUBPART – L: Chapter 12 - Supersonic Aeroplanes.

RESERVED.

SUBPART – M: Chapter 13 Aeroplane - Tilt-Rotors.

RESERVED.

SUBPART – N: Chapter 14 Aeroplane - 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; 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 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.

1. APPLICABILITY:

- 1.1 The standards of this subpart shall, with the exception of those aeroplanes which require a runway length of 610 m or less at maximum certificated mass for airworthiness or propeller-driven aeroplanes specifically designed and used for agricultural or fire-fighting 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 55,000 kg and over for which the application for a Type Certificate was submitted on or after 31 December 2017,
 - b) All subsonic jet aeroplanes, including their derived versions, with a maximum certificated take-off mass of less than 55,000 kg for which the application for a Type Certificate was submitted on or after 31 December 2020,
 - c) All propeller-driven aeroplanes, including their derived versions, with a maximum certificated take-off mass of over 8,618 kg and less than 55,000 kg for which the application for a Type Certificate was submitted on or after December 2020,
 - d) All subsonic jet aeroplanes and all propeller-driven aeroplanes certificated for which the original compliance was demonstrated against the standards as prescribed in Subpart-C, Subpart-D or Subpart-E, for which recertification to Subpart-N is now requested.

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

- 1.2 The following situations for jet aeroplanes and propeller-driven aeroplanes over 8,618 kg maximum certificated take-off mass, however,

do not require demonstration of compliance with the provisions of the standards of this subpart:

- 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 this CAR, is shown for that change in type design. This applies only to changes resulting from a required maintenance action.

2. Noise evaluation measure

- 2.1 The noise evaluation measure shall be the effective perceived noise in EPNdB as described in Appendix-2 of ICAO Annex-16, Volume-I.

3. Reference Noise Measurement Points:

- 3.1 An aeroplane, when tested in accordance with these standards, shall not exceed the noise level specified at paragraph 4 at the following points:

- a) **Lateral full-power reference noise measurement point:**

- 1) **For jet-powered aeroplanes:** 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,
- 2) **For propeller-driven aeroplanes:** the point on the extended centre line of the runway 650 m vertically below the climb-out flight path at full take-off power, as defined in paragraph 5.

- b) **Flyover reference noise measurement point:** the point on the extended centre line of the runway and at a distance of 6.5 km from the start of roll,

- 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.

- 3.2 **Test Noise Measurement Points:** 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.

- 3.3 Sufficient lateral test noise measurement points shall be considered to demonstrate that the maximum noise level on the appropriate lateral line has been clearly determined.

4. **Maximum noise levels:**

- 4.1 The maximum noise levels, when determined in accordance with the noise evaluation method of Appendix-2 of ICAO Annex-16, Volume-I, shall not exceed the following:

- 4.2 **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 4,00,000 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.

- 4.3 **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 3,85,000 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 3,85,000 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 3,85,000 kg and over.

- 4.4 **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 2,80,000 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.

4.5 The sum of the differences at all three measurement points between the maximum noise levels and the maximum permitted noise levels specified in 4.2, 4.3 and 4.4, shall not be less than 17 EPNdB.

4.5 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 paragraphs 4.2, 4.3 and 4.4.

5. Noise certification reference procedures:

5.1 For the demonstration of maximum noise levels, the reference procedures shall comply with the appropriate airworthiness requirements and shall be acceptable to DGCA.

5.2 The take-off and approach reference procedures shall be defined in a manner acceptable to DGCA.

5.3 The reference procedures shall be calculated under the reference atmospheric conditions as specified by DGCA.

6. Test Procedures:

6.1 The test procedures adopted by the applicant shall be acceptable to DGCA.

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 of ICAO Annex-16, Volume-I.

6.3 Acoustic data shall be adjusted by the methods outlined in Appendix-2 of ICAO Annex-16, Volume-I to the reference conditions specified in this subpart. Adjustments for speed and thrust shall be made as described in Appendix-2 of ICAO Annex-16, Volume-I.

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.

- 6.5 Similarly the necessary EPNL adjustment for variations in approach flight path from the reference flight path shall not exceed EPNdB.
- 6.6 For the approach conditions the test procedures shall be accepted if the aeroplane follows a steady glide path angle of $3^\circ \pm 0.5^\circ$.
- 6.7 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 certifying 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 EPNdB and 4 EPNdB, respectively, the resulting numbers shall be more than 2 EPNdB below the noise limits specified in

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.

- 6.8 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 certifying authority representative on the flight deck to be due to atmospheric turbulence, then the flight so affected shall be rejected for noise certification purposes.

SUBPART – O: Noise Measurement for Monitoring Purposes.

RESERVED.

SUBPART – P: Assessment of Airport Noise.

RESERVED.

SUBPART – Q: Balanced Approach to Noise Management.

RESERVED.



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Director General of Civil Aviation

APPENDIX -I

1. **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.
2. **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 and includes balloon whether fixed or free, airship, kites, gliding and flying machines.
3. **Associated aircraft systems:** Those aircraft systems drawing electrical/pneumatic power from an auxiliary power unit during ground operations.
4. **Auxiliary power-unit (APU):** A self-contained power-unit on an aircraft providing electrical/pneumatic power to aircraft systems during ground operations.
5. **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.
6. **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.
7. **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.
8. **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.
9. **Helicopter:** helicopter means a heavier-than-air aircraft supported in flight by the reactions of the air on one or more power-driven rotors on substantially vertical axis.
10. **Human performance:** Human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations.
11. **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.

12. **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.
13. **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.
14. **State of Design:** The State having jurisdiction over the organization responsible for the type design.
15. **Subsonic aeroplane:** An aeroplane incapable of sustaining level flight at speeds exceeding flight Mach number of 1.
16. **Tilt-rotor:** A powered-lift capable of vertical take-off, vertical landing, and sustained low-speed flight, which depends principally on engine-driven rotors mounted on tiltable nacelles for the lift during these flight regimes and on nonrotating aerofoil(s) for lift during high-speed flight.
17. **Type Certificate:** Type certificate means a document issued, validated or accepted by Director General to signify that the design of an aircraft or engine or propeller, complies with the applicable type design standard specified by Director General.

APPENDIX -II

NOMENCLATURE: SYMBOLS AND UNITS

Following is the list of definitions and symbols used in this CAR. Many of the following definitions and symbols are specific to aircraft noise certification. Some of the definitions and symbols may also apply to purposes beyond aircraft noise certification.

Velocity:		
Symbol	Unit	Meaning
C_R	m/s	Reference speed of sound. Speed of sound at reference conditions.
M_{ATR}	—	Helicopter rotor reference advancing blade tip Mach number. The sum of the reference rotor rotational tip speed and the reference speed of the helicopter, divided by the reference speed of sound
M_H	—	Propeller helical tip Mach number. The square root of the sum of the square of the propeller test rotational tip speed and the square of the test airspeed of the aeroplane, divided by the test speed of sound.
M_{HR}	—	Propeller reference helical tip Mach number. The square root of the sum of the square of the propeller reference rotational tip speed and the square of the reference speed of the aeroplane, divided by the reference speed of sound.
Best R/C	m/s	Best rate of climb. The certificated maximum take-off rate of climb at the maximum power setting and engine speed.
V_{AR}	km/h	Adjusted reference speed. On a non-standard test day, the helicopter reference speed adjusted to achieve the same advancing tip Mach number as the reference speed at reference conditions
V_{CON}	km/h	Maximum airspeed in conversion mode. The never-exceed airspeed of a tilt-rotor when in conversion mode.
V_G	km/h	Ground speed. The aircraft velocity relative to the ground.
V_{GR}	km/h	Reference ground speed. The aircraft true velocity relative to the ground in the direction of the ground track under reference conditions. V_{GR} is the horizontal component of the reference aircraft speed V_R .
V_H	km/h	Maximum airspeed in level flight. The maximum airspeed of a helicopter in level flight when operating at maximum continuous power.
V_{MCP}	km/h	Maximum airspeed in level flight. The maximum airspeed of a tilt-rotor in level flight when operating in aeroplane mode at maximum continuous power.
V_{MO}	km/h	Maximum operating airspeed. The maximum operating limit airspeed of a tilt-rotor that may not be deliberately exceeded.

V_{NE}	km/h	Never exceed airspeed. The maximum operating limit airspeed that may not be deliberately exceeded.
V_R	km/h	Reference speed. The aircraft true velocity at reference conditions in the direction of the reference flight path.
Symbol	Unit	Meaning
V_{REF}	km/h	Reference landing airspeed. The speed of the aeroplane, in a specific landing configuration, at the point where it descends through the landing screen height in the determination of the landing distance for manual landings.
V_S	km/h	Stalling airspeed. The minimum steady airspeed in the landing configuration.
V_{tip}	m/s	Tip speed. The rotational speed of a rotor or propeller tip at test conditions, excluding the aircraft velocity component.
V_{tipR}	m/s	Reference tip speed. The rotational speed of a rotor or propeller tip at reference conditions, excluding the aircraft velocity component.
V_Y	km/h	Speed for best rate of climb. The test airspeed for best take-off rate of climb.
V_2	km/h	Take-off safety speed. The minimum airspeed for a safe take-off.
Time:		
Symbol	Unit	Meaning
t_0	s	Reference duration. The length of time used as a reference in the integration equation for computing EPNL, where $t_0 = 10$ s.
t_R	s	Reference reception time. The reference time of reception calculated from time of reference aircraft position and distance between aircraft and microphone used in the integrated procedure.
Δt	s	Time increment. The equal time increment between one-third octave band spectra, where $\Delta t = 0.5$ s.
δ_{tR}	s	Reference time increment. The effective duration of a time increment between reference reception times associated with PNLT points used in the integrated method.
Indices:		
Symbol	Unit	Meaning
i	—	Frequency band index. The numerical indicator that denotes any one of the 24 one-third octave bands with nominal geometric mean frequencies from 50 to 10 000 Hz.
k	—	Time increment index. The numerical indicator that denotes any one of the 0.5 second spectra in a noise time history. For the integrated method, the adjusted time increment associated with each value of k will likely vary from the original 0.5 second time increment when projected to reference conditions.
k_F	—	First time increment identifier. Index of the first 10 dB-down point in the discrete measured PNLT time history.
k_{FR}	—	Reference first time increment identifier. Index of the first 10 dB-down point in the discrete PNLT time history for the integrated method.

k _L	—	Last time increment identifier. Index of the last 10 dB-down point in the discrete measured PNLT time history.
Symbol	Unit	Meaning
k _{LR}	—	Reference last time increment identifier. Index of the last 10 dB-down point in the discrete PNLT time history for the integrated method.
k _M	—	Maximum PNLT _M time increment index. Time increment index of PNLT _M .
t	s	Elapsed time. The length of time measured from a reference zero.
t ₁	s	Time of first 10 dB-down point. The time of the first 10 dB-down point in a continuous function of time. (Kindly refer k _F).
t ₂	s	Time of last 10 dB-down point. The time of the last 10 dB-down point in a continuous function of time. (Kindly refer k _L).
Noise Metrics:		
Symbol	Unit	Meaning
EPNL	EPNdB	Effective perceived noise level. A single-number evaluator for an aircraft pass-by, accounting for the subjective effects of aircraft noise on human beings, consisting of an integration over the noise duration of the perceived noise level (PNL) adjusted for spectral irregularities (PNLT), normalized to a reference duration of 10 seconds.
EPNL _A	EPNdB	Approach EPNL. Effective perceived noise level at the aeroplane approach reference measurement points.
EPNL _F	EPNdB	Flyover EPNL. Effective perceived noise level at the aeroplane flyover reference measurement points.
EPNL _L	EPNdB	Lateral EPNL. Effective perceived noise level at the aeroplane lateral reference measurement points.
L _{AE}	dB	SEL Sound exposure level (SEL). A single event noise level for an aircraft pass by, consisting of an integration over the noise duration of the A-weighted sound level (dBA), normalized to a reference duration of 1 second.
L _{AS}	dB(A)	Slow A-weighted sound level. Sound level with frequency weighting A and time weighting S for a specified instance in time.
L _{ASmax}	dB(A)	Maximum Slow A-weighted sound level. The maximum value of L _{AS} over a specified time interval.
L _{ASmaxR}	dB(A)	Reference maximum Slow A-weighted sound level. The maximum value of L _{AS} over a specified time interval corrected to reference conditions.
LIMIT _A	EPNdB	Approach EPNL limit. The maximum permitted noise level at the aeroplane approach reference measurement points.
LIMIT _F	EPNdB	Flyover EPNL limit. The maximum permitted noise level at the aeroplane flyover reference measurement points.
LIMIT _L	EPNdB	Lateral EPNL limit. The maximum permitted noise level at the aeroplane lateral reference measurement points.
n	noy	Perceived noisiness. The perceived noisiness of a one-third octave band sound pressure level in a given spectrum.

Symbol	Unit	Meaning
N	noy	Total perceived noisiness. The total perceived noisiness of a given spectrum calculated from the 24 values of n.
PNL	PNdB	Perceived noise level. A perception-based noise evaluator representing the subjective effects of broadband noise received at a given point in time during an aircraft pass-by. It is the noise level empirically determined to be equally as noisy as a 1 kHz one-third octave band sample of random noise.
PNLT	TPNdB	Tone-corrected perceived noise level. The value of the PNL of a given spectrum adjusted for spectral irregularities.
PNLT _R	TPNdB	Reference tone-corrected perceived noise level. The value of PNLT adjusted to reference conditions.
PNLTM	TPNdB	Maximum tone-corrected perceived noise level. The maximum value of PNLT in a specified time history, adjusted for the band sharing adjustment ΔB .
PNLTM _R	TPNdB	Reference maximum tone-corrected perceived noise level. The maximum value of PNLTR in a specified time history, adjusted for the band sharing adjustment ΔB in the simplified method and ΔBR in the integrated method.
SPL	dB	Sound pressure level. The level of sound, relative to the reference level of 20 μ Pa, at any instant of time that occurs in a specified frequency range. The level is calculated as ten times the logarithm to the base 10 of the ratio of the time-mean-square pressure of the sound to the square of the reference sound pressure of 20 μ Pa.
SPL _R	dB	Reference sound pressure level. The one-third octave band sound pressure levels adjusted to reference conditions.
SPL _S	dB	Slow-weighted sound pressure level. The value of one-third octave band sound pressure levels with time weighting S applied.
Δ_1	TPNdB	PNLTM adjustment. In the simplified adjustment method, the adjustment to be added to the measured EPNL to account for noise level changes due to differences in atmospheric absorption and noise path length between test and reference conditions at PNLTM.
	dB(A)	For propeller-driven aeroplanes not exceeding 8 618 kg, the adjustment to be added to LASmax to account for noise level changes due to the difference between test and reference aeroplane heights.
Δ_2	TPNdB	Duration adjustment. In the simplified adjustment method, the adjustment to be added to the measured EPNL to account for noise level changes due to the change in noise duration caused by differences between test and reference aircraft speed and position relative to the microphone.
	dB(A)	For propeller-driven aeroplanes not exceeding 8 618 kg, the adjustment to be added to LASmax to account for the propeller helical tip Mach number.

Symbol	Unit	Meaning
Δ_3	TPNdB	Source noise adjustment. In the simplified or integrated adjustment method, the adjustment to be added to the measured EPNL to account for noise level changes due to differences in source noise generating mechanisms between test and reference conditions.
	dB(A)	For propeller-driven aeroplanes not exceeding 8 618 kg, the adjustment to be added to LASmax to account for engine power.
Δ_4	dB(A)	Atmospheric absorption adjustment. For propeller-driven aeroplanes not exceeding 8 618 kg, the adjustment to be added to the measured LASmax for noise level changes due to the change in atmospheric absorption caused by the difference between test and reference aeroplane heights.
Δ_B	TPNdB	Bandsharing adjustment. The adjustment to be added to the maximum PNLT to account for possible suppression of a tone due to one-third octave bandsharing of that tone. PNLTM is equal to the maximum PNLT plus Δ_B .
Δ_{BR}	TPNdB	Reference bandsharing adjustment. The adjustment to be added to the maximum PNLTR in the integrated method to account for possible suppression of a tone due to one-third octave bandsharing of that tone. PNLTMR is equal to the maximum PNLTR plus Δ_{BR} .
Δ_{peak}	TPNdB	Peak adjustment. The adjustment to be added to the measured EPNL 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.

Calculation of PNL and Tone Correction:

Symbol	Unit	Meaning
C	dB	Tone correction factor. The factor to be added to the PNL of a given spectrum to account for the presence of spectral irregularities such as tones.
f	Hz	Frequency. The nominal geometric mean frequency of a one-third octave band.
F	dB	Delta-dB. The difference between the original sound pressure level and the final broadband sound pressure level of a one-third octave band in a given spectrum.
log n(a)	—	Noy discontinuity coordinate. The log n value of the intersection point of the straight lines representing the variation of SPL with log n.
M	—	Noy inverse slope. The reciprocals of the slopes of straight lines representing the variation of SPL with log n.
s	dB	Slope of sound pressure level. The change in level between adjacent one third octave band sound pressure levels in a given spectrum.
Δs	dB	Change in slope of sound pressure level.
