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Aircraft Design and Certification for Portable Electronic Device (PED) Tolerance

RTCA DO-307B
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FOREWORD

This document was prepared by RTCA Special Committee 234 (SC-234) and EUROCAE Working Group 99 (WG-99) and approved by the RTCA Program Management Committee (PMC) and the EUROCAE Council on June 23, 2022.

RTCA, Incorporated is a not-for-profit corporation formed to advance the art and science of aviation and aviation electronic systems for the benefit of the public. The organization functions as a Standards Development Organization and develops consensus-based recommendations on contemporary aviation issues. RTCA's objectives include but are not limited to:

- coalescing aviation system user and provider technical requirements in a manner that helps government and industry meet their mutual objectives and responsibilities;

- analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity and efficiency;

- developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and

- assisting in developing the appropriate technical material upon which positions for the International Civil Aviation Organization and the International Telecommunication Union and other appropriate international organizations can be based.

The organization's recommendations are often used as the basis for government and private sector decisions as well as the foundation for many Federal Aviation Administration Technical Standard Orders and advisory circulars.

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EXECUTIVE SUMMARY

The United States FAA requested that RTCA, Inc. form a special committee SC-202 to present an up-to-date evaluation of the use of portable electronic devices (PEDs) on board civil aircraft with emphasis on intentional transmitters such as mobile phones, wireless radio frequency (RF) network devices, and other wireless-enabled devices such as personal digital assistants (PDAs). Most recently, SC-234 was formed to revise the requirements of this document to be consistent with existing high intensity radiated field (HIRF) requirements and incorporate industry lessons learned in addition to creating a new industry guidance and best practices document for determining aircraft PED tolerance through a safety risk assessment process, superseding RTCA DO-294C.

Special committees SC-202 and SC-234 included representatives from consumer electronic device manufacturers, avionics manufacturers, aircraft manufacturers, airlines, aircraft operators, pilot and flight attendant associations, regulatory agencies, and related industry associations. The committee worked closely with other industry groups such as the Consumer Electronics Association. This work was coordinated with European Organization for Civil Aviation Equipment (EUROCAE) Working Groups 58 and 99.

This report addresses the specific SC-202 Terms of Reference Phase 2, SC-234 Terms of Reference to revise DO-307 and incorporates DO-307 Change 1 to address aircraft design and certification to tolerate operation of PEDs. Previous RTCA reports on aircraft interference from PEDs have emphasized risk assessments and then recommended restrictions on the use of PEDs on aircraft. This report departs from the earlier RTCA reports and is directed to aircraft design recommendations that lead to aircraft tolerance to both intentional RF transmissions and spurious RF emissions from PEDs. The update to DO-307B addresses particularly the spectrum expansion of the 5G technology in the U.S. The update became necessary in view of the work conducted by SC-239 / WG-119.

There are two aspects to the aircraft design recommendations in this report. One aspect defines aircraft system and equipment RF susceptibility qualification recommendations that provide tolerance to RF from intentionally transmitting PEDs. This is commonly referred to as protection from PED back door coupling. The recommendations closely follow existing practices for aircraft system high intensity radiated field (HIRF) protection. Acceptable test approaches for verifying the aircraft system RF susceptibility qualification are defined.

The second aspect defines acceptable interference path loss between aircraft radio receivers and PEDs that emit spurious RF. This is commonly referred to as protection from PED front door coupling. Extensive analysis of measured PED spurious emissions was performed so that the interference path loss targets are based on statistics of actual PED emissions rather than regulatory specifications. Interference path loss test methods are defined.

This report also defines recommended approaches for demonstrating compliance with aircraft design certification regulations.

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TABLE OF CONTENTS

1 INTRODUCTION 1

1.1 Scope 2
1.2 Terms of Reference 2
1.3 Summary of Changes 2

2 BACKGROUND 3

2.1 Previous Studies 4
2.2 Coupling Paths 5
2.2.1 Front Door Coupling of Spurious Radiated Emissions (NIRA) 7
2.2.2 Front Door Coupling of Intentional Radiated Emissions (IRA) 7
2.2.3 Back Door Coupling of Intentional Radiated Emissions (IRU, IRC) 8
2.2.4 Back Door Coupling of Spurious Radiated Emissions (NIRU, NIRC) 9
2.2.5 Interference from Conducted Emissions (CEI and CCT) 9

3 AIRCRAFT SYSTEM TOLERANCE TO INTENTIONALLY TRANSMITTING PEDs (BACK DOOR COUPLING COMPLIANCE) 10

3.1 Aircraft Systems That Should Be Considered 11
3.2 Evaluation of Transmitting PED Field Strength 11
3.3 Aircraft System RF Immunity Requirements for T-PED Tolerance 12
3.4 Methods to Verify Aircraft System PED Tolerance 12

4 AIRCRAFT TOLERANCE TO PED SPURIOUS EMISSIONS (FRONT DOOR COUPLING COMPLIANCE) 17

4.1 Risk Assessment of PED Usage 17
4.2 PED Emissions Analysis 18
4.2.1 RTCA DO-160D Change 1 / EUROCAE ED-14D Change 1 Methods 19
4.2.2 Reverberation Chamber Methods 19
4.2.3 RTCA DO-233 Methods 19
4.2.4 Narrowed Resolution Bandwidth Methods 19
4.3 Harmonizing the Data 20
4.4 PED Emissions Data Evaluation Method 20
4.5 PED RF Emissions Statistics 21
4.6 Multiple Equipment Factor for Front Door Effects 24

4.7 Interference Path Loss Targets 24
4.7.1 Aircraft Receiver Interference Thresholds 28
4.7.2 Target IPL Calculations 28
4.8 Aircraft IPL Measurements 29
4.9 Aircraft Changes that Affect IPL 30

5 CERTIFICATION ASPECTS OF AIRCRAFT PED TOLERANCE 31

5.1 Relevant Airworthiness Regulations and Guidance 31
5.2 Documenting a PED-Tolerant Design 32
5.3 Application to New Aircraft Type Certification 33
5.4 Modifications to Previously Certified PED Tolerant Aircraft 34
5.5 Modifications to Aircraft Not Previously Certified PED Tolerant 35
5.6 Application to Different Classes of Aircraft 35
5.7 Instructions for Continued Airworthiness 35

6 REFERENCES 37

7 MEMBERSHIP 39

APPENDIX A STATISTICAL ANALYSIS OF SPURIOUS EMISSIONS FROM PORTABLE ELECTRONIC DEVICES A-1

A.1 Introduction A-1
A.2 Source of Data A-2
A.3 Presentation of the Methods A-2
A.3.1 Notation A-2
A.3.2 Definition of the α-Quantile e_α A-2
A.4 Analysis Results A-3
A.5 Statistical Estimators A-9
A.5.1 Definition of the α-Quantile Estimation A-9
A.5.2 Estimation of an α-Quantile A-9
A.6 References A-13

APPENDIX B RECOMMENDED AIRCRAFT INTERFERENCE PATH LOSS (IPL) MEASUREMENT TECHNIQUE B-1

B.1 Interference Path Loss Definition B-1
B.2 Evaluation of Worst-Case IPL B-2
B.3 Measurement Frequency Bands B-2

B.4 Measurement Process B-3
B.5 Set-Up B-3
B.6 Reference Measurements B-4
B.7 Measurement B-5
B.7.1 Aircraft Door IPL Measurements B-6
B.7.2 Aircraft Cabin IPL Measurements B-7
B.7.3 Aircraft Cargo Compartment IPL Measurements B-8
B.7.4 Aircraft Flight Deck IPL Measurements B-9
B.8 Calculation of IPL B-10
B.9 Calculation of Single IPL for a Radio Receiver B-11
B.10 Other Methods B-12

APPENDIX C DEMONSTRATION OF PROTECTION OF RADIO ALTIMETERS TO PED NON-INTENTIONAL EMISSIONS (NIRA) C-1

C.1 Background and Introduction C-1
C.2 Radio Altimeter Susceptibility Threshold C-1
C.3 PED Non-Intentional Emissions C-3
C.3.1 DO-307 Emissions Data C-3
C.3.2 SC-239 Emission Analysis C-4
C.3.3 Measured 5G Transmitter Emissions C-4
C.3.4 PED Emission Level for Radio altimeter Band C-5
C.4 Target IPL C-6
C.5 Continuing PED NIRA Tolerance Demonstration C-6
C.5.1 Overview C-6
C.5.2 Commercial Air Transport Aircraft (Usage Category 1) C-7
C.5.3 Regional and General Aviation (Usage Category 2) C-7
C.5.4 Helicopter (Usage Category 3) C-7
C.6 References C-8

APPENDIX D 5G CELLULAR INTENTIONAL RADIATED EMISSIONS AND AIRCRAFT RADIO ALTIMETER BAND D-1

D.1 Background D-1
D.2 Risk Mitigation Options D-2
D.3 References D-3

APPENDIX E ACRONYMS AND ABBREVIATIONS E-1

TABLE OF FIGURES

Figure 2-1: PED Emission TypesX 3
Figure 2-2: Front Door Coupling of Spurious Radiated Emissions (NIRA) 7
Figure 2-3: Front Door Coupling of Intentional Radiated Emissions (IRA) 8
Figure 2-4: Back Door Coupling of Radiated Emissions (IRU, NIRU, IRC, NIRC) 9
Figure 4-1: Derivation of Conversion Factor from Electric Field (dB μV/m) to Power (dBm) Units 23
Figure A-1: Definition of an α-quantile A-1
Figure A-2: Raw Data Set 1 ..... A-4
Figure A-3: Method B on Set 1 α-Quantile with Confidence β = 0.95 ..... A-4
Figure A-4: Raw Data Set 2 ..... A-5
Figure A-5: Method B on Set 2 α-Quantile with Confidence β = 0.95 ..... A-5
Figure A-6: Raw Data Set 4 ..... A-6
Figure A-7: Method B on Set 4 α-Quantile with Confidence β = 0.95 ..... A-6
Figure A-8: Raw Data Set 5 ..... A-7
Figure A-9: Method B on Set 5 α-Quantile with Confidence β = 0.95 ..... A-7
Figure A-10: Raw Data Set 7 ..... A-8
Figure A-11: Method B on Set 7 α-Quantile with Confidence β = 0.95 ..... A-8
Figure A-12: Set 1: Q = 104, N_{sample} = 50, α = 0.80, β = 0.95 ..... A-11
Figure A-13: Set 2: Q = 10^4, Nsample = 200, α= 0.80, β = 0.95 ..... A-11
Figure A-14: Set 4: Q = 10^4, N_{sample} = 50, α = 0.95, β = 0.80 ..... A-12
Figure A-15: Set 5: Q = 10^4, Nsample = 100, α = 0.95, β = 0.95 ..... A-12
Figure A-16: Set 7: Q = 10^4, N_{sample} = 200, α = 0.95, β = 0.95 ..... A-13
Figure B-1: Definition of Interference Path Loss B-1
Figure B-2: Typical Measurement Setup B-3
Figure B-3: Typical Reference Measurement Setup with Optional Amplifier B-5
Figure B-4: Typical Reference Measurement Setup without Optional Amplifier B-5
Figure B-5: Typical Antenna Placement for Door Locations B-7
Figure B-6: Typical Cabin Test Setup B-8
Figure B-7: Typical Antenna Placement in a Cargo Compartment B-9
Figure B-8: Typical Flight Deck Test Setup B-10
Figure B-9: Example of IPL Results for Eight Measurements B-11
Figure C-1: Radio Altimeter Antenna Location Assessment C-8
Figure D-1: Frequency Bands Spectrum Illustration of 5G And Radio altimeters D-1

TABLE OF TABLES

Table 2-1: Potential PED Interference Classes (adapted from ED-118) 6
Table 3-1: Aircraft System RF Radiated Susceptibility Test Recommendations 14
Table 4-1: Count And Class of Portable Electronic Devices Used In Emissions Measurements 18
Table 4-2: Resolution Bandwidth Settings from RTCA DO-160D Change 1/ EUROCAE ED-14 Change 1 Section 21 19
Table 4-3: Resolution Bandwidth Used By NASA During Data Collection 20

Table 4-4: Synopsis of PED RF Emissions Statistics per Appendix A 22
Table 4-5: Synopsis of PED RF Emissions Statistics Converted to Time-Averaged EIRPSD 24
Table 4-6: Recommended Front Door MEF 25
Table 4-7: Target IPL by Receiver 26
Table A-1: PED Frequencies Used A-2
Table C-1: Summary of SC-239 Report Altimeter Susceptibility Thresholds C-2
Table C-2: Summary of SC-239 Report Altimeter NIRA Tolerance Thresholds C-3
Table C-3: Derivation of 5G Emissions for Radio altimeter Band C-5
Table C-4: Target IPL without MEF for Radio altimeters C-6
Table C-5: Target IPL for Radio Altimeters C-6
Table D-1: IRA Target IPL for Radio altimeters D-2

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1 INTRODUCTION

Since the end of the 1950s, aircraft operators, aircraft manufacturers, and regulatory authorities have been concerned with the potential for interference with aircraft electrical and electronic systems by portable electronic devices carried on board by passengers and crewmembers. RTCA established five committees: 1) RTCA SC-88 was the earliest, publishing their study and recommendations in RTCA DO-119 in 1963 [Ref 1], 2) RTCA SC-156 published RTCA DO-199 in 1988 [Ref 3], 3) RTCA SC-177 published RTCA DO-233 in 1996 [Ref 4]. 4) RTCA SC-202 published RTCA DO-294C and DO-307 along with Change 1 to DO-307, and 5) the most recent, RTCA SC-234 publishing Rev A to DO-307 and an accompanying users guide.

One recurring recommendation in these reports is that portable electronic devices should not be used on board aircraft during critical phases of flight. However, research shows that passengers and crewmembers continue to operate portable electronic devices, either intentionally or inadvertently, even during takeoff and landing [Ref 5, 6]. Another recurring recommendation is that the regulatory authorities for consumer electronic devices, such as the US Federal Communications Commission (FCC), develop new standards that would limit the harmful emissions from consumer portable electronic devices. However, the consumer electronic device emissions standards have not changed to incorporate the RTCA recommendations. FCC has participated in several of the PED committees and SC-202 recommended changes to their emissions standards; however, these changes have not been adopted.

At the same time, systems have been developed to facilitate the use of portable electronic devices on board aircraft. For example, wireless RF networks have been installed and certified on aircraft that allow passengers and crewmembers to use laptops and other devices for internet and e-mail access through the wireless network. Picocells are being developed for installation on aircraft to allow passengers and crewmembers to use their personal mobile phones in flight, under the control of the picocells. In-seat power supplies are commonplace on aircraft, to allow passengers to power and use their PEDs during flight.

Given these issues, FAA requested that RTCA address the concept of aircraft design and certification so that the aircraft could tolerate use of portable electronic devices, so that adverse interference to the aircraft is unlikely. FAA requested that RTCA Special Committee 202 accept a task during the SC-202 phase 2 activity to address aircraft design and certification that would mitigate the risks from portable electronic devices. Accordingly, SC-202 designated working group 5 to develop aircraft design and certification recommendations for portable electronic device tolerance.

When implemented into an aircraft design, these design and certification recommendations would ensure that an aircraft is designed for PED tolerance, which would significantly reduce the potential for PED interference during all phases of flight. This approach considers transmitting and non-transmitting portable electronic devices and is not restricted to any specific portable electronic device technology, network implementation or intended device function. This focus on aircraft design and certification may reduce the operating restrictions on use of portable electronic devices by providing an aircraft whose systems have demonstrated proper functioning when exposed to the RF emissions and transmissions of PEDs. This may also minimize the need for aircraft operators to perform an allowance process based on specific types of portable electronic devices, as described in RTCA DO-294C [Ref 2] and Advisory Circular (AC) No. 91.21-1C [Ref 7], if they operate aircraft that have been designed for portable electronic device tolerance.

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