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

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FOREWORD

This document was prepared by RTCA Special Committee 202 (SC-202). This document was approved by the RTCA Program Management Committee (PMC) on October 11, 2007.

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 Federal Advisory Committee 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 (MOPS) 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 (ICAO) and the International Telecommunication Union (ITU) and other appropriate international organizations can be based.

The recommendations of RTCA 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 (TSO).

Since RTCA is not an official agency of the United States Government, its recommendations may not be regarded as statements of official government policy unless so enunciated by the United States Government organization or agency having statutory jurisdiction over any matters to which the recommendations relate.

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EXECUTIVE SUMMARY

The United States Federal Aviation Administration (FAA) requested that RTCA, Inc. form a special committee 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 RF network devices, and other wireless-enabled devices such as personal digital assistants (PDAs).

Special committee SC-202 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 has been coordinated with European Organization for Civil Aviation Equipment (EUROCAE) Working Group 58.

This report addresses the specific Terms of Reference Phase 2 item 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.

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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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 four committees to study this issue and make recommendations. RTCA Special Committee 88 was the earliest, publishing their study and recommendations in RTCA DO-119 in 1963 [Ref 1]. Most recently, RTCA Special Committee 202 published their Phase 1 recommendations in RTCA DO-294B in 2006 [Ref 2]. RTCA Special Committee 156 published RTCA DO-199 in 1988 [Ref 3], and Special Committee 177 published RTCA DO-233 in 1996 [Ref 4].

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 is currently participating in SC-202 to consider changes to their emissions standards; however, these changes have not yet 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 radio frequency emissions and transmissions of portable electronic devices. 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-294B [Ref 2] and Advisory Circular (AC) No. 91.21-1B [Ref 7], if they operate aircraft that have been designed for portable electronic device tolerance.