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Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard

Volume II

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FOREWORD

This document was prepared by Special Committee 156 of the Radio Technical Commission for Aeronautics. It was approved by RTCA on September 16, 1988, and supersedes RTCA D0-119, "Interference to Aircraft Electronic Equipment from Devices Carried Aboard," April 12, 1963.

RTCA is an association of aeronautical organizations of the United States from both government and industry. Dedicated to the advancement of aeronautics, RTCA seeks sound technical solutions to problems involving the application of electronics and telecommunications to aeronautical operations. Its objective is the resolution of such problems by mutual agreement of its member organizations. The findings of RTCA are in the nature of recommendations to all organizations concerned. 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 U. S. government organization or agency having statutory jurisdiction over any matters to which the recommendations relate.

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SECTION 1.0

EXECUTIVE SUMMARY

1.0 EXECUTIVE SUMMARY

In response to an airline request, RTCA Special Committee 156 was formed in 1983 to investigate and quantify, if possible, the potential interference from portable electronic devices carried aboard aircraft by passengers to installed communication, navigation and other systems on the aircraft. While a fairly comprehensive list of incidents of such interference reports was in the record, no demonstration of such interference from a portable electronic device had ever been repeated under controlled conditions in the air or on the ground.

With strong support from the Federal Aviation Administration (FAA), supplemented by data provided by Hewlett Packard and IBM, a reasonable collection of data on the frequency and level of emissions from a variety of portable electronic devices was obtained. Included were lap-top computers, portable televisions, AM and FM radios, scanning monitors, medical devices and battery operated games. Particular attention was paid to RF emissions in seven frequency bands of interest to aviation from Omega navigation at 10 kHz - 14 kHz to DME at 960 MHz - 1.215 GHz.

Susceptibility of installed systems to RF interference was expected to be equal to or better than the limits set in RTCA DO-160B, which provides standards for undesired RF interference radiated by equipment designed for installation in the aircraft. Since these limits were very different from those established in Federal Communications Commission (FCC) Rules and Regulations, Part 15, tests were performed in screen rooms on representative navigation and communication avionics system elements to correlate the portable device emission with installed system susceptibility.

The most elusive factor in the equation was labeled Path Loss Factor (PLF). PLF approximates the attenuation of a signal emitted by a portable device as it passes through a window, bounces off a wing or tail section, reaches an appropriate aircraft antenna, and is measured at the receiver end of the antenna cable.

It was further determined that interference would be more complex in the presence of one or more high level external interfering signals such as FM broadcast. Such intermodulation products were also measured.

The results of the data collection and analysis were reviewed and have resulted in recommendations to the FCC, FAA, airlines and other operators of aircraft.

At the time of publication of this report, the FCC is considering changes to the FCC regulations contained in the Code of Federal Regulations, CFR 47, Part 15. It would be impossible to anticipate the final form of these changes should they be implemented. It is anticipated that changes to CFR 47, Part 15, would affect Subsections 3.4.1; 3.4.2; 6.2 and 6.3 of this report.

This document is published in two volumes.

- Volume I is the report itself that includes the background, data collection, data analysis, conclusion and recommendations.

- Volume II provides amplification or background material for the summary data that is included in the basic report, or listed in Appendix A of Volume I. It is a compilation of some of the committee papers used in the report and permits tracing SC-156's conclusions.

SECTION 2.0

INTRODUCTION

2.0 INTRODUCTION

2.1 Organization of the Document

This volume presents information provided to Special Committee 156 (SC-156) as working papers during the course of its deliberations. Since certain items of Volume I present only summary data, it was decided that additional documentation should be provided to permit tracing the committee's conclusions back to the source information. Source documents are provided by Volume II in two categories. The RTCA identification number has two parts. The first relates to an RTCA chronological number and the second to the committee paper number, e.g., 1-88/SC156-1.

2.2 Categories of Reference Material

2.2.1 Measurements Conducted to Determine Path Loss Factor (PLF) on Aircraft

The information on measurements conducted to determine path loss factor (PLF) represents a wide range of tests performed on several different aircraft. Each set of tests was conducted under different conditions, usually by different personnel with a variety of test equipment and test procedures. The reference material in Section 3.0 provides background for the path loss receiver sensitivity information in Table 5-8 of Volume I and the test data of Appendix A of Volume I.

2.2.2 Measurements Conducted on Various Portable Electronic Devices

Testing was conducted to determine the frequencies at which unwanted radiated emissions occur and the amplitude of those radiations for various portable electronic devices that might be operated aboard commercial aircraft. The emissions from over thirty-four various portable devices were measured according to RTCA/DO-160B. DO-160B is the existing procedure used by RTCA for measuring radiated interference from electrical/electronic equipment installed aboard aircraft. The reference material in Section 4.0 provides the background for the summation of testing on portable products listed in Table 5-7 of Volume I. Most of the units were rotated to measure the maximum level of radiation from the product.