

RTCA, Inc.  
1425 K Street, NW, Suite 500  
Washington, DC 20005 USA

# **Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard**

## **Volume II**

RTCA DO-199  
September 16, 1988  
Supersedes: RTCA DO-119

Prepared by: SC-156  
© RTCA, Inc.

Copies of this document may be obtained from

RTCA, Inc.

Telephone: 202-833-9339

Facsimile: 202-833-9434

Internet: [www.rtca.org](http://www.rtca.org)

Please visit the RTCA Online Store for document pricing and ordering information.

## F O R E W O R D

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.

THIS PAGE INTENTIONALLY LEFT BLANK

# TABLE OF CONTENTS

		<u>Page</u>
FOREWORD	.....	i
TABLE OF CONTENTS	.....	iii
1.0 EXECUTIVE SUMMARY	.....	1
2.0 INTRODUCTION	.....	5
3.0 REFERENCE MATERIAL FOR MEASUREMENTS CONDUCTED TO DETERMINE PATH LOSS FACTOR (PLF) ON AIRCRAFT	.....	9
<u>RTCA Paper No.</u>	<u>Subject</u>	
100-84/SC156-20	Interior Radiation Losses	11
238-84/SC156-26	Interference Effects of Passenger Carry-On Devices	33
240-84/SC156-28	Additional Technical Center Data on Path Loss	37
316-84/SC156-32	RF Noise Level in Boeing 757 Aircraft	57
321-84/SC156-37	RF Path Loss Measurements, DC-10 Aircraft	65
469-84/SC156-53	Correlation of FAA and DAC Path Loss Measurements	75
26-85/SC156-65	Conversion of Fuselage Isolation Data	79
40-85/SC156-70	Comments on HF Transmission Data	83
225-85/SC156-88	H-Field Aircraft Shielding	87
428-85/SC156-108	Measurement of Fuselage Shielding: -10 to 100 kHz	91
436-85/SC156-110	FAA Path Loss Tests	95
545-85/SC156-123	Minimum Path Loss of RF in FAA Technical Center Aircraft N-40	111
137-87/SC156-186	Fuselage Isolation Data - Boeing 757 Aircraft	127
4.0 REFERENCE MATERIAL FOR MEASUREMENTS CONDUCTED ON VARIOUS PORTABLE ELECTRONIC DEVICES	.....	131
<u>RTCA Paper No.</u>	<u>Subject</u>	
320-84/SC156-36	Testing of Portable Electronic Devices to RTCA/DO-160A	135
547-85/SC156-124	Recent Testing of Portable Products	165
322-87/SC156-215	Testing of FM Receivers to FCC Class B Limits	173

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 1.0**  
**EXECUTIVE SUMMARY**

---

THIS PAGE INTENTIONALLY LEFT BLANK

---

## 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.