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Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard

Volume I

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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/DO-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.

TABLE OF CONTENTS

Page

FOREWORD i

TABLE OF CONTENTS iii

1.0 EXECUTIVE SUMMARY 1

2.0 INTRODUCTION 3

2.1 Media Interest 3
2.2 Establishment of SC-156 -- Terms of Reference 3
2.3 Statement of the Problem 4
2.4 Scope of Investigation 5

2.4.1 Type of Aircraft 5
2.4.2 Type of Portable Equipment 5

2.5 Glossary of Terms 6

3.0 BACKGROUND 7

3.1 Incident Reports 7
3.2 Summary of Electromagnetic Interference (EMI) Control for Aircraft Communications, Navigation Systems 7

3.2.1 Between Installed Systems 7
3.2.2 Interference from Ground-Based Sources 11

3.2.2.1 Description of Sources and Interference Mechanisms 11
3.2.2.2 Interference Prevention/Mitigation Techniques 11

3.2.3 Interference from Devices Carried On Board 12

3.2.3.1 Operator Survey 13

3.2.4 Cumulative Interference Effects 13
3.2.5 Vulnerable Frequencies and Functions 16

3.3 Federal Aviation Regulations (FAR) 18
3.4 Existing Industry Standards 18

3.4.1 FCC Controls, Limits, and Effectiveness 18
3.4.2 Other Industry Standards 22

3.4.2.1 VERBAND DEUTSCHER ELEKTROTECHNIKER (VDE) 22
3.4.2.2 International Special Committee on Radio Interference (C.I.S.P.R.) 23

Page

3.4.2.3 Radio Technical Commission for Aeronautics RTCA/DO-160B 23

3.4.3 Summary of Existing Standards 23
3.4.4 Need for New Standards 23

4.0 DATA COLLECTION 27

4.1 Aircraft Equipment Susceptibility 27

4.1.1 List of Aeronautical Systems and Frequencies to be Tested. 27
4.1.2 Standards for Tests Adopted 27
4.1.3 Test Procedures 27

4.1.3.1 Omega/VLF 27
4.1.3.2 Loran-C 31
4.1.3.3 ADF Receiver 33
4.1.3.4 HF Communications 34
4.1.3.5 75 MHz Marker Beacon Receiver 34
4.1.3.6 VOR 35
4.1.3.7 ILS Localizer 36
4.1.3.8 VHF Communications - Voice Modulation 37
4.1.3.9 VHF Communications - Data Link 38
4.1.3.10 ILS Glide Slope 38
4.1.3.11 Systems Not Tested 39

4.2 Path Loss 41

4.2.1 Path Loss Measurements 41

4.2.1.1 On-Aircraft Testing 41
4.2.1.2 Definitions of Path Loss and Path Loss Factor (PLF) 41
4.2.1.3 Characterization of Portable Devices 42

5.0 DATA ANALYSIS 45

5.1 Incident Reports 45
5.2 Aircraft Equipment Susceptibility 46

5.2.1 Test Procedures Employed 46
5.2.2 Test Results 46

5.2.2.1 Further Analysis of Possibility of Interfering with VOR Receivers 46
5.2.2.2 Analysis of VOR and Interfering Signal Stabilities 59
5.2.2.3 Probability 63

5.3 Path Loss 68

Page

5.3.1 Determination of "Portable Device" Test Limits Using PLF 66
5.3.2 Determination of "Portable Device" Test Limits for Low Frequency Aircraft Systems 70
5.3.3 Electromagnetic Shielding of Aircraft Windows 71

5.4 Portable Device Radiation Levels 72
5.5 Comparison of Test Methods 77
5.6 Summary 82

6.0 CONCLUSIONS AND RECOMMENDATIONS 89

6.1 Multiple Conditions Required for Receiver Disruption to Occur 89
6.2 Limits of Radiation, Test Methods 91

6.2.1 Radiated Magnetic Field (H-Field) Measurements 91
6.2.2 Radiated Electric Field (E-Field) Measurements 93
6.2.3 Radiated Electric Field Above 1,000 MHz 93

6.3 Recommendations to FCC 93
6.4 Recommended Changes to Federal Aviation Regulations (FAR) 95

6.4.1 Proposed Revision of FAR 91.19 95
6.4.2 Recommended Regulatory Compliance Information 97

6.5 Procedures for Reporting Suspected Interference 98

6.5.1 Recommended Precautions and Procedures 98

6.5.1.1 Procedures to Assist Control of Device Use By Aircraft Crews 99
6.5.2 Recommended Report 99

MEMBERSHIP 101

APPENDIX A PATH LOSS FACTOR (PLF) TEST DATA
APPENDIX B CONVERTING FIELD STRENGTH IN SPACE TO VOLTAGE LEVEL AT RECEIVER
APPENDIX C INCIDENT REPORTS
APPENDIX D DEMONSTRATION OF CUMULATIVE INTERFERENCE EFFECTS
APPENDIX E COMPARISON OF DO-160B WITH FCC AND VDE STANDARDS
APPENDIX F COMPENDIUM OF REFERENCES CONCERNING HARMFUL INTERFERENCE FROM GROUND EMITTERS TO AIRCRAFT RADIO NAVIGATION AND RADIO COMMUNICATION SYSTEMS DURING THE APPROACH, LANDING, AND TAKEOFF PHASES OF FLIGHT
APPENDIX G RADIO FREQUENCY INTERFERENCE TO NAVIGATION SYSTEMS FROM PORTABLE ELECTRONIC DEVICES

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 of SC-156's conclusions.

2.0 INTRODUCTION

Toward the end of the 1950s, there was increasing concern about the vulnerability of aircraft electrical and electronic systems to interference from electrical devices carried aboard by passengers. Then, as now, installed electronic devices had tests and limits for both emission and susceptibility. Radio frequency interference was occasionally reported by air crews and, as a consequence of a perceived need, RTCA's Executive Committee established Special Committee 88 to investigate "Interference to Aircraft Electronic Equipment from Devices Carried Aboard." On April 12, 1963, the SC-88 Report, RTCA DO-119, was approved by the Executive Committee. The FAA, which had participated in support of SC-88, revised the Federal Aviation Regulations regarding carrying of devices on board by passengers. The responsibility for assuring compliance with the new rule (FAR 91.19) remained with the operator of the aircraft. No regulatory limits were placed on the radiation emissions of portable electronic devices as a result of the recommendations of SC-88.

There were some incidents of radio frequency interference from portable devices during the decades of the 60s and 70s, but not enough to initiate a comprehensive study of the problem.

2.1 Media Interest

In 1983, media attention began to build on the fact that some air carriers did not permit the use of portable computers by passengers. This was a concern to some airline passengers and some computer trade publications went so far as to suggest that their readers avoid these airlines.

This significant media attention was apparent at the first meeting of SC-156 in early December of 1983, and continued with both aviation trade press and portable computer trade press attending the meetings in early 1984.

2.2 Establishment of SC-156 -- Terms of Reference

In late August of 1983, RTCA received a request from the Director of Quality Assurance and Chief Engineer, Eastern Airlines, to form a Special Committee to "generate a Minimum Operational Performance Standards document against which manufacturers (of computers and other portable electronic devices) marketing their products for airborne use, could test and label them as meeting this standard in a manner similar to the Underwriters Laboratory sign of approval." The RTCA Executive Committee considered this request September 23, 1983, and approved the requested committee and the proposed terms of reference as follows:

"Special Committee 156 shall:

1. Investigate potential interference effects on aircraft electronic systems from portable electronic and electrical devices operated aboard aircraft,

2. Develop recommendations to assure control of possible sources of such interference, as appropriate,