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Audio Systems Characteristics and Minimum Operational Performance Standards for Aircraft Audio Systems and Equipment

RTCA DO-214A
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FOREWORD

This report was prepared by Special Committee 226 (SC-226) and approved by the RTCA Program Management Committee (PMC) on December 18, 2013.

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- 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

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EXECUTIVE SUMMARY

RTCA/DO-214 was originally prepared by RTCA Special Committee 164 (SC-164). It was approved by the RTCA Program Management Committee on March 2, 1993 and supersedes RTCA/DO-170, Audio System Characteristics and Minimum Performance Standards, Aircraft Microphones (Except Carbon), Aircraft Headsets and Speakers, Aircraft Audio Selector Panels and Amplifiers. RTCA/DO-214A was prepared by RTCA Special Committee 226 (SC-226). It was approved by the RTCA Program Management Committee on December 18, 2013 and supersedes RTCA/DO-214.

The purpose of this revision is to add a number of important improvements. This revision includes requirements covering technology advances, harmonization of DO-214 with other revised standards, addresses industry and FAA feedback for improvements and from advancements in audio, acoustic and communications sciences and methodologies that have developed since the original release of DO-214. DO-214A is not intended to cover all aspects of the rapidly advancing field of digital audio technology. The scope of digital audio science is much wider and more comprehensive than can be covered in this revision. Examples of changes that have been made are: Active Noise Reduction (ANR) technology has advanced significantly since the original release of DO-214 so ANR requirements have been added to DO-214A. EUROCAE Document ED-112 is now being widely used for Cockpit Voice Recorders (CVR) and CVR Microphones so CVR microphones have been removed from DO-214A. Oxygen Mask Microphones have been added, along with Speakers with Active Circuitry, different types of Handsets and Push-To-Talk switches that are available on the market, as well as some changes covering advancements in digital audio technology. DO-214A has also been harmonized with DO-160G, DO-178C, DO-254 and new industry standards ARINC535B and ARINC538C.

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1.0 PURPOSE AND SCOPE

1.1 Introduction

This document contains audio systems characteristics and minimum operational performance standards for aircraft headset microphones, handset microphones (Except carbon), oxygen mask microphones, headsets, handsets, speakers, audio selector panels (ASP) and amplifiers. These standards specify system characteristics that should be useful to designers, manufacturers, installers and users of the equipment.

Compliance with these standards is recommended as one means of assuring that the equipment will perform its intended function(s) satisfactorily under all conditions normally encountered in routine aeronautical operations. Any regulatory application of this document is the sole responsibility of appropriate governmental agencies.

Section 1.0 of this document provides information needed to understand the rationale for equipment characteristics and requirements stated in the remaining sections. It describes typical equipment applications and operational goals and establishes the basis for standards stated in Section 2.0 through 4.0. Definitions and assumptions essential to the proper understanding of this document are also provided in this section.

Section 2.0 contains the minimum performance standards for the equipment. These standards specify the required performance under standard, operational, and environmental conditions. Also included are recommended bench test procedures necessary to demonstrate equipment compliance with the stated minimum requirements.

Section 3.0 describes the performance required of the installed equipment. Tests for the installed equipment are included when performance cannot be adequately determined through bench testing.

Section 4.0 describes the operational performance characteristics for equipment installations and defines conditions that will assure the equipment user that operations can be conducted safely and reliably in the expected operational environment.

The word "equipment" as used in this document includes all components or units necessary to properly perform the intended function(s). Since the measured values of equipment performance may be a function of the measurement method, standard test conditions and methods of test are recommended.

Consideration was given to the overall system characteristics that affect the intelligibility of air-ground speech communication. This included, to the extent feasible, review and evaluation of all design measures giving promise of audio response improvement. Although consideration was specifically applied to equipment design characteristics, it became evident that environmental conditions and practices of communicators create not only a need for improvements in the system, but seriously limit improvements attainable by design changes alone. Other limitations are imposed by regulatory agencies and international agreements. In view of this, it was considered important, in the interest of aviation, to emphasize these related

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aspects in this document and to point out that control of environmental conditions and user practices require action by other than communication equipment designers. References used in the preparation of this document are listed in Appendix F.

If the measures recommended in this document are followed, and equipment is in good condition, very satisfactory transmission results can be expected (about 80 percent intelligibility, or better, on most contacts). However, this represents a potential capability based on what are believed to be reasonably attainable communicator practices.

It should be noted that this standard is intended to provide minimum performance requirements for equipment. However, the equipment manufacturer must consider the environment in which the equipment is intended to be installed. As an example, a commercial aviation transport aircraft may have different performance requirements than those contained in this performance standard and different than a light general aviation aircraft may have. The equipment must be designed and specified according to the requirements of the target application. As a result Technical Standard Order (TSO) approval obtained in conformance with this standard may not be sufficient for all aircraft or guarantee that a product can be installed on a given aircraft.

1.2 Background

The overall intelligibility of a voice communication system depends on a number of factors: Apparatus design, manufacturing techniques, site communication practices and coverage attempted, maintenance, ambient noise at terminals and communicator practices in talking and listening. While it is probable that some benefits would be obtained by improvements in each of these factors, it is evident that if all else were perfect, difficulties would exist due to ambient noise conditions, communicator practices and bandwidth limitations. This applies to UHF, VHF and HF radio channels. Because of variations in propagation and static (and other sources of noise), HF transmission presents a special difficulty in noise arising within the transmission medium, normally called "circuit noise." These considerations follow.

1.2.1 Noise

The primary contributors to interfering noise are acoustic ambient noise, atmospheric ambient noise and ambient noise produced by the communication system. Here, the design considerations in the audio response area are preventing ambient noise penetration into the communication system through the use of noise reduction technologies, maintenance of optimum system response and improvement of (S+N)/N in the receiver input.

1.2.1.1 Ambient Noise

A few considerations of importance in evaluating the ambient noise situation are (unless otherwise indicated, all Sound Pressure Levels [SPL] are in reference to 20 µPa; dBA indicates the level is measured through an A-weighting filter):

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