

Submitted for recognition as an American National Standard

Design and Performance Criteria Transport Aircraft  
Portable Megaphones

INTRODUCTION

In the preparation of this document, consideration has been given to the performance of existing equipment as well as the recommendations of aircraft operators, and megaphone manufacturers. However, the primary goal of this document is to ensure that future megaphone designs will perform adequately in transport category aircraft emergency situations.

1. SCOPE:

This SAE Aerospace Standard (AS) provides design criteria and performance tests for portable, hand-held, battery-powered, electronic megaphones used by aircraft crew members to provide information and guidance in the event of an aircraft emergency or other non-routine situation.

1.1 Purpose:

The purpose of this document is to assure minimum standards of usability and performance for hand-held electronic megaphones used aboard transport category aircraft for emergency communications.

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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2.1.1 FAA Publications: Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20005.

FAR Part 21 Certification Procedures for Products and Parts  
Amendments 21-1 through 21-73

FAR Part 25 Airworthiness Standards: Transport Category Airplane  
Amendments 25-1 through 25-89

2.1.2 RTCA Publications: Available from Radio Technical Commission for Aeronautics, 1140 Connecticut Avenue, NW, Suite 1020, Washington, DC 20036.

RTCA/DO-160D

2.2 Related Publications:

The following publications are provided for informational purposes only and are not a required part of this document.

2.2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

ARP577 Emergency Placarding - Internal and External

ARP583 Flight Attendant Stations

ARP997 Passenger Cabin Emergency Equipment Stowage

2.3 Definitions:

2.3.1 RATED INPUT: Rated input shall be determined as follows: The megaphone shall be set up under free field conditions and an input applied to the microphone from an acoustically isolated artificial voice, emitting a warble frequency of 1250 to 1750 Hz at a pressure of 100 dynes/cm<sup>2</sup> at 0.7500 in (1.905 cm) and placed at a distance of 0.0625 in (0.1588 cm) away from and on the microphone axis. The electrical output of the microphone measured across a resistance equal to the input impedance shall be considered rated input.

2.3.2 FULL GAIN: The full gain is defined as the input/output ratio of the electronic amplifier at rated input that produces maximum megaphone output within the distortion limits allowed.

2.3.3 USABLE GAIN: The usable gain is defined as the input/output ratio of the electronic amplifier at rated input with the megaphone volume control set as high as possible without feedback.

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### 3. GENERAL REQUIREMENTS:

#### 3.1 Handle Size:

The grip shape shall allow easy and secure handling of the megaphone with either hand. The grip circumference shall be no more than 6.5 in (16.5 cm) and the grip length shall be no less than 4 in (10.2 cm).

#### 3.2 Weight:

The megaphone shall weigh no more than 6 lb (2.7 kg) including batteries.

#### 3.3 Balance:

The megaphone shall be balanced to allow easy one-handed operation for 1 h of continuous use.

#### 3.4 Durability and Reliability:

The megaphone shall be designed to meet the following requirements:

3.4.1 All materials used except small parts (knobs, triggers, fasteners, seals, and small electrical parts), that would not contribute significantly to the propagation of a fire, must be self extinguishing when tested in accordance with applicable requirements of FAR 25.853.

3.4.2 The megaphone shall comply with Section 5 by actual test, proof of identity, or by analysis.

3.4.3 In addition to compliance with Section 5, the megaphone should be shown to operate continuously for a period of not less than 4 h after being completely submerged in saltwater for a period of 2 s.

#### 3.5 Stowage Provisions:

The megaphone design may include a stowage bracket. If included, the stowage bracket shall meet the following specifications:

3.5.1 The bracket shall be designed to minimize the possibility of inadvertent actuation.

3.5.2 The bracket shall allow the release and removal of the megaphone using only one hand.

3.5.3 The design of the bracket should allow versatility of installation.

3.5.4 The design shall allow for ease of serviceability checks.

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### 3.6 Color:

The majority of the megaphone's exterior surface shall be of a bright color (e.g., white, yellow, orange) known to be highly visible in such circumstances as near darkness, smoke, and/or immersion in water.

### 3.7 Anti-feedback Design:

The megaphone design and construction materials shall minimize the possibility of feedback when operated in a transport category aircraft cabin.

### 3.8 Power Source:

The megaphone power source shall be self-contained with no external electrical connections. However, an external power source status indicator is desirable.

### 3.9 Activation:

The means for activating the megaphone shall be obvious, and if incorporated into the handle, shall be invoked by positive compression of the handle itself, or a trigger or button mechanism actuated by the index finger of the holding hand.

### 3.10 Volume Adjustment:

If included, volume adjustment hardware shall comply with the following:

3.10.1 The volume adjustment shall be controlled by a dial or knob that facilitates easy operation.

3.10.2 Volume controls shall increase the volume when turned clockwise and decrease the volume when turned counterclockwise.

3.10.3 The markings for the volume adjustment shall be unambiguous and easy to see.

3.10.4 The volume adjustment shall provide logarithmic control of the megaphone output for a linear rotation of the dial or knob.

### 3.11 Maintainability:

The megaphone shall be easily maintainable with common tools.

### 3.12 Markings:

The megaphone shall comply with FAR 21.607(d) with respect to markings on its major equipment component. In addition, the megaphone shall have marked on its major equipment component the environmental categories in which it has been qualified to operate (see Section 5).

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### 4. MINIMUM PERFORMANCE STANDARDS:

#### 4.1 Operational Life:

At the end of the defined power source service life, the megaphone shall be capable of continuously producing rated output sound pressure at rated input for a period of not less than 1 h.

#### 4.2 Rated Output Pressure:

With the rated input applied to the electronic amplifier set to provide full gain, the megaphone output pressure shall be measured at a distance of 10 ft (3.05 m) on the horn axis. The rated output pressure shall be 112 dB (referenced to 13.79 psi (0.0002 dynes/cm<sup>2</sup>)).

#### 4.3 Usable Output Pressure:

With the megaphone set up under free field conditions and an input applied to the microphone from an acoustically isolated artificial voice emitting a warble frequency of 1250 to 1750 Hz at a pressure of 100 dynes/cm<sup>2</sup> at 0.7500 in (1.905 cm) placed at a distance of 0.0625 in (0.1588 cm) away from and on the microphone axis and the electronic amplifier set to the usable gain position, the megaphone output pressure shall be measured at a distance of 10 ft (3.05 m) on the horn axis. The usable output pressure shall be 112 dB (referenced to 13.79 psi (0.0002 dynes/cm<sup>2</sup>)).

#### 4.4 Amplifier Distortion:

With rated input applied to the electronic amplifier set to provide full gain, the distortion contained in the amplifier output (measured across any resistive load within 20% of rated load) shall not exceed 10% at the usable output pressure, nor shall it exceed 15% at the rated output pressure at any frequency between 400 and 5500 Hz. With rated input applied to the electronic amplifier set to provide a megaphone output pressure equal to usable output pressure, the distortion contained in the amplifier output (measured across any resistive load within 20% of rated load) shall not exceed 10%, nor shall it exceed 15% at the rated output pressure at any frequency between 400 and 5500 Hz.

#### 4.5 Output Sound Pressure Distribution:

With rated input applied to the electronic amplifier set to provide a megaphone output pressure equal to the rated output pressure, sound pressure measurements shall be made at both 15° (0.262 rad) and 30° (0.524 rad) off the megaphone sound axis. Four measurements shall be made at each off-axis angle, one in the horizontal plane on each side of the sound axis and one in the vertical plane above and below the sound axis. The off axis output pressure for each off-axis angle shall be figured as the arithmetical average of the four readings. The maximum off-axis deviation from the rated output pressure shall be 3 dB at 15° and 6 dB at 30°.

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### 4.6 Frequency Response:

The megaphone shall be set up under free field conditions with an input applied to the microphone from an acoustically isolated artificial voice emitting a warble frequency of 1250 to 1750 Hz at a sound pressure of 141 dynes/cm<sup>2</sup> at 0.7500 in (1.905 cm) placed at a distance of 0.0625 in (0.1588 cm) away from and on the microphone axis. The megaphone output shall be measured at a distance of 10 ft (3.05 m) on the horn axis, and the megaphone volume control shall be set to provide a measured output pressure of 106 dB (referenced to 13.79 psi (0.0002 dynes/cm<sup>2</sup>)). The input frequency shall then be varied over a range of 400 to 5500 Hz and the megaphone output pressure measured. The megaphone output pressure shall vary no more than 10 dB. The volume control shall then be set to yield an output of 99 dB (referenced to 13.79 psi (0.0002 dynes/cm<sup>2</sup>)) and the input frequency again varied over a frequency range of 400 to 5500 Hz. The measured megaphone output pressure shall vary no more than 10 dB through this range.

### 4.7 Internal Noise:

With the electronic amplifier input bridged with a resistor equal in value to the input impedance and the amplifier output terminated with a resistance equal to the megaphone load impedance, set the amplifier to provide full gain. The measured voltage across the output load shall be 55 dB below rated output pressure level when measured with a thermal type of voltmeter.

### 4.8 Loudspeaker Noise:

With the megaphone operating at usable output pressure, the natural resonance(s) of the mechanical structure(s) shall occur at frequencies outside the usable frequency range of the loudspeaker. In addition, other inherent megaphone noises shall not impair the output sound quality.

### 4.9 Operation in Aircraft Environment:

Operation of the megaphone in an aircraft cabin shall not impair the megaphone performances required in 4.1 through 4.8.

## 5. TEST PROCEDURES - ENVIRONMENTAL:

### 5.1 Temperature Variation:

The megaphone shall comply with the test requirements specified in RTCA DO-160D, Section 5, Category C, as it applies to Section 4, Category AI and 4.5.1, 4.5.2, and 4.5.3.

### 5.2 Humidity:

The megaphone shall comply with the test requirements specified in RTCA DO-160D, Section 6, Category A.