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Ultrasonics — Measurements of electroacoustical parameters and acoustic output power of spherically curved transducers using the self-reciprocity method

National foreword

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ULTRASONICS – MEASUREMENTS OF ELECTROACOUSTICAL PARAMETERS AND ACOUSTIC OUTPUT POWER OF SPHERICALLY CURVED TRANSDUCERS USING THE SELF-RECIPROCITY METHOD

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IEC TS 62903 has been prepared by IEC technical committee 87: Ultrasonics. It is a Technical Specification.

This second edition cancels and replaces the first edition published in 2018. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Several quantities are recognized as complex-valued quantities in the definitions and in the main text.
b) Annex I was added to provide typical measurement ranges and to provide example calibration results.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
87/825/DTS	87/829/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

In this document, the following print types are used:

- terms defined in Clause 3: **in bold type**.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

An ultrasonic transducer is an important acoustic device that can act as a transmitter or a receiver in the applications of medical ultrasound, non-destructive testing, and ultrasonic materials processing. The performance of a transducer is a decisive factor that governs the device's range of applicability, efficiency and quality control in the manufacturing. The mechanisms, transmitting fields, performances, and measurement methods used for these transducers have been studied over the past few decades. However, the electroacoustical characterization and measurement methods applied for spherically curved transducers have not been defined in standard documents for either terms or protocols.

This document defines the relevant electroacoustical parameters for these devices and establishes the self-reciprocity measurement method for spherically curved concave focusing transducers.

ULTRASONICS – MEASUREMENTS OF ELECTROACOUSTICAL PARAMETERS AND ACOUSTIC OUTPUT POWER OF SPHERICALLY CURVED TRANSDUCERS USING THE SELF-RECIPROCITY METHOD

1 Scope

This document, which is a Technical Specification,

a) establishes the free-field convergent spherical wave self-reciprocity method for ultrasonic transducer calibration,
b) establishes the measurement conditions and experimental procedure required to determine the transducer's electroacoustic parameters and acoustic output power using the self-reciprocity method,
c) establishes the criteria for checking the reciprocity of these transducers and the linear range of the focused field, and
d) provides guiding information for the assessment of the overall measurement uncertainties for radiation conductance.

This document is applicable to:

1) circular spherically curved concave focusing transducers without a centric hole working in the linear amplitude range,
2) measurements in the frequency range 0,5 MHz to 15 MHz, and
3) acoustic pressure amplitudes in the focused field within the linear amplitude range.

Characterization and sensitivity calibration of hydrophones using the reciprocity method are not addressed in this document but covered in IEC 62127-2 [1][1] and IEC 60565-1 [2].

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-801, *International Electrotechnical Vocabulary – Chapter 801: Acoustics and electroacoustics*, available at www.electropedia.org

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-801 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

[1] Numbers in square brackets refer to the Bibliography.